KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-05/BOS /Botany (UG) /20-21 ೨೪೪ Date: 16 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Botany UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.
2. Special BOS Res. No. 01, dt. 10.07.2020.
3. Special Faculty Res. No. 01, dt. 11.08.2020.
4. Special Academic Council Res. No. 38, dt. 21.08.2020.
5. Vice-Chancellor's order dated - 07-10-2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Botany UG syllabus for I to VI Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website (www.kud.ac.in).

15/10/2020
(Dr. Hanumantappa K.T)
REGISTRAR

To,

1. The Chairman, BOS Botany (UG), Dept. of Botany, K.U.Dharwad.
2. The Chairman, Dept. of Botany, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fwcs to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Botany, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website (www.kud.ac.in).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analysist, Computer Unit Exam Section, K.U.Dharwad.

Annexure "A"

KARNATAK UNIVERSITY, DHARWAD

Syllabus and Structure

For

B. Sc. Botany

(I-VI SEMESTER)

Under

CHOICE BASED CREDIT SYSTEM (CBCS)

w.e.f. 2020 - 2021 onwards

SEMESTER I

CORE COURSE: BOTANY PAPER - I

BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATE)

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1: Microbes **(10 Lectures)**

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit 2: Algae **(12 Lectures)**

General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas, Oedogonium*, *VaucheriaSargassum, Batrachospermum*. Economic importance of algae

Unit 3: Fungi **(12 Lectures)**

Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition , nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium, Alternaria* (Ascomycota), *Puccinia, Agaricus* (Basidiomycota); Symbiotic Associations-Lichens:
General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

Unit 4: Introduction to Archegoniate **(2 Lectures)**

Unifying features of archegoniates, Transition to land habit, Alternation of generations.

Unit 5: Bryophytes **(10 Lectures)**

General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included) . Ecology and economic importance of Bryophytes with special mention of *Sphagnum*.

Unit 6: Pteridophytes **(8 Lectures)**

General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.

Unit 7: Gymnosperms **(6 Lectures)**

General characteristics, classification. Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus*. (Developmental details not to be included). Ecological and economical importance.

Practical

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of *Nostoc, Chlamydomonas* (Electron micrographs), *Oedogonium, Vaucheria, Fucus* and Polysiphonia* through temporary preparations and permanent slides. (* *Fucus* - Specimen and permanent slides)
5. *Rhizopus and Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. *Alternaria:* Specimens/photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
11. ***Marchantia***- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
12. ***Funaria***- Morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
13. ***Selaginella***- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
14. ***Equisetum***- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s rhizome (permanent slide).
15. ***Pteris***- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
16. ***Cycas***- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
17. ***Pinus***- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, , l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

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23. H.N.Srivastava , 2003. Algae Pradeep Publication, Jalandhar, India
24. Singh-Pande-Jain 2004-05. A Text Book of Botany. Rastogi Publication, Meerut
25. Anil K.Thakur & Susheel K.Bassi. Diversity of Microbes and Cryptogams. Chand Publication.

26. A.V.S.S.Sambamurty. A Text Book of Algae. I.K. International Private Ltd.
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28. McGraw Hill Publishing Co., New Delhi.
29. Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd.
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SEMESTER I

CORE COURSE: BOTANY PAPER - I

BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATE)

THEORY

Time : 3 Hours Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 1	:	Two Sub questions
From Unit – 2	:	Two Sub questions
From Unit – 3	:	Two Sub question
From Unit – 4	:	One Sub questions
From Unit – 5	:	Two Sub questions
From Unit – 6	:	One Sub question
From Unit – 7	:	Two Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 1	:	One Sub question
` From Unit – 2	:	Two Sub question
From Unit – 3	:	Two Sub question
From Unit – 5	:	One Sub questions
From Unit – 6	:	One Sub question
From Unit – 7	:	One Sub question

Q. III. Answer any **THREE** of the following: 3 x 10 = 30 Marks

From Unit – 1	:	One Sub question
` From Unit – 2	:	One Sub question
From Unit – 3	:	One Sub question
From Unit – 5	:	One Sub questions
From Unit – 6	:	One Sub question

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SEMESTER I

CORE COURSE: BOTANY PAPER - I

BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATE)

THEORY

Time : 3 Hours **Max. Marks: 80**

BLUE PRINT OF THE QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1	Microbes	10	02	01	01	19
2.	2	Algae	12	02	02	01	24
3.	3	Fungi	12	02	02	01	24
4.	4	Introduction to Archegoniate	02	01	00	00	02
5.	5	Bryophytes	10	02	01	01	19
6.	6	Pteridophytes	08	01	01	01	17
7.	7	Gymnosperms	06	02	01	00	09
Total			60	12	08	05	114

SEMESTER I

CORE COURSE: BOTANY PRACTICAL - I

BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATE)

Time : 03 Hours Max. Marks: 40

Q. 1.	Identify and classify the given specimen A. B, C, D, E and F giving reasons.	12 marks
Q. 2.	Make Simple/ Differential staining of the given specimen H and show the preparation to the examiner (No written answer is expected).	03 marks
Q. 3.	Identify the given specimen / slide I, J, K, L, M and N giving reasons.	09 marks
Q. 4.	Identify the given specimen / Photograph O giving reasons.	02 marks

Practical Record (Journal)	05 Marks
Botanical Study-Tour Report	05 marks
Viva-voce	04 Marks

Instructions to the Examiner

Q. 1. One Specimen each from Algae, Fungi, Bryophyte, Pteridophyte and Gymnosperm.

Q.2. Simple/ Differential staining of Bacteria

Q. 3. One specimen / slide each from Algae, Fungi, Bryophyte, Pteridophyte and Gymnosperm.

Q. 5. One specimen / slide / Electron Micrograph of Viruses or Bacteria.

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SEMESTER II

CORE COURSE BOTANY –PAPER II
PLANT ECOLOGY AND TAXONOMY
(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1: Introduction **(02 Hours)**

Unit 2: Ecological factors **(10 Hours)**

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes.

Unit 3: Plant communities **(06 Hours)**

Characters; Ecotone and edge effect; Succession; Processes and types.

Unit 4: Ecosystem **(08 Hours)**

Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous

Unit 5: Phytogeography **(04 Hours)**

Preinciple Biogeographical zones, Endemisim

Unit 6 : Introduction to Taxonomy **(02 Hours)**

Identification, Classification, Nomenclature

Unit 7 : Identification **(04 Hours)**

Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access

Unit 8 : Taxonomic Evidences **(06 Hours)**

From Palynology, Cytology, Phytochemistry and Molecular data.

Unit 9 : Taxonomic Hierarchy Ranks, categories and taxonomic groups **(02 Hours)**

Unit 10 : Botanical Nomenclature **(06 Hours)**

Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Unit 11 Classification **(06 Hours)**

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

Unit 12 Biometrics, numerical taxonomy and cladistics **(04 Hours)**

Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

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PRACTICALS

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (b)Study of biotic interactions of the following: Stem parasite (*Cuscuta)*, Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):**Brassicaceae** - *Brassica, Alyssum / Iberis;* **Asteraceae** -*Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax;* **Solanaceae** -*Solanum nigrum, Withania;* **Lamiaceae** -*Salvia, Ocimum*; **Liliaceae** - *Asphodelus / Lilium / Allium.*
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

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For laboratory exercises

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SEMESTER II

CORE COURSE BOTANY –PAPER II

PLANT ECOLOGY AND TAXONOMY

(Credits: Theory-4, Practicals-2)

THEORY

Time : 3 Hours Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 2	:	Two Sub questions
From Unit – 3	:	One Sub questions
From Unit – 4	:	Two Sub questions
From Unit – 5	:	One Sub questions
From Unit – 7	:	One Sub questions
From Unit – 8	:	One Sub questions
From Unit – 9	:	One Sub questions
From Unit – 10	:	One Sub questions
From Unit – 11	:	One Sub questions
From Unit – 12	:	One Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 2	:	Two Sub questions
From Unit – 3	:	One Sub questions
From Unit – 4	:	One Sub questions
From Unit – 5	:	One Sub questions
From Unit – 7	:	One Sub questions
From Unit – 10	:	One Sub questions
From Unit – 11	:	One Sub questions

Q. III. Answer any **THREE** of the following: 3 x 10 = 30 Marks

From Unit – 2	:	One Sub questions
From Unit – 3	:	One Sub questions
From Unit – 4	:	One Sub questions
From Unit – 8	:	One Sub questions
From Unit – 11	:	One Sub questions

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SEMESTER II

CORE COURSE BOTANY –PAPER II

PLANT ECOLOGY AND TAXONOMY

(Credits: Theory-4, Practicals-2)

THEORY

Time : 3 Hours **Max. Marks: 80**

BLUE PRINT OF THE QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1.	Introduction	02	00	00	00	00
2.	2.	Ecological Factors	10	02	02	01	24
3.	3.	Plant communities	06	01	01	01	17
4.	4.	Ecosystem	08	02	01	01	19
5.	5.	Phytogeography	04	01	01	00	07
6.	6.	Introduction to Taxonomy	02	00	00	00	00
7.	7.	Identification	04	01	01	00	07
8.	8.	Taxonomic Evidences	06	01	00	01	12
9.	9.	Taxonomic Hierarchy	02	01	00	00	02
10.	10.	Botanical Nomenclature	06	01	01	00	07
11.	11.	Classification	06	01	01	01	17
12.	12	Biometrics, Numerical Taxonomy and Cladistics	04	01	00	00	02
		Total	60	12	08	05	114

SEMESTER II

CORE COURSE BOTANY – PRACTICAL - II

PLANT ECOLOGY AND TAXONOMY

(Credits: Theory-4, Practicals-2)

PRACTICAL

Time : 3 Hours Max. Marks: 40

Q. 1. Give an account of external and internal features of ecological adaptations of specimen A and mention the habitat to which it belongs. 05 marks

Q. 2. Assign the specimens B, C and D to the respective families giving diagnostic features and their classifications (up to family). 09 marks.

Q. 3. Estimate the salinity / P^H of given water sample E. Write the procedure and inference 04 marks

Q. 4. Draw the floral diagram and write floral formula of specimen F. 03 marks.

Q. 5. Identify the slides / specimens G, H, I, giving reasons. 06 marks

Practical Record (Journal)	05 Marks
Submission of Herbaria of weeds (Any Five)	04 marks
Viva-voce (On Ecology / Vegetation types)	04 Marks

Instructions to the Examiner

Q. 1. One ecological specimen (External adaptation – 1 mark, Internal adaptation – 2 marks, diagram (T.S.) – 2 marks, mentioning habitat – 1 mark)

Q. 2. Three families done in the practical class.
(Identification – 1 mark, Classification – 1 mark, Features – 2 marks)

Q. 3. For P^H (Setting instrument – 2 marks, record of reading – 2 marks, conclusion & result – 1 mark)
For salinity of water (conducting the test – 2 marks, tabulation of readings – 1 mark, calculation and result – 2 marks)

Q. 4. A twig with flower buds (Floral diagram – 2 marks, Floral formula – 1 mark)

Q. 5. 3 Slides / specimens of ecological interest (Identification – 1 mark, description – 1 mark)

SEMESTER III

CORE COURSE BOTANY –PAPER III
PLANT ANATOMY AND EMBRYOLOGY
(Credits: Theory-4, Practicals-2)
THEORY

Lectures: 60

Unit 1: Meristematic and permanent tissues **(8 Hours)**
Root and shoot apical meristems; Simple and complex tissues.

Unit 2: Organs **(4 Hours)**
Structure of dicot and monocot root stem and leaf.

Unit 3: Secondary Growth **(8 Hours)**
Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood).

Unit 4: Adaptive and protective systems **(8 Hours)**
Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.

Unit 5: Structural organization of flower **(8 Hours)**

Structure and development of anther and pollen; Structure and development of ovule, types of ovules; Types of embryo sacs, organization and ultra structure of mature embryo sac.

Unit 6: Pollination and fertilization **(8 Hours)**
Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Unit 7: Embryo and endosperm **(8 Hours)**
Endosperm types, structure and functions; Dicot and monocot embryo; Embryo-endosperm relationship.

Unit 8: Apomixis and polyembryony **(8 Hours)**
Definition, types and practical applications.

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PRACTICALS

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays;* Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/ campylotropous.
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Dissection of embryo/endosperm from developing seeds.
13. Calculation of percentage of germinated pollen in a given medium.
14. Demonstration of Microtomy.

SUGGESTED READINGS

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
3. Bhoojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. 4th revised and Enlarged edition. Vikas Publishing House, Delhi.
4. Cutter, E.G. 1969. Part I. Cells and tissues. Edward Arnold, London.
5. Cutter, E.G. 1971. Plant Anatomy: Experiment and Interpretation. Part II. Organs. Edward Arnold, London.
6. Easu, K. 1977. Anatomy of seed plants. 2nd edition. John Wiley & Sons, New York.
7. Fahn. A. 1974. Plant Anatomy. 2nd edition. Pergamon Press, Oxford.
8. Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Publishing Co., Inc., Menlo Park, California, USA.
9. Raven, P.H. , Evert, R.F. and Eichhorn, S.E. 1999. Biology of Plants. 5th edition. W.H. Freeman and Co., Worth Publishers, New York.
10. Johri, B.M. 1984. Embryology of Angiosperms. Springer-Verlag, Berlin.
11. Maheshwari, P. 1950. An Introduction to Embryology of Angiosperms. Tata McGraw Hill, New York.
12. Shukla, A.K. 1999. Biology of Pollen. Atlas Books & Periodicals.
13. Raghavan, V. 1986. Embryogenesis in Angiosperms: A Developmental and Experimental Study. Cambridge University Press, New York.
14. B.P.Pandey. Plant Anatomy
15. M.S.Tayal. Plant Anatomy
16. Singh, Pandey and Jain. Embryology of angiosperms.
17. V.K.Gupta. Embryology of angiosperms.
18. K.R.Shivanna. Pollen Biotechnology.

SEMESTER III

CORE COURSE BOTANY –PAPER III
PLANT ANATOMY AND EMBRYOLOGY

Time : 3 Hours Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 1	:	One Sub questions
From Unit – 2	:	Two Sub questions
From Unit – 3	:	Two Sub questions
From Unit – 4	:	Two Sub questions
From Unit – 5	:	One Sub questions
From Unit – 6	:	One Sub questions
From Unit – 7	:	One Sub questions
From Unit – 8	:	Two Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 1	:	One Sub questions
From Unit – 3	:	One Sub questions
From Unit – 4	:	One Sub questions
From Unit – 5	:	One Sub questions
From Unit – 6	:	One Sub questions
From Unit – 7	:	One Sub questions
From Unit – 8	:	Two Sub questions

Q. III. Answer any **THREE** of the following: 3 x 10 = 30 Marks

From Unit – 1	:	One Sub questions
From Unit – 3	:	One Sub questions
From Unit – 5	:	One Sub questions
From Unit – 6	:	One Sub questions
From Unit – 7	:	One Sub questions

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SEMESTER III

CORE COURSE BOTANY –PAPER III
PLANT ANATOMY AND EMBRYOLOGY

THEORY

Time : 3 Hours **Max. Marks: 80**

BLUE PRINT OF THE QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1.	Meristematic and Permanent Tissues	08	01	01	01	17
2.	2.	Organs	04	02	00	00	04
3.	3.	Secondary Growth	08	02	01	01	19
4.	4.	Adaptive and Protective System	08	02	01	00	09
5.	5.	Structural and Organization of flower	08	01	01	01	17
6.	6.	Pollination and Fertilization	08	01	01	01	17
7.	7.	Embryo and Endosperm	08	01	01	01	17
8.	8.	Apomixis and Polyembryony	08	02	02	00	14
		Total	60	12	08	05	114

SEMESTER III

CORE COURSE BOTANY –PRACTICAL- III
PLANT ANATOMY AND EMBRYOLOGY

PRACTICAL

Time : 3 Hours Max. Marks: 40

Q. 1. Prepare a double stained temporary micropreparation of T.S. of specimen A. Draw a labelled diagram and mention the features of anatomical interest. 07 marks
Show the preparation to the examiner.

Q. 2. Make a temporary micropreparation of specimen B so as to expose _____.
Show the preparation to the examiner (No written answer is expected). 03 marks

Q. 3. Make a temporary micropreparation of specimen C so as to expose _____.
Draw a neat labelled diagram Show the preparation to the examiners. 03 marks

Q. 4. Identify and describe the salient features observed in the specimen / slide D, E, F, G, H and I. 18 marks

Q. 5. Estimate the percentage of pollen viability in the given flower A by Hanging drop method 04 marks

Practical Record (Journal) 05 Marks

Instructions to the Examiner

Q. 1. Any one stem showing anomalous secondary growth.

Q. 2. One specimen from anatomy.

Q. 3. Mounting – Embryo / endosperm.

Q. 4. Two slides from anatomy, One specimen / Photograph from Pollination and Microtomy each, two slides from embryology.

Q. 5. Unopened flowers with intact anthers
(Preparation – 2 marks, procedure – 3 marks, Inference – 2 marks)

SEMESTER IV
CORE COURSE BOTANY –PAPER IV
PLANT PHYSIOLOGY, METABOLISM AND PHYTOCHEMISTRY
(Credits: Theory-4, Practicals-2)
THEORY

Lectures: 60

Unit 1: Plant-water relations **(8 Hours)**

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Unit 2: Mineral nutrition **(6 Hours)**

Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

Unit 3: Translocation in phloem **(6 Hours)**

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

Unit 4: Photosynthesis **(12 Hours)**

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C_3, C_4 and CAM pathways of carbon fixation; Photorespiration.

Unit 5: Respiration **(6 Hours)**

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Unit 6: Enzymes **(4 Hours)**

Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Unit 7: Plant growth regulators **(6 Hours)**

Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Unit 8: Plant response to light and temperature **(6 Hours)**

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

Unit 9: Phytochemistry **(6 Hours)**

1. General account: Plants as source of meducune. Phytochemistry and its importance in modern medicine. Classification of plant drugs. Chemical and and pharmacological drug evaluation – microscopic, physical, chemical and biological.

2. Secondary Metabolites: Definition of secondary metabolites and difference with primary metabolites. Major types – Terpenoids, phenolics, alkaloids and their protective action against pathogenic microbes and herbivores.

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PRACTICAL

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O_2 evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.
9. Biochemical tests for proteins, carbohydrates and fats.
10. Microscopic features of some common powder drugs
11. Test for secondary metabolites - Terpenoids, phenolics, alkaloids.

Demonstration experiments (any four)

1. Bolting. 2. Effect of auxins on rooting. 3. Suction due to transpiration.
4. R.Q. 5. Respiration in roots.

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SUGGESTED READINGS

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
4. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds). 1997. Plant Metabolism (2nd edition). Longman, Essex, England.
5. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York.
6. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc. New York.
7. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. John Wiley Sons, Chichester, England.
8. Mohr, H. and Schopfer, P. 1995. Plant Physiology. Springer-Verlag, Berlin.
9. Salisbury, F.B.and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishin Co., California.
10. Taiz, L. and Zeiger, E. 2002 . Plant Physiology (3rd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
11. Devi P 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.
12. Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory Manual. Springer-Verlag, Berlin.
13. Ninfa, A.J. and Ballou, D.P. 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology., Fitzgerald Science Press, Ind., Maryland, USA.
14. Roberts, J. and Tucker, G.A. (Eds.) 2000 Plant Hormone Protocols. Humana Press, New Jersey, USA.
15. Scott, R.P.W. 1995. Techniques and Practice of Chromatography. Marcel Dekker, Inc., New York.
16. Wilson, K. and Goulding, K.H. (eds.) 1986. A Biologists Guide to principles and Techniques of Practical Biochemistry. Edward Arnold, London.
17. V. Verma. Plant Physiology
18. S.N.Pandey and B.K.Sinha. Plant Physiology. IV Edition. Vikas Publication.
19. S.K.Verma. Plant Physiology. S. Chand Publications, Meerut.

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SEMESTER IV
CORE COURSE BOTANY –PAPER IV
PLANT PHYSIOLOGY, METABOLISM AND PHYTOCHEMISTRY

Time : 3 Hours Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 1	:	One Sub questions
From Unit – 2	:	One Sub questions
From Unit – 3	:	One Sub questions
From Unit – 4	:	Three Sub questions
From Unit – 5	:	One Sub questions
From Unit – 6	:	One Sub questions
From Unit – 7	:	One Sub questions
From Unit – 8	:	Two Sub questions
From Unit – 9	:	One Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 1	:	One Sub questions
From Unit – 2	:	One Sub questions
From Unit – 3	:	One Sub questions
From Unit – 4	:	One Sub questions
From Unit – 6	:	One Sub questions
From Unit – 7	:	One Sub questions
From Unit – 8	:	One Sub questions
From Unit – 9	:	One Sub questions

Q. III. Answer any **THREE** of the following: 3 x 10 = 30 Marks

From Unit – 1	:	One Sub questions
From Unit – 4	:	One Sub questions
From Unit – 5	:	One Sub questions
From Unit – 7	:	One Sub questions
From Unit – 9	:	One Sub questions

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SEMESTER IV

CORE COURSE BOTANY –PAPER IV

PLANT PHYSIOLOGY, METABOLISM AND PHYTOCHEMISTRY

THEORY

Time : 3 Hours **Max. Marks: 80**

BLUE PRINT OF THE QUESTION PAPER

Sl. No.	Unit	Title	Teaching Hours	Total Questions Allotted			Total Marks
				2 marks	5 Marks	10 Marks	
1.	1	Plant water Relations	08	01	01	01	17
2.	2	Mineral Nutrition	06	01	01	00	07
3.	3	Translocation in Phloem	06	01	01	00	07
4.	4	Photosynthesis	12	03	01	01	21
5.	5	Respiration	06	01	00	01	12
6.	6	Enzymes	04	01	01	00	07
7.	7	Plant Growth Regulators	06	01	01	01	17
8.	8	Plant response to Light and Temperature	06	02	01	00	09
9.	9	Phytochemistry	06	01	01	01	17
Total			60	12	08	05	114

SEMESTER IV
CORE COURSE BOTANY –PRACTICAL - IV
PLANT PHYSIOLOGY, METABOLISM AND PHYTOCHEMISTRY

PRACTICAL

Time : 3 Hours Max. Marks: 40

Q. 1. Set up an experiment as per slip A. Write requirements, principle involved, procedure and conclusion. (Show the set up of the experiment to the examiners). 12 marks.

Q. 2. Perform and write the Biochemical test of the given sample B for _____ (Show the result to the examiners). 04 marks.

Q. 3. Identify and comment on the physiological phenomenon involved in the experiments C, D, E. 12 marks.

Q. 5. Identify, mention the parts used and describe microscopic features of the given powdered drug G. 03 marks

Q. 6. Perform the phyto-chemical test for the given sample H. 04 Marks

Practical Record (Journal) 05 Marks.

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Instructions to the Examiner

Q. 1. One experiment as per the slip. (Requirements – 2 marks, setting – 4 marks, procedure – 4 marks, conclusion – 2 marks)

Q. 2. Perform the test for Carbohydrates or Proteins or Fats. (Procedure – 2 marks, result – 2 marks)

Q. 3. Any three physiology experiments as per the practical syllabus. (Identification – 1 mark, procedure – 1 mark and Inference – 2 marks)

Q. 5. Identification and parts used – 1 Mark and description – 2 Mark.

Q. 6. Procedure – 2 Marks, Result – 2 Mark.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER V

(Student shall choose either paper- I or Paper-II or paper –III)

PAPER-I: CELL AND MOLECULAR BIOLOGY

(Credits: Theory-4, Practicals-2)

THEORY **Lectures: 60**

Unit 1: Techniques in Biology **(8 Lectures)**

Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.

Unit 2: Cell as a unit of Life **(2 Lectures)**

The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.

Unit 3: Cell Organelles **(20 Lectures)**

Mitochondria: Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA. Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA. ER, Golgi body & Lysosomes: Structures and roles. Peroxisomes and Glyoxisomes: Structures, composition, functions in animals and plants, ribosome structure and biogenesis.

Nucleus: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus (brief).

Unit 4: Cell Membrane and Cell Wall **(6 Lectures)**

The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall-structure and functions.

Unit 5: Cell Cycle **(6 Lectures)**

Overview of Cell cycle, Mitosis and Meiosis; Molecular controls

Unit 6: Genetic material **(6 Lectures)**

DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material.DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi–conservative, mode of replication, replication of linear, ds-DNA, replicating the 5′end of linear chromosome including replication enzymes.

Unit 7: Transcription and Translation (Prokaryotes and Eukaryotes) **(6 Lectures)**

Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code.

Unit 8: Regulation of gene expression **(6 Lectures)**

Prokaryotes:Lac operon and Tryptophan operon ; and in Eukaryotes.

PRACTICAL

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. Study of mitosis and meiosis (temporary mounts and permanent slides).
5. Study the effect of temperature, organic solvent on semi permeable membrane.
6. Demonstration of dialysis of starch and simple sugar.
7. Study of plasmolysis and deplasmolysis on *Rhoeo* leaf.
8. Measure the cell size (either length or breadth/diameter) by micrometry.
9. Study the structure of nuclear pore complex by photograph (from Gerald Karp) Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
10. Study DNA packaging by micrographs.
11. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.

SUGGESTED READINGS

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Karnatak Universiry, Dharwad

DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER V

CELL AND MOLECULAR BIOLOGY

Practical

Time : 04 Hours Max. Marks: 40

Q. 1.	Make a temporary micropreparation of the squash/ smear of the material A. Draw labeled diagram of any two stages of cell division seen in your preparation and show to the examiners	08 marks.
Q. 2.	Determine the length and breadth of the given material B by micrometric method.	05 marks.
Q. 3.	Conduct the experiment as per the direction given.	08 marks.
Q. 4.	Identify and describe the cytological stage in the slides F, G and H	09 marks.

Practical Record (Journal)	05 marks.
Submission of slides (2 meiosis slides and 3 mitosis slides)	05 marks.

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Instructions to the Examiner

Q. 1. Squash - *Allium* root tips.
Smear - *Allium , Tradescantia, Aloe vera* – flower buds may be given.
(preparation - 5 mark, drawing – 3 marks)

Q. 2. Onion peels
(calibration – 2 marks, drawing – 1 mark, measurement – 2 marks)

Q. 3. Any one experiment given in the practical list (Sl. No. 05 to 07)
(Requirements – 2 marks, setting – 2 marks, procedure – 2 marks, conclusion – 2 marks)

Q. 4. One slide from mitosis and two slides from meiosis
(identification – 1 mark, description – 1 mark, labelled diagram – 1 mark)

Karnatak Universiry, Dharwad

DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER V

CELL AND MOLECULAR BIOLOGY

Time : 3 Hours Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 1	:	One Sub question
From Unit – 2	:	One Sub question
From Unit – 3	:	Two Sub question
From Unit – 4	:	One Sub questions
From Unit – 5	:	Two Sub questions
From Unit – 6	:	Two Sub questions
From Unit – 7	:	Two Sub questions
From Unit – 8	:	One Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 1	:	One Sub question
From Unit – 3	:	Two Sub questions
From Unit – 4	:	One Sub questions
From Unit – 5	:	One Sub question
From Unit – 6	:	One Sub question
From Unit – 7	:	One Sub question
From Unit – 8	:	One Sub question

Q. III. Descriptive answers: 10 Marks
One questions from Unit – 1
OR
One questions from Unit – 3

Q. IV. Descriptive answers: 10 Marks
One questions from Unit – 3
OR
One questions from Unit – 4 or 5

Q. V. Descriptive answers: 10 Marks
One questions from Unit – 6
OR
One questions from Unit – 7 or 8

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KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER V

(Student shall choose either paper- I or Paper-II or paper –III)

PAPER-II: ECONOMIC BOTANY AND BIOTECHNOLOGY

(Credits: Theory-4, Practicals-2)

THEORY **Lectures: 60**

Unit 1: Origin of Cultivated Plants **(4 Lectures)**
Concept of centres of origin, their importance with reference to Vavilov's work

Unit 2: Cereals **(2 Lectures)**
Wheat -Origin, morphology, uses

Unit 3: Legumes **(4 Lectures)**
General account with special reference to Gram and soybean

Unit 4: Spices **(4 Lectures)**
General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses)

Unit 5: Beverages **(2 Lectures)**
Tea (morphology, processing, uses)

Unit 6: Oils and Fats **(2 Lectures)**
General description with special reference to groundnut

Unit 7: Fibre Yielding Plants **(4 Lectures)**
General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Unit 8: Introduction to biotechnology **(2 Lectures)**
Historical account, branches of biotechnology.

Unit 9: Plant tissue culture **(16 Lectures)**

Introduction, steps involved in plant tissue culture, Micropropagation: haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

Unit 10: Recombinant DNA Technology **(20 Lectures)**

Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection. Molecular diagnosis of human disease, Human gene Therapy.

PRACTICAL

1. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests
2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.
5. Preparation of synthetic seeds.

SUGGESTED READINGS

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER V

(Student shall choose either paper- I or Paper-II or paper –III)
PAPER-III: BIOINFORMATICS

(Credits: Theory-4, Practicals-2)
THEORY

Lectures: 60

Unit 1: Introduction to Bioinformatics **(5 Lectures)**
Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics.

Unit 2: Databases in Bioinformatics **(5 Lectures)**
Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System.

Unit 3 : Biological Sequence Databases **(25 Lectures)**
National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database. EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools. DNA Data Bank of Japan (DDBJ): Introduction, Resources at DDBJ, Data Submission at DDBJ. Protein Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR. Swiss-Prot: Introduction and Salient Features.

Unit 4: Sequence Alignments **(10 Lectures)**
Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM).

Unit 5: Molecular Phylogeny **(8 Lectures)**
Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction.

Unit 6: Applications of Bioinformatics **(7 Lectures)**
Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement.

Practical

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree.

Suggested Readings

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: SKILL ENHANCE COURSES (SEC-I)
(Student shall choose either paper- IA or Paper-IB for SEC-I)

SEMESTER V

PAPER-IA: HERBAL TECHNOLOGY

(Credits: 2)

THEORY **Lectures: 30**

Unit 1: Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants. **(6 Lectures)**

Unit 2: Pharmacognosy - systematic position m edicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka. **(6 Lectures)**

Unit 3: Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster). **(8 Lectures)**

Unit 4: Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds) **(8 Lectures)**

Unit 5: Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy) **(2 Lectures)**

SUGGESTED READINGS

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book _Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH _publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: SKILL ENHANCE COURSES (SEC-I)
(Student shall choose either paper- IA or Paper-IIB for SEC-I)

SEMESTER V

PAPER-IB: NURSARY AND GARDENING

(Credits: 2)

THEORY **Lectures: 30**

Unit 1: Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants. **(4 Lectures)**

Unit 2: Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification. **(6 Lectures)**

Unit 3: Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glass house. **(6Lectures)**

Unit 4: Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting. **(8 Lectures)**

Unit 5: Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures. **(6 Lectures)**

SUGGESTED READINGS

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National _Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: SKILL ENHANCE COURSES (SEC-II)
(Student shall choose either paper- IIA or Paper-IIB for SEC-II)

SEMESTER V

PAPER-IIA: FLORICULTURE

(Credits: 2)

THEORY **Lectures: 30**

Unit 1: Introduction: History of gardening; Importance and scope of floriculture and landscape gardening. **(2 Lectures)**

Unit 2: Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators. **(8 Lectures)**

Unit 3: Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai. **(5 Lectures)**

Unit 4: Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India. **(5 Lectures)**

Unit 5: Landscaping Places of Public Importance: Landscaping highways and Educational institutions. **(2 Lectures)**

Unit 6: Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchids). **(6 Lectures)**

Unit 7: Diseases and Pests of Ornamental Plants. **(2 Lectures)**

SUGGESTED READINGS

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: SKILL ENHANCE COURSES (SEC-II)
(Student shall choose either paper- IIA or Paper-IIB for SEC-II)

SEMESTER V

MEDICINAL BOTANY

(Credits: 2)

THEORY **Lectures: 30**

Unit 1: History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations. **(10 Lectures)**

Unit 2: Conservation of endangered and endemic medicinal plants. Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding. **(10 Lectures)**

Unit 3: Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases. **(10 Lectures)**

SUGGESTED READINGS

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
2. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER VI

(Student shall choose either paper- I or Paper-II or paper –III)

PAPER-I: GENETICS AND PLANT BREEDING

(Credits: Theory-4, Practical-2)

THEORY **Lectures: 60**

Unit 1: Heredity **(20 Lectures)**

Brief life history of Mendel, Terminologies, Laws of Inheritance, Modified Mandelian Ratios: 2:1- lethal Genes; 1:2:1- Co- dominance, incomplete dominance; 9:7; 9:4:3; 13:3; 12:3:1., Chi- Square, Pedigree Analysis, Cytoplasmic Inheritance: Shell Coiling in Snail, Kappa particles in Paramecium, leaf variegation in ***Mirabilis jalapa***, Male sterility, Multiple allelism in ***Nicotiana tobaccum***, Pleiotropism, Chromosome theory of Inheritance.

Unit 2: Sex-determination and Sex-linked Inheritance **(4 Lectures)**

Sex-determination in ***Drosophila* sp.** and Sex-linked Inheritance in ***Melandrium album.***

Unit 3: **Linkage and Crossing over** **(8 Lectures)**

Linkage: concept & history, complete & incomplete linkage, bridges experiment, coupling & repulsion, recombination frequency, linkage maps based on two and three factor crosses. Crossing over: concept and significance, cytological proof of crossing over.

Unit 4: Mutations and Chromosomal Aberrations **(4 Lectures)**

Types of mutations, effects of physical & chemical mutagens. Numerical chromosomal changes: Euploidy, Polyploidy and Aneuploidy ; Structural chromosomal changes: Deletions, Duplications, Inversions & Translocations.

Unit 5: Plant Breeding **(4 lectures)**

Introduction and objectives. Breeding systems: modes of reproduction in crop plants.
Important achievements and undesirable consequences of plant breeding.

Unit 6: Methods of crop improvement **(8 lectures)**

Introduction: Centres of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.

Unit 7: Quantitative inheritance **(4 lectures)**

Concept, mechanism, examples. Monogenic vs polygenic Inheritance.

Unit 8: Inbreeding depression and heterosis **(4 lectures)**

History, Genetic basis of inbreeding depression and heterosis; Applications.

Unit 9: Crop improvement and breeding **(4 lectures)**

Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

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PRACTICAL

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.
3. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs.
6. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
7. Hybridization techniques - Emasculation, Bagging (For demonstration only).
8. Induction of polyploidy conditions in plants (For demonstration only).
9. In-vitro germination of pollens and estimation of percentage of pollen viability by hanging drop method.

SUGGESTED READINGS

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning.
6. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

Karnatak Universiry, Dharwad

DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER VI

GENETICS AND PLANT BREEDING

(Credits: Theory-4, Practical-2)

THEORY

Time : 3 Hours Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

	From Unit – 1	:	Two Sub questions
`	From Unit – 2	:	One Sub question
	From Unit – 3	:	Two Sub questions
	From Unit – 4	:	One Sub question
	From Unit – 5	:	One Sub question
	From Unit – 6	:	Two Sub questions
`	From Unit – 7	:	One Sub question
	From Unit – 8	:	One Sub question
	From Unit – 9	:	One Sub question

Q. I. Answer any **SIX** of the following: 6 x 05 = 30 Marks

	From Unit – 1	:	Three Sub questions
`	From Unit – 2 & 3	:	One Sub question
	From Unit – 4 & 5	:	One Sub question
	From Unit – 6	:	One Sub question
	From Unit – 7 & 8	:	One Sub question
	From Unit – 9	:	One Sub question

Q. III. Descriptive answers: 10 Marks

One questions from Unit – 1

OR

One questions from Unit – 2 & 3

Q. IV. Descriptive answers: 10 Marks

One questions from Unit – 1

OR

One questions from Unit – 4 or 5

Q. V. Descriptive answers: 10 Marks

One questions from Unit – 6

OR

One questions from Unit – 7 or 8

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Karnatak Universiry, Dharwad

DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER VI

GENETICS AND PLANT BREEDING

Practical

Time : 04 Hours Max. Marks: 40

Q. 1.	Estimate the percentage of pollen viability in the given flower A by Hanging drop method	07 marks
Q. 2.	Demonstrate the emasculation technique in the given plant twig B Show the preparation to the examiners and write the procedure.	05 marks.
Q. 3.	Solve the genetic problem C and D. .	08 marks.
Q. 4.	Identify and comment on the specimens / photographs D, E, F, G & H.	15 marks.
	Practical Record (Journal)	05 Marks.

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Instructions to the Examiners

Q. 1. Unopened flowers with intact anthers (Preparation – 2 marks, procedure – 3 marks, Inference – 2 marks)

Q. 2. One plant propagation or hybridization technique
(Preparation – 2 marks, Procedure – 2 marks, inference – 2 marks)

Q. 3. Genetic Problems – 02 (04 Marks each)

Q. 4. One material from Practical 1, 2, 3, 4, 5, 6 & 8 (Any five)

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER VI

(Student shall choose either paper- I or Paper-II or paper –III)
PAPER-II: ANALYTICAL TECHNIQUES IN PLANT SCIENCES

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1: Imaging and related techniques (15 Lectures)
Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit 2: Cell fractionation (8 Lectures)

Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, $CsCl_2$ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

Unit 3: Radioisotopes (4 Lectures)
Use in biological research, auto-radiography, pulse chase experiment.

Unit 4: Spectrophotometry (4 Lectures)
Principle and its application in biological research.

Unit 5: Chromatography (8 Lectures)
Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

Unit 6: Characterization of proteins and nucleic acids (6 Lectures)
Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

Unit 7:Biostatistics (15 Lectures)
Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

Practicals

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separate DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

Suggested Readings

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: DISCIPLINE SPECIFIC ELECTIVE (DSE)

SEMESTER VI

(Student shall choose either paper- I or Paper-II or paper –III)

PAPER-III: RESEARCH METHODOLOGY

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1: Basic concepts of research (10 Lectures)

Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs emperical). Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.

Unit 2: General laboratory practices (12 Lectures)

Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases. Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions. Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.

Unit 3: Data collection and documentation of observations (6 Lectures)

Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of tissuespecimens and application of scale bars. The art of field photography.

Unit 4: Overview of Biological Problems (6 Lectures)

History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics-Transcriptional regulatory network.

Unit 5: **Methods to study plant cell/tissue structure (6 Lectures)**

Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.

Unit 6: Plant microtechniques (12 Lectures)

Staining procedures, classification and chemistry of stains. Staining equipment. Reactiv dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials.

Unit 7: The art of scientific writing and its presentation (8 Lectures)

Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.

Practical

1. Experiments based on chemical calculations.
2. Plant microtechnique experiments.
3. The art of imaging of samples through microphotography and field photography.
4. Poster presentation on defined topics.
5. Technical writing on topics assigned.

Suggested Readings

1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
3. Ruzin, S.E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.

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KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: SKILL ENHANCE COURSES (SEC-I)

SEMESTER VI

(Student shall choose either paper- IA or Paper-IB)

PAPER-IA: PLANT DIVERSITY AND HUMAN WELFARE

(Credits: 2)

THEORY **Lectures: 30**

Unit 1: Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes. **(8 Lectures)**

Unit 2:Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss,

Management of Plant Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR;
Biodiversity legislation and conservations, Biodiversity information management and communication. **(10 Lectures)**

Unit 3:Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Social approaches to conservation,
Biodiversity awareness programmes, Sustainable development. **(6 Lectures)**

Unit 4: Role of plants in relation to Human Welfare; a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses. **(6 Lectures)**

SUGGESTED READINGS

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity – Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: SKILL ENHANCE COURSES (SEC-I)

SEMESTER VI

(Student shall choose either paper- IA or Paper-IB)

PAPER-IB: ETHNOBOTANY

(Credits: 2)

THEORY **Lectures: 30**

Unit 1: Ethnobotany
Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses. **(8 Lectures)**

Unit 2: Methodology of Ethnobotanical studies
a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places. **(4 Lectures)**

Unit 3: Role of ethnobotany in modern Medicine
Medico-ethnobotanical sources in India;Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadiractha indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauvolfia sepentina, Trichopus zeylanicus, Artemisia,Withania*.
Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management). **(12 Lectures)**

Unit 4: Ethnobotany and legal aspects
Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge. **(6 Lectures)**

SUGGESTED READINGS

1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2) S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981
3) Lone et al., Palaeoethnobotany
4) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
5) S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
6) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
7) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-1996-9)

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: SKILL ENHANCE COURSES (SEC-II)

SEMESTER VI

(Student shall choose either paper- IIA or Paper-IIB)

PAPER- IIA: MUSHROOM CULTURE TECHNOLOGY

(Credits: 2)

THEORY **Lectures: 30**

Unit 1: Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus*. **(5 Lectures)**

Unit 2: Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production. **(12 Lectures)**

Unit 3: Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in saltsolutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins. **(8 Lectures)**

Unit 4: Food Preparation_: Types of foods prepared from mushroom. Research Centres - National level and Regional level._Cost benefit ratio - Marketing in India and abroad, Export Value. **(5 Lectures)**

SUGGESTED READINGS

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

KARNATAKA UNEVIRSITY, DHARWAD
BOTANY: SKILL ENHANCE COURSES (SEC-II)

SEMESTER VI

(Student shall choose either paper- IIA or Paper-IIB)

PAPER- IIB: INTELLECTUAL PROPERTY RIGHTS

(Credits: 2)
THEORY **Lectures: 30**

Unit 1: Introduction to intellectual property right (IPR) **(2 lectures)**
Concept and kinds. Economic importance. IPR in India and world: Genesis and scope, some important examples.IPR and WTO (TRIPS, WIPO).

Unit 2 : Patents **(2 Lectures)**
Objectives, Rights, Patent Act 1970 and its amendments. Procedure of obtaining patents, Working of patents. Infringement.

Unit 3: Copyrights **(2 Lectures)**
Introduction, Works protected under copyright law, Rights, Transfer of Copyright, Infringement.

Unit4: Trademarks **(2 Lectures)**
Objectives, Types, Rights, Protection of goodwill, Infringement, Passing off, Defences, Domain name.

Unit 5: Geographical Indications **(2 Lectures)**
Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position.

Unit 6:Protection of Traditional Knowledge **(6 Lectures)**
Objective, Concept of Traditional Knowledge, Holders, Issues concerning, Bio-Prospecting and Bio-Piracy, Alternative ways, Protectability, needfor a Sui-Generis regime, Traditional Knowledge on the International Arena, at WTO, at National level, Traditional Knowledge Digital Library.

Unit 7: Industrial Designs **(2 Lectures)**
Objectives, Rights, Assignments, Infringements, Defences of Design Infringement

Unit 8: Protection of Plant Varieties **(4 Lectures)**
Plant Varieties Protection-Objectives, Justification, International Position, Plant varieties protection in India. Rights of farmers, Breeders and Researchers.National gene bank, Benefit sharing.Protection of Plant Varieties and Farmers' Rights Act, 2001.

Unit 9:Information Technology Related Intellectual Property Rights **(4 Lectures)**
Computer Software and Intellectual Property, Database and Data Protection, Protection of Semi-conductor chips, Domain Name Protection

Unit 10: Biotechnology and Intellectual Property Rights. **(4 Lectures)**
Patenting Biotech Inventions: Objective, Applications, Concept of Novelty, Concept of inventive step, Microorganisms, Moral Issues in Patenting Biotechnological inventions.

SUGGESTED READINGS

1. N.K. Acharya: Textbook on intellectual property rights, Asia Law House (2001).
2. Manjula Guru & M.B. Rao, Understanding Trips: Managing Knowledge in Developing Countries, Sage Publications (2003).
3. P. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill (2001).
4. Arthur Raphael Miller, Micheal H.Davis; Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, West Group Publishers (2000).
5. Jayashree Watal, Intellectual property rights in the WTO and developing countries, Oxford University Press, Oxford.

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KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-02/BOS /Chemistry (UG) /20-21/ 983 Date: 16 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Chemistry UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.
2. Special BOS Res. No. 02, dt. 13.07.2020.
3. Special Faculty Res. No. 03, dt. 11.08.2020.
4. Special Academic Council Res. No. 35, dt. 21.08.2020.
5. Vice-Chancellor's order dated - 07-10-2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Chemistry UG syllabus for I to VI Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website (www.kud.ac.in).

15/10/2020
(Dr. Hanumantappa K.T)
REGISTRAR

To,

1. The Chairman, BOS Chemistry (UG), Dept. of Chemistry, K.U.Dharwad.
2. The Chairman, Dept. of Chemistry, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fwcs to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Botany, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website (www.kud.ac.in).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analysist, Computer Unit Exam Section, K.U.Dharwad.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. Programme

***

SYLLABUS FOR

CHEMISTRY (OPTIONAL)

AS DISCIPLINE SPECIFIC COURSE (DSC) and

SKILL ENHANCEMENT COURSE (SEC)

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

*****

Effective from 2020-21

B.Sc. Programme structure under CBCS

Semester	*Core			Elective			Ability Enhancement Course						Total Credits
	DSC			**DSE			***SEC			AECC			
	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	
I	DSC-1A	4+0+4	4+2=6							English-1	2+1+0	2+1=3	26
	DSC-2A	4+0+4	4+2=6							MIL-1	2+1+0	2+1=3	
	DSC-3A	4+0+4	4+2=6							ENVIRONMENTAL SCIENCE	2+0+0	2+0=2	
II	DSC-1B	4+0+4	4+2=6							English-2	2+1+0	2+1=3	26
	DSC-2B	4+0+4	4+2=6							MIL-2	2+1+0	2+1=3	
	DSC-3B	4+0+4	4+2=6							CONSTITUTION OF INDIA	2+0+0	2+0=2	
III	DSC-1C	4+0+4	4+2=6							English-3	2+1+0	2+1=3	24
	DSC-2C	4+0+4	4+2=6							MIL-3	2+1+0	2+1=3	
	DSC-3C	4+0+4	4+2=6										
IV	DSC-1D	4+0+4	4+2=6							English-4	2+1=0	2+1=3	24
	DSC-2D	4+0+4	4+2=6							MIL-4	2+1=0	2+1=3	
	DSC-3D	4+0+4	4+2=6										
V				DSE-1E	4+0+4	4+2=6	SEC-1E	2+0+0	2				22
				DSE-2E	4+0+4	4+2=6	SEC-2E	2+0+0	2				
				DSE-3E	4+0+4	4+2=6							
VI				DSE-1F	4+0+4	4+2=6	SEC-1F	2+0+0	2				22
				DSE-2F	4+0+4	4+2=6	SEC-2F	2+0+0	2				
				DSE-3F	4+0+4	4+2=6							
TOTAL			72			36			08			28	144

L+T+P= Lecturing in Theory + Tutorial + Practical Hours per Week (no tutorial for practical subject).

* If the core course is Mathematics, there shall be two papers of 75 marks each. Then L+T+P = (2x3)+(2x1)+0, but credit shall be 6 only.

** Each DSE shall have at least two papers and student shall choose any one paper from each DSE.

*** SEC 1 & 2 shall be from all three DSC but student shall choose any two in each semester (SEC may be practical or theory for 2 credits only).

Note: 1. Each DSC/DSE Shall have 60hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam) and 52 hrs practical/sem for 50 marks(40 Sem. End exam +10 IA Exam).

2. English/MIL Shall have 45 hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam).

3. Environmental Science/ Constitution of India / SEC shall have 30 hrs syllabus / semester for 50 marks in theory/ Practical (40 Sem. End exams +10 IA Exam).

Karnatak University, Dharwad

CBCS syllabus for Under Graduate Programme in Chemistry (opt.) as

DISCIPLINE SPECIFIC COURSE (DSC)

Effective from 2020-21

Semester	Theory/ Practical	Subject Code	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam.	Internal Assessment Marks	Sem final Exam. Marks	Total Marks	Credits
I	Theory	DSC (CHT: A)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (CHPr: A)	04 hrs	52	03 hrs	10	40	50	02
II	Theory	DSC (CHT: B)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (CHPr: B)	04 hrs	52	03 hrs	10	40	50	02
III	Theory	DSC (CHT: C)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (CHPr: C)	04 hrs	52	03 hrs	10	40	50	02
IV	Theory	DSC (CHT: D)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (CHPr: D)	04 hrs	52	03 hrs	10	40	50	02
V	*Theory P-I /P- II	DSE (CHT: P-I E CHT: P-II E)	04 hrs / 04 hrs	60/60	03 hrs	20	80	100	04
	Practical	DSE (CHPr: E)	04 hrs	52	03 hrs	10	40	50	02
VI	*Theory P-I /P- II	DSE (CHT: P-I F CHT: P-II F)	04 hrs / 04 hrs	60/60	03 hrs	20	80	100	04
	Practical	DSE (CHPr: F)	04 hrs	52	03 hrs	10	40	50	02
Total						180	720	900	36

*Candidate shall choose either paper –I or P-II but not both in DSE theory.

SKILL ENHANCEMENT COURSE (SEC) for Chemistry opted as DSC

Semester	Theory	Subject Code	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam.	Internal Assessment Marks	Sem final Exam. Marks	Total Marks	Credits
V	Theory	(SEC-CH- 1E)	02 hrs	30	1.5 hrs	10	40	50	02
V	Theory	(SEC-CH- 2E)	02 hrs	30	1.5 hrs	10	40	50	02
VI	Theory	(SEC-CH- 1F)	02 hrs	30	1.5 hrs	10	40	50	02
VI	Theory	(SEC-CH- 2F)	02 hrs	30	1.5 hrs	10	40	50	02
Total						40	160	200	08

Discipline Specific Course(DSC) under CBCS

B.Sc. Semester - I

CHEMISTRY: CHT: A

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs./wk. Total Practical: 52 hrs.**
		40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wave functions (atomic orbitals) and their variations for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1*s* and 2*s* atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of *s*, *p* and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number (m_s).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. **(14 Lectures)**

Chemical Bonding and Molecular Structure: Ionic Bonding*:* General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures of NO_3^-, CO_3^{2-}, and SO_4^{2-}.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches. **(16 Lectures)**

Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule. **(8 Lectures)**

Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (up to two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds. Threo and erythro; D and L; *cis* - *trans* nomenclature; CIP Rules: R/ S (for up to 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems). **(10 Lectures)**

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Up to 5 Carbons). Preparation*:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions*:* Free radical Substitution: Halogenation.

Alkenes: (Up to 5 Carbons) Preparation*:* Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition(alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation.

Alkynes: (Up to 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. **(12 Lectures)**

CHEMISTRY LAB: CHPr: A

1) Volumetric analysis – Meaning of terms such as standard solution, Normality, Molarity, Molality, Equivalent mass. Types of titrations, equations and indicator used in the titration. Calibration of glass wares (burette, pipette, volumetric flask) and weights (both grams and milligrams).Use of analytical balance.

2) Standardization of NaOH solution using standard oxalic acid solution and estimation of HCl in the given solution.

3) Standardization of HCl solution using standard sodium carbonate solution and estimation of total alkalinity or sodium carbonate and sodium bicarbonate in the given solution using double titration method.

4) Standardization of $KMnO_4$ solution using standard oxalic acid solution and estimation of Mohr's salt and water of crystallization in Mohr's salt.

5) Standardization of $K_2Cr_2O_7$ solution using standard Mohr's salt solution and estimation of ferrous and ferric ions in a given mixture.

6) Standardization of $Na_2S_2O_3$ solution using standard $K_2Cr_2O_7$ solution and estimation of iodine in the given solution.

7) Standardization of EDTA solution using standard $ZnSO_4$ solution and estimation of Zn^{2+} in the given solution.

8) Estimation of temporary, permanent and total hardness of water using standard EDTA solution.

9) Estimation of Phenol/Aniline by bromination method.

10) Estimation of acetamide by hydrolysis method.

11) Estimation of Ethyl benzoate by hydrolysis method.

12) Estimation of aspirin in the tablet by hydrolysis method.

- Standard solution for all the experiments shall be prepared by students for both regular practicals and examinations.

Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.

Examination

In a batch of ten students, at least five different experiments may be given in the practical examination. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

Accuracy for Standardization/blank titration - 09 marks , Accuracy for main titration 15 marks, Reactions and calculations – 4 marks, Technique and Presentation-2 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Deduction of Marks for accuracy:

Standardization /blank titration: ±0.2 CC -09 marks, ± 0.4 CC- 07 marks, ±0.6 CC- 06marks, ±0.8 CC- 04 marks, above ±0.8 CC- zero marks.

Main titration: ±0.2 CC -15 marks, ± 0.4 CC- 12 marks, ±0.6 CC- 09 marks, ±0.8 CC- 06 marks, ±0.9 CC- 03 marks, above ±0.9 – zero marks.

Discipline Specific Course (DSC) under CBCS

B.Sc. Semester - II

CHEMISTRY: CHT: B

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs./wk. Total Practical: 52 hrs.**
		40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behavior, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation (numerical problems). Andrews isotherms of CO_2. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

Temperature dependence of these distributions. Most probable, average and root mean square velocities and their comparisons. Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

(8 Lectures)

Liquids: Surface tension and parachor and its applications. Determination of surface tension using stalagmometer (drop weight and drop number method). Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only). Refractive index and its determination by Abbe's refractometer(numerical problems).

(7 Lectures)

Solids: Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals. **(7 Lectures)**

Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction(numerical problems). Methods for determination of order of a reaction by half life period and differential equation method. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). **(8 Lectures)**

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure

Aromatic hydrocarbons: *Preparation* (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. *Reactions*: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene). **(8 Lectures)**

Alkyl and Aryl Halides:

Alkyl Halides (Up to 5 Carbons): Types of Nucleophilic Substitution (S_N1, S_N2 and S_Ni) reactions. *Preparation:* from alkenes *and* alcohols. *Reactions:* hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs. substitution.

Aryl Halides *Preparation:* (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. *Reactions (Chlorobenzene):* Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. **(8 Lectures)**

Alcohols, Phenols and Ethers (Up to 5 Carbons)

Alcohols: *Preparation:* Preparation of 1^o, 2^o and 3^o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. *Reactions:* With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation *Diols:* (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) *Preparation:* Cumene hydroperoxide method, from diazonium salts. *Reactions:* Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer- Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehye, acetaldehyde, acetone and benzaldehyde) *Preparation:* from acid chlorides and from nitriles.

Reactions – Reaction with HCN, ROH, $NaHSO_3$, R-NH_2 derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

(14 Lectures)

CHEMISTRY LAB: CHPr: B

1. Explanation regarding crystallization, fractional crystallization, sublimation, reflux, distillation, fractional distillation, distillation under reduced pressure , steam distillation and determination of melting point of the crystallized solid & boiling point of the liquid. (Students should write in the journal regarding the above).
2. Experiment No 2 to 7 : **Systematic qualitative analysis** of organic compounds (without preparation of the derivative).**The following any twelve compounds may be given**.
   Phthalic acid, cinnamic acid, phenol, β- naphthol, aniline , p-toluidine, benzaldehyde, acetophenone, acetanilide , benzamide, thiourea, chlorobenzene, m-dinitro benzene, di-phenyl and ethyl acetate.
3. Experiment No 8 to 12: **Preparation of organic compounds.**
   i. Bromination – Phenol / aniline to 2,4,6-tribromo phenol/aniline or acetanilide to p-bromo acetanilide (any one).
   ii. Nitration – Salicylic acid to 5-nitro salicylic acid / acetanilide to p-nitro acetanilide (any one).
   iii. Dehydration – Phthalic acid to phthalic anhydride.
   iv. Hydrolysis - Benzamide to benzoic acid.
   v. Oxidation – Benzaldehyde to benzoic acid.
   vi. Reduction – m-dinitrobenzene to m- nitro aniline.

Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.

Examination

In a batch of ten students, each student should perform qualitative analysis of organic compound and preparation of organic compound. Not more than 2 students should get the same experiment. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

Journal – 05 marks , Viva-Voce-5 marks,(Total=40 marks.)

1. For Preparation Experiments (10 Marks):

Reaction and calculation of theoretical yield – 2 mark, technique and presentation-2 marks , observed yield -04 marks, M.P- 02 marks. Total – 10 marks.

D**eduction of Marks:**

Error yield- less than 10%- 04 marks, 11-15% 03 marks, 16-20% 02 marks, 21-25% 01 marks, more than 25% Zero marks

2. For qualitative analysis of organic compound(20 Marks)

Nature of the compound – 4 marks. element test – 4 marks, functional group and confirmative test – 05marks , melting point/ boiling point – 3 marks, name and structure-04 marks, Total - 20marks.

Discipline Specific Course (DSC) under CBCS

B.Sc. Semester - III

CHEMISTRY: CHT: C

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs./wk. Total Practical: 52 hrs.**
		40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

Chemical Energetics: First Law of Thermodynamics. Enthalpy, concept of standard state, standard enthalpy, Types of enthalpies: formation, combustion, neutralization, integral and differential enthalpies of solution and dilution, lattice enthalpy(numerical problems). Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. **(08 Lectures)**

Chemical Equilibrium: Limitations of first law of thermodynamics**,** concept of entropy, Second law of thermodynamics**,** Free energy, free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^{0}, Le Chatelier's principle. Relationships between K_p, K_C and K_X for reactions involving ideal gases(numerical problems). Third Law of thermodynamics and calculation of absolute entropies of substances. **(08 Lectures)**

Ionic Equilibria: Strong, moderate and weak electrolytes with examples, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle(numerical problems). **(10 Lectures)**

Distribution law: Nernst distribution law and its derivation. Limitations of law. Modification of distribution law for change in molecular state(association and dissociation). Application in solvent extraction- simple and multiple extractions. Derivation for multiple extraction(numerical problems). **(4 Lectures)**

Carboxylic acids and their derivatives: Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Carboxylic acids (aliphatic and aromatic):*Preparation:* Acidic and Alkaline hydrolysis of esters. *Reactions:* Hell – Vohlard - Zelinsky Reaction.

Carboxylic acid derivatives (aliphatic) (Up to 5 carbons) : *Preparation:* Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. *Reactions:* Comparative study of acylation of acyl derivatives. Reformatsky Reaction, Perkin condensation. **(6 Lectures)**

Amines and Diazonium Salts: Amines (Aliphatic and Aromatic): (Up to 5 carbons)

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Diazonium salts: *Preparation:* from aromatic amines. *Reactions:* conversion to benzene, phenol, dyes. **(6 Lectures)**

Heterocyclic Compounds: Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structural elucidation of Indole, Fischer indole synthesis, Structural elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis.

Alkaloids: Natural occurrence, General structural features, Hoffmann's exhaustive methylation, Structure elucidation and synthesis of Hygrine and Nicotine.

Terpenes: Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Neral and α-terpineol. **(18 Lectures)**

CHEMISTRY LAB: CHPr: C

1. Explanation regarding errors, types of errors, accuracy, precision, significant figures, standard deviation, and Use of log table (students should write in the journal regarding the above).
2. Study of effect of acid strength on hydrolysis of methyl acetate using HCl and H_2SO_4.
3. Determination of velocity constant and effect of concentration on velocity constant of second order reaction KI + $K_2S_2O_8$ (a = b).
4. Study of adsorption of acetic acid on animal charcoal.
5. Determination of surface tension and parachor of benzene series or alcohol series.

6. Determination of surface tension and parachor of toluene, xylene and n-hexane and calculate the atomic parachor of Carbon and Hydrogen
7. Determination of viscosity of toluene and carbon tetrachloride by Ostwald's Viscometer method.
8. Determination of viscosity of binary liquid mixtures of Toluene & carbon tetrachloride and to calculate the percentage composition of the unknown mixture.
9. Study of distribution of acetic acid/ benzoic acid between water and toluene.
10. Determination of enthalpy of ionization of acetic acid by calorimetric method.
11. Determination of heat of solution of KNO_3 by calorimetric method.
12. Determination of degree of dissociation of KCl by Landsberger's method.

Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.

Examination

In a batch of ten students, not more than two students should get the same experiment in the practical examination. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

Accuracy-18 marks, Technique and Presentation-3marks Calculation and graph- (5+4) 9 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Deduction of Marks for accuracy:

Error up to 5% - 18 marks, 6 - 10% 15 marks, 11-15%- 12 marks, 16-20% 09 marks, above 20% zero (0) marks

Discipline Specific Course (DSC) under CBCS

B.Sc. Semester - IV

CHEMISTRY: CHT: D

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs./wk. Total Practical: 52 hrs.**
		40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

Chemistry of *s* and *p* Block Elements:

Diagonal relationship and anomalous behaviour of first member in s block elements. Complex formation tendency of *s* and *p* block elements. Structure, bonding, preparation, and uses of boron nitrides, borohydrides (diborane), carboranes, silicates, oxides and oxoacids of nitrogen, peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens. Bonding inXeF_2, XeF_4 and XeO_3. **(10 Lectures)**

Chemistry of *d* and *f* Block Elements:

Transition Elements: General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states. Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states (excluding their metallurgy)

Lanthanides and Actinides: Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).Preparation of Trans-uranic elements. **(10 Lectures)**

Coordination Chemistry-I: Werner's theory**,** IUPAC system of nomenclature, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Drawbacks of VBT. **(5Lectures)**

Nuclear Chemistry: Nuclear particles (positron, neutrino, mesons, pions and quarks), nuclear instability, Nuclear reactions [(α, n), (n, α), (α, p), (p, α), (p, n), & (n, p)], nuclear fission, nuclear reactor and types of nuclear reactors in India, applications of radioisotopes in tracer technique, and carbon dating(numerical , problems). **(05Hours)**

Solutions: Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature- composition curves of ideal and non-ideal solutions. Distillation of solutions.

Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. **(6 Lectures)**

Phase Equilibrium: Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H_2O and Na-K only).

(8 Lectures)

Conductance: Ionic conductance, ohms law**,** conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Conductivity cell, measurement of conductance of ionic solution and its applications in : a) determination of degree of ionization of weak electrolyte b) solubility and solubility products of sparingly soluble salts c) ionic product of water d) hydrolysis constant of a salt and e) conductometric titrations of acid-base(numerical problems).

Ionic mobility, transference number and its experimental determination using Hittorf and Moving boundary methods (numerical problems). **(6 Lectures)**

Electrochemistry: Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential, standard electrode, type of electrodes, reference electrodes, sign convention of cell. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. pH determination using hydrogen electrode, quinhydrone electrode and glass electrode . Potentiometric titrations-qualitative treatment (acid-base and oxidation-reduction only).

Battery technology: Primary and secondary cells, lead storage battery and its applications, Ni-Cd cells, Lithium battery, fuel cells and their applications. **(10 Lectures)**

CHEMISTRY LAB: CHPr: D

1. Explanation regarding solubility, solubility product, common ion effect and applications of these in physico-chemical principles of separation of cations into groups in qualitative analysis of in-organic salts (students should write in the journal regarding the above).

2 to 10: Semi-micro qualitative analysis of mixtures of two simple inorganic salts containing two anions and two cations.

ANIONS: CO_3^{2-}, S^{2-}, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, $C_2O_4^{2-}$, BO_3^{3-} and PO_4^{3-}

CATIONS: Pb^{2+}, Cu^{2+}, Al^{3+}, Fe^{2+}, Fe^{+3}, Mn^{2+}, Co^{2+}, Ni^{2+}, Zn^{2+}, Ca^{2+}, Ba^{2+}, Mg^{2+}, Na^+, K^+ and NH_4^+.

Phosphate separation technique is to be demonstrated but not to be given at the time of examination.

11. Determination of dissolved oxygen present in water by Winkler's method.

12. Determination of C.O.D in polluted water.

Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.

Examination

In a batch of ten students, not more than two students should get the same mixture in the practical examination. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

Preliminary tests and presentation (6+2) - 8 marks , Negative radicals (group test + C.T) (2+3)×2=10 marks, positive radicals (group test + C.T) (2+4)×2=12 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester - V

CHEMISTRY: Paper-I (CHT:P-I E)

(Candidate shall choose either Paper-I or paper-II)

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs./wk. Total Practical: 52 hrs.**
		40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

I. Coordination Chemistry-II and Organometallic Compounds:

Crystal Field Theory: Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for O_h and T_d complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Organometallic Compounds: Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds), heptacity. Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Structure and bonding of mononuclear and polynuclear carbonyls of 3d metals. π-acceptor behaviour of carbon monoxide. **(15 Lectures)**

II: Analytical Chemistry

Flame Atomic Absorption and Emission Spectrometry*:* Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Thermal methods of analysis: Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Separation techniques: Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions.Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution. Chromatography: Classification, principle and efficiency of the technique. Mechanism of

separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: GLC, and TLC. **(15 Lectures)**

III. Biochemistry:

Carbohydrates: Classification of carbohydrates, reducing and non-reducing sugars, their open chain structure. Epimers, mutarotation and anomers. Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosachharides, structure of disacharrides (sucrose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Amino Acids, Peptides and Proteins: Classification *of Amino Acids,* Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups.

Enzymes and correlation with drug action: Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and their role in biological reactions, Specificity of enzyme action(Including stereospecificity), Drug action-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group,-NH_2 group, double bond and aromatic ring,

Nucleic Acids: Components of Nucleic acids: Adenine, guanine, thymine, Uracil and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides **(nomenclature**), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA(**types of RNA**), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Lipids: Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol). **(15 Lectures)**

IV. Quantum Chemistry:

Black body radiation, Spectral distribution of black body radiation, Plank's theory, derivation for Planck's radiation law, photoelectric effect, Compton effect, wave nature of electron, derivation of Schrödinger's wave equation, wave function and its interpretation, Eigen function and Eigen values, normalization and orthogonality.

Equation of motion for a particle, Newtonian, Lagrangian and Hamiltonian equations of motion, elementary wave motion. Operators, eigen values and expectation values, commuting operators, linear operator and hermitian operators. Solutions of Schrödinger equations of a free particle, particle in a box problem: in one and three dimensions, degeneracy, reflection and penetration of a particle in a one dimensional box of semi-infinite barrier, a particle in a box of finite walls.

Rigid rotator, derivation of selection rules for transitions in rotating molecule, linear harmonic oscillator, Hermite polynomials. Equation for the hydrogen atom in spherical polar coordinates and an indication of the method of its solution, the quantum numbers and their significance**.** **(15 Lectures)**

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester - V

CHEMISTRY: Paper-II (CHT:P-II E)

(Candidate shall choose either Paper-I or paper-II)

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs./wk. Total Practical: 52 hrs.**
		40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

I. Coordination Chemistry-II and Organometallic Compounds:

Crystal Field Theory: Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Organometallic Compounds: Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds), heptacity. Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Structure and bonding of mononuclear and polynuclear carbonyls of 3d metals. π-acceptor behaviour of carbon monoxide. **(15 Lectures)**

II. Industrial chemistry

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Fertilizers: Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

Alloys: Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels. **(15 Lectures)**

III. Introduction to Green Chemistry

Meaning of Green Chemistry. Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry Twelve principles of Green Chemistry with their explanations and examples

Examples of Green Synthesis/ Reactions and some real world cases

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)
2. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction
3. Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)
4. Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.
5. Designing of Environmentally safe marine antifoulant.
6. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.
7. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.
8. Healthier fats and oil by Green Chemistry: Enzymatic interesterification for production of no Trans-Fats and Oils **(15 Lectures)**

IV. Quantum Chemistry:

Black body radiation, Spectral distribution of black body radiation, Plank's theory, derivation for Planck's radiation law, photoelectric effect, Compton effect, wave nature of electron, derivation of Schrödinger's wave equation, wave function and its interpretation, Eigen function and Eigen values, normalization and orthogonality.

Equation of motion for a particle, Newtonian, Lagrangian and Hamiltonian equations of motion, elementary wave motion. Operators, eigen values and expectation values,

commuting operators, linear operator and hermitian operators. Solutions of Schrödinger equations of a free particle, particle in a box problem: in one and three dimensions, degeneracy, reflection and penetration of a particle in a one dimensional box of semi-infinite barrier, a particle in a box of finite walls.

Rigid rotator, derivation of selection rules for transitions in rotating molecule, linear harmonic oscillator, Hermite polynomials. Equation for the hydrogen atom in spherical polar coordinates and an indication of the method of its solution, the quantum numbers and their significance**.** **(15 Lectures)**

CHEMISTRY LAB: CHPr: E

(Common for both Paper I and II)

SET –I: INORGANIC EXPERIMENTS

A. Gravimetric Analysis (20 marks)

1. Determination of barium as $BaSO_4$.
2. Determination of Aluminium as Al_2O_3.
3. Determination of iron as Fe_2O_3.

B. Complex Preparation(10 marks)

4. Preparation of trans-potassium diaqua di oxalato chromate (III).
5. Preparation of tris(thiourea) copper (I) sulphate monohydrate.
6. Preparation of sodium tris oxalate ferrate (III).

SET –II: PHYSICAL EXPERIMENTS

1. Determination of concentration of HCl and CH_3COOH or mixture of HCl + CH_3COOH by conductometric titrations using standard NaOH.
2. Determination of equivalent conductance of strong electrolyte (NaCl) and equivalent conductance at infinite dilution (λ_∞).
3. Determination of concentration of strong acid by potentiometric titration against standard solution of 0.1 N NaOH.
4. Determination of K_a of a weak acid potentiometrically.
5. Verification of Beer- Lambert's law by colorimetric method. Calculation of molar extinction coefficient and determination of unknown concentration of tetraammine copper (II) complex / ferric thiocyanate complex.
6. Determination of critical solution temperature of two partially miscible liquids (water and phenol).

Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to

the semester before commencement of the regular practicals. The same shall be recorded in the Journal.

Examinations

In a batch of 10 students in the practical examination, 05 students shall be given Set – I experiments: **Inorganic** (one each from A and B) and the other 05 students be Set–II experiments (**PHYSICAL EXPERIMENTS**). Selection of experiments may be done by the students based on the picking up of chits.

Distribution of Marks:

Journal-5 marks and Viva-Voce-5 marks

SET-I: INORGANIC EXPERIMENTS

Note: At least two different experiments from set I (one each from A and B) shall be given in a batch of 05 students. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

A. Gravimetric Determination (20 Marks)

Technique-02 marks, Accuracy-16 marks, calculation - 02marks, Total - 20 marks

Deduction of Marks for accuracy:

±6mg -16 marks, ± 8mg-14 marks, ±10 mg -12 marks, ±12mg-10 marks, ±14mg-08 marks, ±16mg-06 marks, above ±16 mg -zero marks.

B. Complex Preparation(10 marks)

Technique-02 marks, Yield of the complex- 08marks, Total -10 marks

Deduction of Marks for accuracy:

Preparation Error yield- Less than 10%- 08 marks, 11-15% -06 marks, 16-20% -04 marks, 21-25% -03 marks, more than25% -zero marks

SET –II: PHYSICAL EXPERIMENTS

NOTE: In a batch of 05 students, not more than two students should get the same experiment in the practical examination. Selection of experiments may be done by the students based on picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

Technique and Presentation-3 Calculation and graph- (5+4) 9 marks, Accuracy-18 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Deduction of Marks for accuracy:

Error up to 5% - 18 marks, 6 - 10% 15 marks, 11-15% 12 marks, 16-20% 6 marks, above 20% zero (0) marks

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester - VI

CHEMISTRY: Paper-I (CHT: P-I F)

(Candidate shall choose either Paper-I or II)

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem. end Examination (3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs. / wk. Total Practical: 52 hrs.**
		40 marks for Sem. end Examination (3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

I. Metallurgy, Inorganic Polymers and Bio-Inorganic chemistry

Metallurgy: Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy(Ag and Au), Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process.

Inorganic Polymers: Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

Bio-inorganic chemistry: Role of metal ions present in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role (bones). **(15 Lectures)**

II. Application of Spectroscopy to Simple Organic Molecules

a)Ultraviolet Spectroscopy:

Electromagnetic radiations, electronic transitions, λ_{max} & ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes- alicyclic homo nuclear and hetero nuclear. cis – trans isomerism, α, β – unsaturated compounds, aldehydes, ketones, carboxylic acids and esters.

b)Infrared Spectroscopy:

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

c) Nuclear Magnetic resonance(NMR):

Basic principles of PMR, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant, areas of signals. Interpretation of PMR structure of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, ethyl acetate, toluene, acetophenone and acetanilide. **(15 Lectures)**

III. Molecular Spectroscopy:

Electromagnetic spectrum, Interaction of electromagnetic radiation with matter.

(a). Rotational spectroscopy:

Rotation of molecules, diatomic: rigid rotator, selection rule: derivation for expression of energy and bond length (HCl), problems on bond length, polyatomic molecules: linear, symmetric top, asymmetric top molecules (qualitative approach).

(b). Vibrational spectroscopy:

Vibrating diatomic molecules - energy of diatomic molecules, Hooks law and force constant, Vibrational spectra: harmonically vibrating diatomic molecules (HCl) and anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies, and problems on force constants. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectra: Classical theory, Rotational Raman spectroscopy (Linear and symmetric top molecules for S and R branch), Vibrational Raman spectroscopy; vibration - rotational Raman spectra(Rotational fine structures), complementary of Raman and IR.

(c). Electronic spectroscopy:

Diatomic molecules: Born- Oppenheimer approximation, Vibrational course structure of electronic transition and intensity, Franck – Condon principle, pre-dissociation, 'g' and 'u' transitions and their applications in organic molecules. **(15 Lectures)**

IV. Photochemistry and Chemical Kinetics-II

Photochemistry: Characteristics of electromagnetic radiation, Beer –Lambert's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield and its determination using thermopile and actinometer, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitized reactions, quenching. Role of photochemical reactions in biochemical processes, photo stationary states, chemiluminescence, Fluorescence and phosphorescence. (numerical problems). **(10 Lectures)**

Chemical Kinetics-II : Reversible, Parallel, Consecutive and Chain reactions. Derivations of rate constant for first order parallel, reversible and consecutive reactions. Reaction kinetics of thermal and photochemical Hydrogen – Bromine Reactions. **(05 Lectures)**

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester - VI

CHEMISTRY: Paper-II (CHT:P-II F)

(Candidate shall choose either Paper-I or paper-II)

Credits: I. Theory : 04 **Theory class 4hrs /wk. Total theory: 60 Lectures**
80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical : 02 **Practical: 4 hrs./wk. Total Practical: 52 hrs.**
40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits : 06 **Total Theory marks 100 and Practical marks 50**

I. Environment Chemistry

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Methods of estimation of CO, NO_X, SO_X and control procedures.

Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens.

Water Pollution: Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal.

Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water. **(15 Lectures)**

II. Application of Spectroscopy to Simple Organic Molecules

a)Ultraviolet Spectroscopy:

Electromagnetic radiations, electronic transitions, λ_{max} & ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes-alicyclic homo nuclear and hetero nuclear. cis – trans isomerism, α, β – unsaturated compounds, aldehydes, ketones, carboxylic acids and esters.

b)Infrared Spectroscopy:

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

c) Nuclear Magnetic Resonance (NMR):

Basic principles of PMR, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant, areas of signals. Interpretation of PMR structure of simple organic molecules such as ethylbromide, ethanol, acetaldehyde, ethyl acetate, toluene, acetophenone and acetanilide. (15 **Lectures)**

III. Molecular Spectroscopy:

Interaction of electromagnetic radiation with matter, electromagnetic spectrum.

(a). Rotational Spectroscopy:

Rotation of molecules, diatomic: rigid rotator, selection rule : derivation for expression of energy and bond length (HCl), problems on bond length, polyatomic molecules: linear, symmetric top, asymmetric top molecules(qualitative approach).

(b). Vibrational Spectroscopy:

Vibrating diatomic molecules - energy of diatomic molecules, force constant, vibrational spectra: harmonically vibrating diatomic molecules (HCl) and anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies, and problems on force constants. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectra: Classical theory, Rotational Raman spectroscopy (Linear and symmetric top molecules for S and R branch), Vibrational Raman spectroscopy; vibration - rotational Raman spectra(Rotational fine structures), complementary of Raman and IR.

(c). Electronic Spectroscopy:

Diatomic molecules: Born- Oppenheimer approximation, vibrational course structure of electronic transition and intensity, Franck – Condon principle, pre-dissociation, 'g' and 'u' transitions and their applications in organic molecules. **(15 Lectures)**

IV. Polymer Chemistry and Micelle:

Polymer Chemistry: Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Crystallization and Crystallinity: Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. Nature and structure of polymers-Structure Property relationships.

Determination of molecular weight of polymers (M_n, M_W, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

Properties of Polymers: (Physical, thermal, Flow & Mechanical Properties). Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, polyamides. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].

(12 Lectures)

Micelle: Emulsions, micro emulsions or micellar emulsions, and its Stability, Properties of Micro emulsions**:** electro kinetic effects. Colloidal electrolytes or association colloids, types of Colloidal electrolytes. **Micelles:** surface-active agents or surfactants. (**03 Hours**)

CHEMISTRY LAB: CHPr-F

(Common for both Paper I and II)

SET – I: PHYSICAL EXPERIMENTS

1. Determination of dissociation constant of acetic acid conductometrically.
2. Determination of solubility of sparingly soluble salt ($BaSO_4$/$PbSO_4$) conductometrically.
3. Determination of redox potentials of Fe^{3+}/Fe^{2+} using of $FeSO_4.7H_2O$ solution (0.1N) by potentiometric titration against the standard solution of $K_2Cr_2O_7$ (0.1N)
4. Determination of solubility and solubility product of sparingly soluble salts (AgCl) potentiometrically.
5. Preparation of standard acidic buffer solutions using 0.1M acetic acid & 0.1M sodium acetate using Henderson-Hasselbatch and determination of mole ratio of buffer solutions of unknown pH.
6. Determination of percentage composition of unknown mixture of A and B liquids using Abbe's refractometer (formula and graphical method).

SET-II: INORGANIC / ORGANIC

A. Ore / Alloy Analysis (20 marks)

1. Extraction of Iron (III) from haematite ore or solid Fe_2O_3 and determination of percentage of iron in the solution using standard $K_2Cr_2O_7$ solution (internal indicator method).
2. Extraction of Cu and Zn from brass and determination of percentage of copper in the solution using standard $Na_2S_2O_3$ solution.
3. Extraction of calcium from limestone and determination of percentage of calcium in the solution by oxalate method.

B. Organic analysis (10 marks)

4. Separation of amino acids by paper chromatography, measuring R_f value and determination of glycine present in the solution volumetrically.
5. Saponification value of oil or fat.
6. Determination of Iodine number of an oil/ fat.

Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.

Examinations

A batch of 10 students in the practical examination, 05 students may be given Set – I experiments (**PHYSICAL EXPERIMENTS**) and the other 05 students may be given Set – II experiments **(SET-II: INORGANIC / ORGANIC)**. Selection of experiments may be done by the students based on the picking up of chits.

Distribution of Marks:

Journal-5 marks and Viva-Voce-5 marks

SET – I : PHYSICAL EXPERIMENTS

NOTE: In a batch of 05 students, not more than two students should get the same experiment in the practical examination. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

Technique and Presentation-3 Calculation and graph- (5+4) 9 marks, Accuracy-18 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Deduction of Marks for accuracy:

Error up to 5% - 18 marks, 6 - 10% 15 marks, 11-15% 12 marks, 16-20% 6 marks, above 20% zero (0) marks

SET-II: INORGANIC / ORGANIC

Note: At least two different experiments from set II (one each from A and B) shall be given in a batch of 05 students. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

A. Ore / Alloy Analysis(20 marks)

Technique-02 marks, Accuracy- 14 marks, calculation -4 marks, Total 20 marks.

Deduction of Marks for accuracy:

Determination ±0.2 CC -14marks, ± 0.4 CC- 12marks, ±0.6 CC- 10 marks, ±0.8 CC- 06 marks, above ±0.9 - zero marks.

B. Organic analysis (10 marks)

Technique-02 marks Accuracy – 08 marks, Total 10 marks.

Deduction of Marks for accuracy:

Determination ±0.2 CC -08marks, ± 0.4 CC- 06marks, ±0.6 CC- 04 marks, ±0.8 CC- 03 marks, above ±0.9 - zero marks.

GENERAL PATTERN OF THEORY QUESTION PAPER FOR ALL THE SEMESTERS

1. **Question number 1-12 carries 2marks to answer any 10 questions : 20 marks**
2. **Question number 13-21 carries 5marks to answer any 6 questions : 30 marks**
3. **Question number 22-26 carries 10marks to answer any 3 questions : 30 marks**
   (10 marks questions may be 6+4 or 7+3 or 10) Total: 80 marks

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Inorganic Chemistry

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Organic Chemistry

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2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi,2004
3. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry,* Orient Longman, NewDelhi (1988).
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8. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry,* S. Chand, 2010.
9. Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. *Organic Chemistry,* John Wiley & Sons (2014).
10. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
11. Organic Chemistry-F.A. Carey, 4th Edition, McGraw Hill (2000).
12. Advanced Organic Chemistry - J. March, John Wiley & Sons, 1992
13. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983
14. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998
15. Organic Chemistry - L.Ferguson, Von Nostrand, 1985
16. Organic Chemistry - M. K. Jain, Nagin & Co., 1987

Physical Chemistry

1. Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
2. Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. P.W. Atkins: Physical Chemistry.

5. W.J. Moore: Physical Chemistry
6. Text Book of Physical Chemistry - P.L. Soni, S. Chand & Co.,1993
7. Text Book of physical chemistry - S. Glasstone, Mackmillan India Ltd., 1982
8. Principles of Physical Chemistry - B. R. Puri, L.R. Sharma and M.S.Patania, S.L.N. Chand & Co. 1987
9. Physical Chemistry - Alberty R. A. and Silbey, R.J.John Wiley and sons, 1992
10. Physical Chemistry - G.M.Barrow, Mc Graw Hill, 1986
11. Physical Chemistry(3rd Edition) - Gilbert W. Castilian, Narosa Publishing House,1985
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York.

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. *Vogel's Textbook of Quantitative Chemical Analysis*, John Wiley & Sons, 1989.
2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7^{th} Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
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Polymer Chemistry

1. Seymour, R.B. & Carraher, C.E. *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.
2. Odian, G. *Principles of Polymerization*, 4^{th} Ed. Wiley, 2004.
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Green Chemistry

1. Ahluwalia, V.K. & Kidwai, M.R. *New Trends in Green Chemistry*, Anamalaya Publishers (2005).
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6. Lancaster, M. *Green Chemistry: An Introductory Text* RSC Publishing, 2 Edition, 2010.

Industrial and environmental Chemistry

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Harwood Ltd. UK.
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11. P. C. Jain & M. Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
12. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi
13. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

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1. Chandra, A. K. *Introductory Quantum Chemistry* Tata McGraw-Hill (2001).
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1. John R. Dyer: *Applications of Absorption Spectroscopy of Organic Compounds,* Prentice Hall.
2. R.M. Silverstein, G.C. Bassler & T.C. Morrill*: Spectroscopic Identification of Organic Compounds*, John Wiley & Sons.
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6. Introduction to Spectroscopy, Donald L. Pavia, Gary M. Lampman, and George S. Kriz, Cenage Learning, USA, (2015).

Practical Chemistry

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
3. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
4. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
5. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
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8. Experiments in Physical Chemistry by Shoemaker and Garland, McGraw Hill, New York.
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10. Experimental Physical Chemistry by W. G. Palmer, Cabridge University Press, London.
11. Experimental Physical Chemistry by V. D. Athawale and Parul Mathur, New Age International, New Delhi.

SKILL ENHANCEMENT COURSES (SEC) in Chemistry

B.Sc. Semester - V

CHEMISTRY : SEC- I (SEC-CH- 1E)

Total Syllabus: 30 hrs / Sem.: 2 hrs / Week

Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)

Duration of Exam: 1.5 hrs

ANALYTICAL CHEMISTRY

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators.

a. Determination of pH of soil samples.
b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.
b. Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products: Nutritional value of foods, idea about food processing and food preservations and adulteration.

a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
b. Analysis of preservatives and colouring matter.

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).
b. To compare paint samples by TLC method.

Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

Analysis of cosmetics: Major and minor constituents and their function

a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration
c. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
b. d. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft drinks. **30 Lectures**

Reference Books:

1. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis. 7^{th} Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
2. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
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4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.
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7. Freifelder, D. Physical Biochemistry 2^{nd} Ed., W.H. Freeman and Co., N.Y. USA (1982).
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9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7^{th} Ed., Prentice Hall.
10. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6^{th} Ed., Prentice Hall.
11. Robinson, J.W. Undergraduate Instrumental Analysis 5^{th} Ed., Marcel Dekker, Inc., New York (1995).

SKILL ENHANCEMENT COURSES (SEC) in Chemistry

B.Sc. Semester - V

CHEMISTRY : SEC- II (SEC-CH- 2E)

Total Syllabus: 30 hrs / Sem.: 2 hrs / Week

Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)

Duration of Exam: 1.5 hrs

PHARMACEUTICAL CHEMISTRY

Drugs & Pharmaceuticals: Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti- inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Fermentation: Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Practical in one hour, nevertheless no practical examination.

a. Preparation of Aspirin and its analysis.
b. Preparation of magnesium bisilicate (Antacid). **30 Lectures**

Reference Books:

1. G.L. Patrick: Introduction to *Medicinal Chemistry, Oxford University* Press, UK.
2. Hakishan, V.K. Kapoor: *Medicinal and Pharmaceutical Chemistry,* VallabhPrakashan, Pitampura, New Delhi.
3. William O. Foye, Thomas L., Lemke , David A. William: *Principles of Medicinal Chemistry*, B.I. Waverly Pvt. Ltd. New Delhi.

SKILL ENHANCEMENT COURSES (SEC) in Chemistry

B.Sc. Semester - VI

CHEMISTRY: SEC- III (SEC-CH- 1F)

Total Syllabus: 30 hrs / Sem.: 2 hrs / Week

Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)

Duration of Exam: 1.5 hrs

PESTICIDE CHEMISTRY

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes:

Organochlorines (DDT, Gammexene,);

Organophosphates (Malathion, Parathion);

Carbamates (Carbofuran and carbaryl);

Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Practical in one hour, nevertheless no practical examination.

1 To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.

2 Preparation of simple organophosphates, phosphonates and thiophosphates.

30 Lectures

Reference Book:

1. Cremlyn, R. *Pesticides. Preparation and Modes of Action*, John Wiley & Sons, NewYork, 1978.

SKILL ENHANCEMENT COURSES (SEC) in Chemistry

B.Sc. Semester - VI

CHEMISTRY: SEC- IV (SEC-CH- 2F)

Total Syllabus: 30 hrs / Sem.: 2 hrs / Week

Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)

Duration of Exam: 1.5 hrs

FUEL CHEMISTRY

Review of energy sources (renewable and non-renewable).Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications.

Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants.

Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

30 Lectures

Reference Books:

1. Stocchi, E. *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK (1990).
2. Jain, P.C. & Jain, M. *Engineering Chemistry* Dhanpat Rai & Sons, Delhi.
3. Sharma, B.K. & Gaur, H. *Industrial Chemistry,* Goel Publishing House, Meerut (1996).

GENERAL PATTERN OF THEORY QUESTION PAPER FOR ALL SEC PAPERS

1. **Question number 1-6 carries 2marks to answer any 5 questions : 10 marks**
2. **Question number 7-14 carries 4marks to answer any 5 questions : 20 marks**
3. **Question number 15-17 carries 5marks to answer any 2 questions : 10marks**

Total: 40 marks

Name and signature of Committee members of BOS in B.Sc. Chemistry, prepared the syllabi pertaining to B.Sc. Chemistry (General) under CBCS for Karnatak University, Dharwad, effective from 2020-21.

1	Prof. M.Y.Kariduraganavar , Chairman , UG BOS in Chemistry and Chairman P. G. Department of Chemistry K.U. Dharwad	Chairman
2	Smt. K.K Kerwadikar Principal Govt. First Grade College Karwar.	Member
3	Dr. S.N. Setty Principal KCS, Dr. A. V. Baliga Arts/ Science College Kumta	Member
4	Dr. Smt. Shobha Sharma Principal B. N. Degree College Dandeli	Member
5	Dr. S. M. Tuwar Associate Professor Dept. of Chemistry Dharwad	Member(Co-opted)
6	Prof. K.V. Pai Department of Industrial Chemistry Kuvempu University Shivamogga	Member(External)

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-06/BOS /Zoology (UG) /20-21/ 992 Date: 16 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Zoology UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.
2. Special BOS Res. No. 01, dt. 04.07.2020.
3. Special Faculty Res. No. 14, dt. 11.08.2020.
4. Special Academic Council Res. No. 39, dt. 21.08.2020.
5. Vice-Chancellor's order dated -07-10-2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Zoology UG syllabus for I to VI Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website (www.kud.ac.in).

Dated: 15/10/2020

(Dr. Hanumantappa K.T)
REGISTRAR

To,

1. The Chairman, BOS Zoology (UG), Dept. of Zoology, K.U.Dharwad.
2. The Chairman, Dept. of Zoology, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fwcs to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Zoology, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website (www.kud.ac.in).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analysist, Computer Unit Exam Section, K.U.Dharwad.

KARNATAK UNIVERSITY, DHARWAD

CBCS SYLLABUS

FOR

BACHELOR OF SCIENCE

ZOOLOGY

(I TO VI SEMESTERS)

FROM

2020-21 & ONWARDS

PREAMBLE

Zoology is the study of animals as well as human beings. It comprises and deals with the study of the organisms; development, structure, classification, habits, habitats, distribution, physiology, biochemistry, genetics, evolution, etc. Many branches, specialization and fields of Zoology have contributed immensely to the progress of human welfare. The university has introduced the CBCS system, which gives an opportunity to the students to choose any field and acquire knowledge in the subject Zoology. The knowledge gained in the subject not only leads the students to pursue higher education and research, but also enables them to undertake self employment.

OBJECTIVES

The main purpose of B.Sc. Zoology course is to create knowledge among the students to know the importance of animals with emphasis on the following domains.

- To improve the knowledge on the systematic classification, physical structure, physiological reactions, biological functions, culture and maintenance of beneficial organisms, etc.
- To gain skill in microscopy, preparation of sample, observations of animal activities at molecular, structural and organisms level.
- To make the students to acquaint with estimations, analysis of molecules to carry out routine clinical analysis of any samples.
- To make the students to aware and emphasize the role of genes/chromosomes in inheritance and genetic diseases.
- To make them self employable and a good entrepreneur in due course.

For fulfillment of the above objectives, the following papers namely, non chordate, chordate, histology, evolution, paleontology, biostatistics, molecular cell biology, developmental biology, biochemistry, physiology, ethology, applied zoology, genetics, biotechnology, nanotechnology, ecology, zoogeography and wildlife biology have been introduced in the B.Sc. Zoology degree course.

OUTCOME OF THE COURSE

By learning Zoology subject with emphasis on above said different domains, the students will acquire the necessary knowledge and skills to pursue further studies and research in a wide range of subjects like, molecular biology, applied zoology, genetics, biotechnology, environmental biology, wildlife biology, ethology, etc. One can also make use of the knowledge to become a self entrepreneur using the economically important animals and their products.

Karnatak University, Dharwad

CBCS syllabus for Under Graduate Programme in Zoology (optional)

Effective from 2020-21

Sem	Theory / Practical	Subject Code	Total Teaching hours per week	Total Teaching hours per Semester	Duration of Exams	Internal Assessment Marks	Semester End Exam Marks	Total Marks	Credits
I	**Theory**	**DSC ZOOT: 1.1**	**04 hrs**	**60**	**03 hrs**	**20**	**80**	**100**	**04**
	Practical	**DSC ZOOP: 1.1**	04 hrs	60	03 hrs	**10**	**40**	**50**	**02**
II	**Theory**	**DSC ZOOT: 2.1**	04 hrs	60	03 hrs	**20**	**80**	**100**	**04**
	Practical	**DSC ZOOP: 2.1**	04 hrs	60	03 hrs	**10**	**40**	**50**	**02**
III	**Theory**	**DSC ZOOT: 3.1**	04 hrs	60	03 hrs	**20**	**80**	**100**	**04**
	Practical	**DSC ZOOP: 3.1**	04 hrs	60	03 hrs	**10**	**40**	**50**	**02**
IV	**Theory**	**DSC ZOOT: 4.1**	04 hrs	60	03 hrs	**20**	**80**	**100**	**04**
	Practical	**DSC ZOOP: 4.1**	04 hrs	60	03 hrs	**10**	**40**	**50**	**02**
V	**Theory**	**DSE ZOOT: 5.1A OR ZOOT: 5.1B**	04 hrs	60	03 hrs	**20**	**80**	**100**	**04**
	Practical	**DSE ZOOP: 5..1A OR ZOOP:5.1B**	04 hrs	60	03 hrs	**10**	**40**	**50**	**02**
	Theory	**SEC-1 ZOOT: 5.2A**	02 hrs	30	02 hrs	**10**	**40**	**50**	**02**
	Theory	**SEC-2 ZOOT: 5.2B**	02 hrs	30	02 hrs	**10**	**40**	**50**	**02**
VI	**Theory**	**DSE ZOOT: 6.1A OR DSE ZOOT: 6.1B**	04 hrs	60	03 hrs	**20**	**80**	**100**	**04**
	Practical	**DSE ZOOP: 6.1A OR ZOOP: 6.1B**	04 hrs	60	03 hrs	**10**	**40**	**50**	**02**
	Theory	**SEC-1 ZOOT: 6.2A**	02 hrs	30	02 hrs	**10**	**40**	**50**	**02**
	Theory	**SEC-2 ZOOT: 6.2B**	02 hrs	30	02 hrs	**10**	**40**	**50**	**02**
Total						**220**	**880**	**1100**	**44**

Credit means the unit by which the course work is measured. One hour session of Lecture per week for 16 weeks amounts to 1 credit. Four hours session of Practicals per week for 16 weeks amounts to 2 credits per semester.

I SEMESTER
PAPER DSCZOOT 1.1 : NON-CHORDATA

Total Teaching Hours: 60 hrs

I INTRODUCTION 02 hrs
Biodiversity and its importance, Principles of animal classification definition of species.

II KINGDOM PROTISTA (PROTOZOA) 06 hrs
General characters and classification up to classes with suitable examples. Structure and life history of malarial parasite *Plasmodium vivax.*

III PORIFERA 05 hrs
General characters and classification up to classes with suitable examples. Canal system in sponges.

IV CNIDARIA 05 hrs
General characters and classification upto classes with suitable examples. Polymorphism in Cnidaria.

V PLATYHELMINTHES 05 hrs
General characters and classification up to classes with suitable examples. Parasitic adaptation. Life history of *Fasciola hepatica.*

VI ASCHELMINTHES 06 hrs
General characters and classification up to classes with suitable examples. Life history of *Ascaris and Wuchereria bancrofti.*

VII ANNELIDA 08 hrs
General characters and classification upto classes with suitable examples. *Hirudinea* type study – Externals, setae, digestive system; circulatory system, nervous system, nephridia and reproductive system. Tubicolous polychaetes – *Sabella Chaetopterus*.

VIIIVIII
IX ONYCHOPHORA 02 hrs
Salient features of *Peripatus* and is systematic position

X ARTHROPODA 10 hrs
General characters and classification up to classes with suitable examples. Collection and preservation methods of insects. Beneficial and harmful insects – Integrated Pest Management (IPM).

XI MOLLUSCA 06 hrs
General Characters and classification upto classes with suitable examples. Foot and shell in mollusca.

XII ECHINODERMATA 05 hrs
General Characters and classification upto classes with suitable examples. Water vascular system..

PRACTICAL DSCZOOP 1.1

1. Classification of each phylum upto classes with at least one suitable example.
2. Study of Leech/Cockroach- externals, digestive system, nervous system, Jaws, nephridia, ovary of Leech, Mouth parts, salivary glands, spermatheca of cockroach.
3. Mouth parts of insects permanent slides.
4. Study of protozoan culture/Vermiculture.
5. Collection and preservation methods of insects.

Collection methods: Hand picking, beating, aerial and aquatic nets, Burlese funnel and aspirator.
Trapping methods, types; light trap, sticky trap, pitfall Trap, bait, pheromone trap.
Preservation methods: Dry method (Pinning), Wet method (Liquid preservation) and microscopic preservation (Slide preservation).
Morphological Identification and Dissection of Insects:
Digestive, Circulatory, Nervous, excretory and Reproductive system.

6. Insect Culture: Media preparation for collection and culture. (*Drosophila*).
7. Field study.

SCHEME OF PRACTICAL EXAMINATION

1. Explain the system in	10
2. Protozoan culture/ Rectal parasites /nephredia/ovary/jaw/mouthparts/ salivary glands/Spermatheca	05
3. Identifications (A to E)	10
4. Field Study Report	06
5. Viva	04
6. Journal	05
	Total 40

II SEMESTER
PAPER DSCZOOT 2.1 : CHORDATA

Total Teaching Hours:60hrs

I INTRODUCTION 05 hrs

General characters of the phylum and classification up to sub phyla. Hemichordata, Urochordata, Cephalochordata with suitable examples. Retrogressive metamorphosis in Urochordates.

II VERTEBRATA 02 hrs

General characters of vertebrates and outline classification.

III CYCLOSTOMATA 02 hrs

General organization and distribution.

IV PISCES 06 hrs

Chondrichthies: General Characters with suitable examples.
Osteichthyes: General Characters with examples. Fish migration, types of scales and fins.

V AMPHIBIA 04 hrs

General characters and classification up to orders with suitable examples.

VI REPTILIA 05 hrs

General characters and classification up to orders (living reptiles only) with suitable examples. Poisonous and non-poisonous snakes of India and types of venom.

VII AVES 09 hrs

General characters and classification. Distinctive features of archaeornithes and neornithes with reference to palaeognathae (flightless birds), Impennae and Neognathae,giving suitable examples. Flight adaptations, beak and foot modifications.

VIII MAMMALIA 15 hrs

General characters and classification up to orders. Distinctive features of prototheria and metatheria with examples (with special emphasis on monotremes and marsupials). Important characters of primates, Chiroptera, Cetacea, Perissodactyla. Artiodactyla, Carnivora, Rodentia, Lagomorpha and Pholiodota with examples. Rat as type study – (muscular system excluded)

IX OSTEOLOGY 08 hrs

Study of endoskeleton of *Frog* and *Rabbit.*

X COMPARATIVE ANATOMY 04 hrs

Comparative account of Heart, brain.

PRACTICAL DSCZOOP 2.1

1. Classification up to orders with at least one suitable example.
2. Study of Local fish/rat/chick (anyone) externals, Digestive system, Circulatory system, Urinogenital system and brain
3. Endoskeleton of *frog* and *rabbit*
4. Comparative anatomy of heart and brain.

FIELD ORIENTED PROJECTS:

1. Field Study is compulsory
2. Visit to Zoo/forest/sanctuaries/ national park/ surrounding area to study the animal diversity related to project i.e., study the fishes, amphibians, reptiles, birds and mammals.

SCHEME OF PRACTICAL EXAMINATION

1. Explain the system in	06
2. Comparative anatomy (anyone)	05
3. Osteology (any two)	06
4. Identify and comment on A to D	08
5. Field study trip	06
6. Viva	04
7. Journal	05
	Total 40

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SCHEME OF THEORY EXAMINATION QUESTION PAPER

B.Sc. Degree Examination Month/Year

Semester

Zoology (CBCS System)

PAPER; DSCZOOT 1.1 Name of the paper

Time: Three Hours **Maximum: 80 Marks**

Instruction to Candidate

a. Answer all the questions.

b. Draw a neat labelled diagram wherever necessary.

I. Answer any TEN of the following in 3-4 sentences each: **10X2 = 20**

1-12 Questions

II. Answer any SIX of the following in 10-15 sentences each : **6X5 = 30**

13-20 Questions

III. Answer the following **3X10 = 30**

21. a OR b

22. a OR b

23. a OR b

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Suggested Readings:

1. Agarwal V. P. and Dalela R. C. (1975): Textbook of Vertebrate Zoology. Jai Prakashnath Co.
2. Barnes, R.D. (1982): Invertebrate Zoology. Fifth edition
3. Barnes, R.D. (1982): Vertebrate Zoology. Fifth edition
4. Barnes, R.S.K., Calow, P., Olive, P.J.W Golding, D.W. and Spicer, J.I. (2002): The Invertebrates: A New Synthesis, III Edition, Blackwell Science
5. Barrington E. J. W. (1981): Invertebrate structure and Function. ELBS.
6. Dhami P.S. and Dhami J. K. (2000): Chordate Zoology. S. Chand & Co. Dhami P.S. and Dhami J. K. (2000): Invertebrate Zoology. S. Chand & Co.
7. Ekambaranatha Iyer M. and Anantakrishnan T. N. (1990): A manual of Zoology. Vol. I. Invertebrata (Part 1 &2). S. Vishwanathan Pvt. Ltd.
8. Ekambaranatha Iyer M. and Anantakrishnan T. N. (1990): A manual of Zoology. Vol. II. Chordata S. Vishwanathan Pvt. Ltd.
9. Jordan E. L. and Verma P.S. (1976): Chordate Zoology. S. Chand & Co. Jordan E. L. and Verma P.S. (1976): Invertebrate Zoology. S. Chand & Co.
10. Kotpal R. L. (1993): Protozoa- Echinodermata (all volumes). Rastogi Publ. Pough H (2004): Vertebrate life, VIII Edition, Pearson International.
11. Ruppert and Barnes, R.D. (2006): Invertebrate Zoology, VIII Edition. Holt Saunders International

III SEMESTER

PAPER DSCZOOT 3.1: HISTOLOGY, EVOLUTION, PALEONTOLOGY AND BIOSTATISTICS

Credits:04 **Total Teaching Hours: 60 hrs**

I HISTOLOGY 20 hrs

Study of histological structure and functions of the following mammalian organs

a. Tongue
b. Stomach
c. Intestine
d. Testis
e. Ovary
f. Liver
g. Islets of Langerhans
h. Thyroid
i. Kidney
j. Adrenal

II EVOLUTION 18 hrs

Origin of earth, origin of life, theories of organic evolution. Lamarckism, *Darwin Wallace* Theory of natural selection Evidences in favor of evolution.

Neo-Darwinism (synthetic theory of evolution, gene mutation, gene flow, genetic drift, *Hardy Weinberg* equilibrium) concept of species Speciation, allopatric and sympatric species

III PALEONTOLOGY 15 hrs

Geological time scales, fossils and fossilization. Radiometric dating – detection of age of fossils. Indian fossil sites. Mesozoic reptiles. Connecting links, living fossils, origin and evolution of man. Evolution of horse.

IV BIOSTATISTICS 07 hrs

Use of statistics in life sciences, data collection, observations and variables, sampling and sampling methods, representation, tabular and graphical representations; frequency tables, line graphs, bar graphs, histograms, frequency polygon and curve and pie charts; measure of central tendency; mean; median and mode. Measures of dispersion; range, standard deviation; Standard error

PRACTICAL DSCZOOP 3.1

Total Teaching Hours : 60 hrs

1. Observation of mammalian histology slides of the organs studied in the theory paper.
2. Preparation of permanent histology slides, three slides to be submitted at the time of practical examination.
3. Evolution of man and horse (charts or models)
4. Mesozoic reptiles (charts or models)
5. Connectinglinks/living fossils : *Neopilina, peripatus, limulus, latimuria, sphenodon, archaeopteryx and duck billed platypus*
6. Vestigial organs
7. Biostatistics practicals
   a. Measures of central tendency i) Obtain the mean, medium and mode, ii) Form a frequency distribution table of the data and then compute mean, median andmode.
   b. Prepare a frequency distribution table and draw a histogram, frequency polygon and frequency curve.

SCHEME OF PRACTICAL EXAMINATION

1.	Preparation of permanent histology slide	08
2.	Identifications	
	a. Histology – Any 4	08
	b. Evolution – Any 1	02
	c. Connecting links/living fossils –Any 1	02
3.	Histology slide submission – 3 slides	06
4.	Biostatistics	05
5.	Viva	04
6.	Journal	05
	Total	**40**

IV SEMESTER
PAPER DSCZOOT 4.1: BIOCHEMISTRY AND PHYSIOLOGY

Credits: 04 **Total Teaching Hours: 60 hrs**

I CARBOHYDRATES, PROTEINS and LIPIDS 09 hrs

Definition, classification and biological significance.

II. ENZYMES 06 hrs

Classification of enzymes – IUB system, mechanism of enzyme action, enzyme substrate complex, specificity of enzymes, reversibility of enzyme action, enzyme inhibitors, a brief account of coenzymes, cofactors and ions, clinical importance of enzymes

III. NUCLEIC ACIDS 03hrs

Nucleotides, nucleosides, nitrogen bases, structure of nucleic acid (DNA & t-RNA).

IV. VITAMINS 04hrs

Fat soluble vitamins (A, D, E and K) water soluble vitamins (B-complex and C) functions and deficiency symptoms

V BIOENERGETICS 04 hrs

Concept of bioenergetics, energy yielding pathways, glycolysis, bioenergetics of glycolysis, the Kreb's cycle, bioenergetics of Kreb's cycle, the electron transportsystem, phosphorylation

VI. DIGESTION 03 hrs

Mechanical digestion, chemical digestion, assimilation and absorption of proteins, carbohydrates and lipids. Hormonal regulation of enzyme secretion

VII. RESPIRATION 03 hrs

External and internal respiration. Respiratory pigments, hemoglobin, hemocyanin and hemerythrin. Physiology of respiration, exchange of gases, transport of oxygen, oxygen dissociation curves, Bohr Effect, transport of carbon dioxide, chloride shift, respiratory quotient

VIII. CIRCULATION 03 hrs

Types of circulation, structure, functions and regulation of human heart, blood pressure, Composition of human blood, Neurogenic and myogenic hearts

IX. NITROGEN EXCRETION 04 hrs

Nitrogen excretion in aquatic terrestrial and aerial animals; ammonotelism, ureotelism and uricotelism with examples; ornithine cycle, physiology of urine formation in man

X. MUSCLE CONTRACTION 05 hrs

Principal types of muscles, ultra-structure of striated muscles, role of myosin, actin, tropomyosin, troponin and actinin; Mechanism of muscle contraction and relaxation, the sliding filament theory, Chemical changes during muscle contraction, Neuromuscular junction

XI. NERVOUS COORDINATION 04 hrs

Structure and conduction of nerve impulse in medullated and non-medullated nerves, synaptic transmission.

XII. ENDOCRINE SYSTEM 06hrs

Structure and function of endocrine glands. Hypothalamo-hypophyseal Portal system. Types of hormones and their mechanism.

XIII. IMMUNOLOGY 06 hrs

Type of immunity: Innate and adaptive immunity, Cell mediated and humoural mediated immunity, Haematopoiesis, Activation of adaptive immunity, Generation of antibody diversity, Vaccines and its types.

AIDS: causative factors, effects and preventive measures

(Unit I to IV: Biochemistry; Unit V to XIII: Physiology)

PRACTICAL DSCZOOP 4.1

Total Teaching Hours: 60 hrs

1. Biochemical tests for proteins, carbohydrates and fats.
2. Normal and abnormal constituents of urine.
3. Action of salivary amylase.
4. Preparation of haematin crystals.
5. Estimation of hemoglobin.
6. Total count (TC) differential count (DC) or RBC and WBC.
7. Blood clotting time.
8. Demonstration of blood pressure.
9. Blood typing – A, B, AB, O and Rh factors in Human blood.

SCHEME OF PRACTICAL EXAMINATION

1.	Qualitative test for proteins/carbohydrates/fats	10
2.	Normal/abnormal constituents of urine	05
3.	Preparation of hematincrystals/clottingtime/ Action of salivary amylase	06
4.	Hemoglobin estimation TC/DC	10
5.	Viva	04
6.	Journal	05
	Total	**40**

PAPER DSEZOOT 5.1 A V SEMESTER

PAPER DSCZOOT 5.1A: MOLECULAR CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY

Credit: 04 **Total Teaching Hours: 60 hrs**

I MICROSCOPY 03 hrs

Properties of Light. Light, fluorescence, electron and phase contrast microscopes.

II CELL AND ITS ORGANELLES 05 hrs

Ultra-structure of prokaryotes and eukaryotes (animals cell) molecular structure and function of Plasma membrane, endoplasmic reticulum, Golgi complex, mitochondria, lysosomes, ribosomes, nucleus and nucleolus.

III CHROMOSOMES 03 hrs

Types of Chromosomes, heterochromatin and euchromatin, polytene chromosomes.

IV FLOW OF GENETIC MATERIAL AND ITS MAINTAINENCE AND REGULATION: 05 hrs

Griffith's transformation experiment, Avery–MacLeod–McCarty experiment. Hershey – Chase experiment, Double helical structure of DNA, Messilson and Sthal semi-conservative replication, Replication in prokaryotes and eukaryotes. DNA _Transcription, Translation in prokaryotes, RNA_ RNA as genetic material, types of RNA and structure of t-RNA. Genetic code and its properties.

IV MITOSIS AND CELLCYCLE 04 hrs

Stages of Mitosis, Interphase, G_1 S and G_2 phases, molecular events at different stages of cell cycle.

V MEIOSIS 04 hrs

Phases of meiotic cycle, first meiotic division - prophase-I, leptotene, zygotene, pachytene, synaptonemal complex and recombination and diplotene, diakinesis, Mechanism of crossing over, metaphase I, anaphase I and telophase I and cytokinesis, second meiotic division, Significance of meiosis

VI CANCER AND CARCINOGENIC AGENTS 03 hrs

Types of cancer, proto-oncogenes, oncogenes, carcinogenic agents, physical, chemical and biological causes and suppressor genes (RB gene, p53 gene).

VII INTRODUCTION TO DEVELOPMENTAL BIOLOGY 02 hrs

Scope and theories of development biology. Gametogenesis (in detail)

VIII FERTILIZATION 03 hrs

Types and mechanism of fertilization, approximation of gametes, fertilizin and antifertilizin acrosome reaction, amphimixis, Monspermic and polyspermic fertilization. Significance of fertilization.

IX PARTHENOGENESIS 03 hrs

Kinds of parthenogenesis. Natural arrhenotoky, thelytoky and cyclical. Artificial parthenogenesis, significance of parthenogenesis

X CLEAVAGE 04 hrs

Types of cleavage, holoblastic, meroblastic, radial and spiral types with examples

XI EARLY DEVELOPMENTOF FROG 05 hrs

Structure of frog's egg, cleavage, blastula, fate maps, gastrulation, morphogenesis, notogenesis, and neurulation.

XII ORGANIZER PHENOMENON 05 hrs

Definition, potencies of the dorsal lip of the blastopore of amphibian gastrula, Brachet's experiment, experiment of Spemann and Mangold, induction, chemical nature of organizer, parts of organizer, theories of organizer phenomenon

XIII EXTRA-EMBRYONIC MEMBRANES AND EARLY DEVELOPMENTOF CHICK 08 hrs

Development, structure and functions of yolk sac, amnion, chorion and allantois. Structure of hen's egg, cleavage, blastula, gastrulation, origin and structure of primitive streak, structure of 18, 24, 36 and 48 hrs chick embryos

XIV PLACENTA 03hrs

Yolksac placenta, allantoic placenta, structure (morphological and histological) and functions of placenta, classification of placenta with examples

(Unit I to VII: Cell Molecular Biology; Unit VIII to XV: Developmental Biology)

PRACTICAL DSE ZOOP 5.1A

Credit: 04

1. Study of fixatives and stains: Preparation of formaldehyde (4 to 10%), alcohol (70 to 100%) Boin's fluid, Carnoy's fluid, borax carmine (alcoholic), eosin (alcoholic) iron hematoxylin, acetocarmine, aceto-orcien, Schiff's reagent (Feulgen method) and Giemsa's stain.
2. Observation and study of permanent slides for mitosis, meiosis and salivary gland chromosomes
3. Squash preparation of onion root tip to study stages of mitosis
4. Squash preparation of grass hopper testis/flower bud to study stages of meiosis
5. Squash preparation of salivary gland chromosomes of Drosophila
6. Stages of development of frog : the study of cleavage stages, blastula, gastrula and neurula and various stages of tadpole
7. Observation of various stages of frog development in nature
8. Study of permanent slides of chick embryo: 18 hrs, 24 hrs, 36 hrs and 48 hrs whole mounts and T, S of 18 hrs and 24 hrs chick embryos
9. Mounting of chick embryo

SCHEME OF PRACTICAL EXAMINATION

1.	Composition and preparation	i. Fixative	02
		ii. Stain	02
2.	Stages of mitosis/meiosis (two stages)		04
3.	Squash preparation (mitosis/meiosis)		07
4.	Mounting of chick embryo		08
5.	Identifications, Developmental stages of frog (2) chick (2)		08
6.	Viva		04
7.	Journal		05
	Total		**40**

OR

Credit: 04 **DSEZOOT: 5.1 B ETHOLOGY& APPLIED ZOOLOGY**

5.2.1: ETHOLOGY: (Unit I to VIII)

I INTRODUCTION 04 hrs

Definition, scope of ethology, contributions of Konrad Lorenz, Niko Tinbergen and Karl Von Frisch.

II TYPES OFANIMAL BEHAVIOUR 06 hrs

Innate behavior, taxes, reflexes, instincts and motivation, learned behavior, habituation, imprinting, conditioned reflexes and insight learning.

III SOCIAL ORGANIZATIONIN ANIMALS 05 hrs

Honey bees, termites and langur.s

IV COURTSHIP BEHAVIOUR 05 hrs

General principles of courtship behavior with suitable examples

Courtship behavior, Types of courtship behavior with suitable examples

(Fiddler crab, Scorpion, Salamander, Bower bird).

V PARENTAL CARE 05 hrs

Parental care in fishes, amphibians and birds with suitable examples.

VI NESTING BEHAVIOUR 05 hrs

Types of Nests: Nests and nesting behavior in wasps and birds (with suitable examples).

VII COLORATION AND MIMICRY 05 hrs

Definition, types of mimicry, Batesian Mullerian protective, aggressive and warning mimicry with suitable Indian examples.

APPLIED ZOOLOGY (Unit IX to XIV)

VIII AQUACULTURE 05 hrs

Fresh water, brackish and marine water fish culture in India, prawn and pearl culture.

IX VERMICULTURE 05 hrs

Introduction and importance of vermiculture. Different species of earthworm used in vermiculture, uses of earthworms for biodegradation of organic waste materials, earthworm as protein source, vermiculture technique.

XII. POULTRY SCIENCE 05 hrs

Introduction, breeds of fowls, poultry keeping, nutritive value of egg and meat, poultry diseases.

XIII. DAIRY TECHNOLOGY 05 hrs

Introduction, breeds of cattle, breeding and cattle improvement in India nutritive value of milk and milk byproducts.

XIV SERICULTURE 05 hrs

Introduction,Life cycle of Bombyx mori, Rearing of silkworm (Early and Late age), Types Of montages, Harvesting of cocoons and Spinning. Diseases of silkworm and control . Measures.

Credit : 02 PRACTICAL DSCZOOP 5.1B

1. Identification of castes in social insects.
2. Observation of courtship behavior in animals.
3. Observation of parental care in animals.
4. Observation of different types of nests and nest materials.
5. Coloration and mimicry.
6. Breeds of poultry.
7. Study of commercially important
   a. Crustaceans
   b. Molluscs
   c. Fishes
8. Visit to nearby diary, poultry, bee keeping unit, vermiculture unit and termite mound for observation.

SCHEME OF PRACTICAL EXAMINATION

1.	Identification	20
	a. Types of Nest (any 1)	
	b. Castes in social insects (any 2)	
	c. Coloration and mimicry	
	d. Poultry breeds	
	e. Commercially important fishes, crustaceans, molluscans, freshwater fish and marine water fish (one from each)	
	f. Courtship behavior (any one)	
	g. Parental care (any one).	
2.	Project	10
3.	Viva	04
4.	Journal	05
		Total 40

Fifth Semester B.Sc. (Zoology) Skill Enhancement Course

Paper Code: SEC-1 ZOOT 5.2A **Paper Title:** Immunology
Teaching Hours: 2 H / Week **Marks:** Th-40+IA-10
Total hours: 30 **Credits :**2

Unit 1: **Overview of the Immune System.** 08 Hours
Introduction to basic concepts in immunology, principles of innate and adaptive immune system

Unit 2: **Cells and Organs of the Immune System:** **06 Hours**
Haematopoeisis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system

Unit 3: Antigens: **06 Hours**
Basic properties of antigens, B and T cell, epitopes.

Unit 4: Antibodies: **06 Hours**
Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis.

Unit 5: **Vaccines:** **04 Hours**
General introduction to vaccines, Various types of vaccines; Attenuated viral and bacterial (Live) vaccines, Inactivated vaccines, Toxoid vaccines, Sub unit vaccines and Conjugate vaccines.

SUGGESTED READINGS

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
2. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology,* VII Edition,
3. Mosby, Elsevier Publication.
4. Abbas, K. Abul and Lechtman H. Andrew (2003.) *Cellular and Molecular Immunology.* V Edition. Saunders Publication.

Fifth Semester B.Sc. (Zoology) Skill Enhancement Course

Paper Code: SCE-2 ZOOT 5.2B **Paper Title:** APICULTURE
Teaching Hours: 2 H / Week **Marks:** Th-40+IA-10
Total hours:30 **Credits :**2

Unit 1: Biology of Bees 5hr
History, classification and biology of honey bees.
Social organization of bee colony, honey bee foraging plants.

Unit 2: Rearing of Bees 12hr
Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth
Bee Pasturage
Selection of Bee species for Apiculture
Bee keeping equipment.
Methods of extraction of honey (Indigenous and Modern).

Unit 3: Diseases and Enemies 5hr
Bee diseases and enemies.
Control and preventive measures

Unit 4: Bee economy 4hr
Products of Apiculture industry and its uses (honey, bee wax, propolis), pollen, etc.

Unit 5: Entrepreneurship in Apiculture 6hr
Bee keeping industry – recent efforts, modern methods in employing artificial Bee hives for cross pollination in horticultural gardens.

SUGGESTED READINGS

1. Bisht D.S.-.Apiculture, ICAR Publication.
2. Singh S., ( ) Beekeeping in India, Indian council of Agricultural Research, New Delhi.
3. Prost. P.J. (1962) – Apiculture, Oxford and IBH, New Dhelli

VI SEMESTER

PAPER DSEZOOT:6.1A: GENETICS, BIOTECHNOLOGY AND NANO TECHNOLOGY
Credits:04

Total Teaching Hours : 60 hrs

I INTRODUCTION 04 hrs

Heredity and environment, definition of genotype, phenotype, Mendel and his contributions, monohybrid and dihybrid cross.

II INTERACTION OF GENES 08 hrs

Supplementary factors- 9:3:3:1	Example : comb pattern in fowls
Dominant epitasis – 12:3:1	Example : plumage color in Leghorn and Wyandotte
Recessive epistasis - 3:3:4	Example – coat color in mice
Complementary factors 9:7	Example – flower color in sweet peas
Lethal gene	Example- coat color in mice

III MULTIPLE ALLELES 04 hrs

Inheritance of coat color in rabbit, isoalleles – psuedoalleles and position effect, ABO blood groups in human, Rh factor

IV LINKING AND CROSSING OVER 04 hrs

Linkage in Drosophila, theories of linkage, crossing over, cytological basis of crossing over, significance of crossing over, genetic map of chromosomes

V SEX DETERMINATION 04 hrs

Chromosomal mechanism of sex determination, genic balance theory, gynandromorphs and intersexes. Environmental and hormonal effects on determination of sex, Amniocentesis.

VI SEX LINKED INHERITANCE 04 hrs

Sex linked inheritance in Drosophila and man. Hemophilia and color blindness in man. Sex linkage in poultry. Y linked genes.

VII MUTATIONS 03 hrs

Chromosomal aberrations, molecular basis of gene mutation and types.

VIII HUMAN GENETICSAND EUGENICS 09 hrs

Karyotype analysis: normal male, normal female, Down's syndrome, cat cry syndrome, Turner syndrome, Klinefelter syndrome, and 21 trisomy; Common human genetic disorders, inborn errors of metabolism, albinism, phenylketonuria, alkaptoneuria, sickle cell anemia, thalassemia, Huntington's chorea, Eugenics.

IX EXTRACHROMOSOMAL INHERITANCE 02 hrs

Kappa particles in paramecium

X CONCEPT AND SCOPE OF BIOTECHNOLOGY 04 hrs

XI Isolation of DNA, molecular cloning, gene cloning, gene library, diagnosis of hereditary diseases, DNA finger printing, PCR technique, application of biotechnology, animal cloning, transgenic animals/proteomics, genomics, human genome project. 08 hrs

XII Introduction to nano science and nanotechnology, Types of nano-materials, nanobiotechnology in healthcare, environmental nanotechnology 06 hrs

(Unit I to X: Genetics; Unit XI: Biotechnology; Unit XII : Nanotechnology)

PRACTICAL: DSCZOOP :6.1A

Credits: 02

1. Karyotype analysis; normal male, normal female, Down's syndrome, Catcry syndrome, Tuner's syndrome, Klinefelter's syndrome, and 21 trisomy
2. Mutant forms of Drosophila
3. Genetic problems; monohybrid inheritance (3), dihybrid inheritance (3)
4. Genetic problems: multiple alleles- ABO blood groups in humans (3)
5. Genetic problems: sex linked inheritance in Drosophila (2) and man (2)
6. Calculation of allele frequency – PTC (Phenyl thio Carbamide) tongue rolling, attached ear lobes

SCHEME OF PRACTICAL EXAMINATION

1.	Karyotype analysis	10
2.	Mutant forms of drosophila (any 2)	06
3.	Genetic problem (5) Monohybrid, dihybrid, multiple alleles and sex-linkedinheritance in drosophila and man	15
4.	Viva	04
5.	Journal	05
	Total	**40**

OR

PAPER DSEZOOT 6.1B: ENVIRONMENTAL BIOLOGY& ZOOGEOGRAPHY AND WILDLIFE BIOLOGY

Credit: 04 **Total Teaching Hours: 60 hrs**

I INTRODUCTION 03 hrs

Ecological spectrum, subdivisions of ecology, scope of ecology

II BIOGEOCHEMICAL CYCLES 06 hrs

Principles and concepts to biogeochemical cycles. Hydrological, Carbon, Nitrogen, Oxygen, Sulphur and Phosphorus cycles

III ABIOTIC AND BIOTIC FACTORS 08 hrs

Biotic factors, light, effect of light on plants and animals. Temperature; thermal stratification, cyclomorphosis. Adaptations to extreme temperatures; soil; soil organisms; water; oxygen; carbon dioxide; fire and wind

Biotic factors, animal relationships, mutualism, commensalism, parasitism, amensalism, predation and competition with relevant examples

IV HABITATS 06 hrs

Marine habitat, zonation of the sea and ecological classification of marine biota, coastal ecology, estuarine ecology and mangroves.

Freshwater habitat, lentic and lotic systems. Ecological classification of fresh water animals'

Terrestrial habitat; a brief account of biomes

Ecological adaptations to marine, freshwater and terrestrial habitats

V POPULATION ECOLOGY 04 hrs

Population density, natality and mortality, age distribution, population growth rate, population growth curves, biotic potential, Allee's principle and Gause's Principle

VI COMMUNITY ECOLOGY 06 hrs

Community structure, ecological determinants, ecological stratification, ecotone and edge effect, ecological niches, ecological succession, climax community, alpha, beta, gamma diversity, Shanon index. Liebig's and Shelford's laws and combined concept of limiting factors

VII **POLLUTION** 06 hrs

Air, Water, Soil Pollution, noise, visual and agricultural pollution, e-waste, solid and hazardous waste management with example. **Toxicants – natural and synthetic toxicants and toxicity measurements. Global warming, acid rain, bio-accumulation, bio - magnification, eutrophication- types and its impact.**

ZOOGEOGRAPHY AND WILDLIFE BIOLOGY (Unit – VIII to XII)

VIII GEOGRAPHIC DISTRIBUTIONOF ANIMALS 03 hrs

Continuous and discontinuous distributions with examples, barriers of dispersal, topographic and vegetation barriers, large bodies of water as barriers, climatic barriers

IX ZOOGEOGRAPHY 06 hrs

Zoogeographical realms (with subdivisions) of world, with climatic conditions and examples of characteristic fauna, a brief account of Wallace's line

X DISTRIBUTION OF WILD LIFE IN INDIA 04 hrs

The Himalayan ranges, the peninsular India subregion, deccan plateau, western ghats, eastern hill chain, Aravali ranges, Indian desert, tropical rain forests, wildlife in Andaman and Nicobar Islands

XI WILD LIFE PROBLEMS 02 hrs

Hunting, overharvesting, habitat destruction degradation, due to over population, and possibilities of climatic changes

XII WILD LIFE CONSERVATION 06 hrs

Need for wild life conservation agencies engaged in wild life conservation. Government organization and nongovernment organizations. Wild Life Protection Act 1972, CITES: Convention on International Trade in Endangered Species of wild life flora and fauna; endangered fauna and flora of India. Red data book. Ramsar convention. CBD: convention of Biological Diversity, Project Tiger

PRACTICAL DSCZOOP 6.1B

Credit: 02

1. Estimation of dissolved oxygen, carbon dioxide, hardness, chloride, alkalinity and pH of waters.
2. Study of tropical pond as an ecosystem, study of fauna and flora and interaction between the various constituents using Charts
3. Study of community by quadrat method to determine frequency, density and abundance of different species present in the community, alpha diversity
4. Location of species of zoological interest on the Indian map and world map, flightless birds, Tiger, Lion, Gorilla, Hippopotamus, Rhinoceros, Dipnoi and Peripatus.
5. Location of tiger reserves, national parks, biosphere reserves, wild life sanctuaries of India on map
6. Study of threatened animals of India (by models/pictures/charts) Tiger, Lion, One horned Rhinoceros, Gaur, Golden Langur, Lion tailed monkey, Musk deer, Mouse deer, Kashmir stag, Great Indian Hornbill and Indian rock python
7. Study of biomass of consumers of a particular area by quadrat method- by determining the dry weight of living organisms – both animals and plants per unit area.
8. Study of ecological adaptations and morphological peculiarities- Hermit crab, Stick insect, Glow worm,Stinkbug, Pufferfish, Anglerfish, Exocoetes, Phrynosoma, Draco, Chameleon, and Bat

SCHEME OF PRACTICAL EXAMINATION

1.	Estimation	10
2.	Identification-5	10
3.	Project works report on ecology/wildlife biology	10
4.	Viva connected with field work report	05
5.	Journal	05
	Total	**40**

Sixth Semester B.Sc. (Zoology) Skill Enhancement Course

Paper Code: SEC-1 ZOOT 6.2 A **Paper Title: INSECT, VECTOR AND DISEASES**
Teaching Hours: 2 H / Week **Marks:** Th-40+IA-10
Total hours: 30 **Credits :**2

Unit I: **05 Hours**
Introduction to Insects: General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts and feeding habits.

Unit II: **04 Hours**
Concept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector).

Unit III: **10 Hours**
Dipteran as Disease Vectors : Dipterans as important insect vectors – Mosquitoes, Houseflies;
Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Filariasis; Causes, symptoms Control of mosquitoes and Control of house fly.

Unit IV: **04 Hours**
Siphonaptera as Disease Vectors: Fleas as important insect vectors; Study of Flea-borne diseases – Plague, Control of fleas.

Unit VI: **04 Hours**
Siphunculata as Disease Vectors: Human louse (Head, Body) as important insect vectors; Study of louse-borne diseases –Typhus fever and Control of human louse.

Unit VII: **03 Hours**
Hempitera as Disease Vectors
Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Control and prevention measures.

SUGGESTED READINGS

1. Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK
2. Chapman, R.F. (1998). *The Insects: Structure and Function.* IV Edition, Cambridge University Press, UK
3. Pedigo L.P. (2002). *Entomology and Pest Management.* Prentice Hall Publication
4. Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Wiley-Blackwell

Sixth Semester B.Sc. (Zoology) Skill Enhancement Course

Paper Code: SEC-2 ZOOT 6.2 B **Paper Title**: Aquarium fish keeping
Teaching Hours: 2 H / Week **Marks:** Th-40+IA-10
Total hours:30 **Credits:** 2

UNIT – 1 **15 Hours**

Introduction to Aquarium Fish Keeping: The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes.

Biology of Aquarium Fishes: Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.

Food and feeding of Aquarium fishes: Use of live fish feed organisms. Preparation and composition of formulated fish feeds.

UNIT – 2 **15 Hours**

Fish Transportation: Live fish transport - Fish handling, packing and forwarding techniques.
Maintenance of Aquarium: General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a, Cottage Industry.

Aquarium design, Construction and preparation: size, shape, substrate, ornamental aquatic plants. Construction and functions of Bio-filters; aerators – accessories for fish tanks and maintenance of water quality: controlling ammonia build up, Ph.

SUGGESTED READINGS

1. Baradach, JE, JH Ryther and WO Mc Larney (1972). Aquaculture. The Farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, New York.
2. Jameson, J.D. and R. Santhanam (1996). Manual of ornamental fisheries and farming technology. Fisheries College and Research Institute, Thoothukudi.
3. Mitchell Beazley, 1998. The complete guide to tropical aquarium fish care. Read and Consumes Book Ltd., London.
4. Jameson, J.D. Alangara Meen Valarpu (in Tamil). National Book House, New Delhi. 5. Mill Dick, 1993: Aquarium fish, DK Publ. Co, Inc. New York –USA

SCHEME OF THEORY EXAMINATION QUESTION PAPER
B.Sc Degree examination Month/Year
Semester
Zoology (CBCS System)
PAPER; DSC-ZT (code) Name of the paper

Time: Three Hours Maximum marks; 80

Instruction to Candidates

a) Answer all the questions
b) Draw a neat labeled diagram wherever necessary

I. Answer any TEN of the following in 3-4 sentences each 10 x2 =20
Q. 1- 12

II. Answer any SIX of the following in 10 - 15 sentences each 5 x6 =30

Q. 13- 20

III. Answer any of the following 3 x10 =30

Q. 21. a OR b.
22. a OR b
23. a OR b

****

The question paper should be prepared from all the units with equal weight age.

SCHEME OF THEORY EXAMINATION QUESTION PAPER
B.Sc Degree examination Month/Year
Semester
Zoology (CBCS System)
PAPER; SEC-ZT (code) Name of the paper

Time: Two Hours Maximum marks; 40

Instruction to Candidates

a) Answer all the questions
b) Draw a neat labeled diagram wherever necessary

I. Answer any FOUR of the following in 3-4 sentences each 4 x2 = 8
Q. 1- 6

II. Answer any THREE of the following in 10 - 15 sentences each 3 x4 =12

Q. 7- 12

III. Answer any of the following 2 x10 =20

Q. 13. a OR b.
14. a OR b

****

The question paper should be prepared from all the units with equal weight age.

ಶ್ರೀ ಶಿವಾಜಿ ಶಿಕ್ಷಣ ಸಂಸ್ಥೆಯ
ಮಹಾಸತಿ ಕಲಾ,ವಾಣಿಜ್ಯ ಹಾಗೂ ವಿಜ್ಞಾನ ಮಹಾವಿದ್ಯಾಲಯ ಉಳಗಾ,ಕಾರವಾರ–581328
ನ್ಯಾಕ್‌ನಿಂದ "ಬಿ" ಮಾನ್ಯತೆ ಪಡೆದಿದೆ
ShriShivaji Education Society's,
MAHASATEE ARTS,COMMERCE& SCIENCE COLLEGE,ULGA,KARWAR,
Uttar Kannada,Karnataka-581328
Accredited by NAAC with "B" Grade
Phone:08382-257033 E-mail:sesmahasateeuk@gmail.com Website:www.sesmacsuk.co.in

SYLLABUS

FOR

BACHELOR OF SCIENCE (B.Sc.) COURSE

FOR THE YEAR-2021-2022

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

Tele: 0836-2215224
e-mail: academic.st@kud.ac.in
Pavate Nagar,Dharwad-580003
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ – 580003

NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಬಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

Practical Subject

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. (Hons.) Program

***

SYLLABUS

Subject: BOTANY

[Effective from 2021-22]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,

OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and

SKILL ENHANCEMENT COURSE (SEC) FOR SEM I

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in BOTANY for B.Sc. (Hons.)

Effective from 2021-22

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	DSCC 1	Theory	04hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-1	Theory	03 hrs	42	02 hrs	40	60	100	03
	*SEC-1	Practical	03 hrs	30	02 hrs	25	25	50	02
II	DSCC2	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-2	Theory	03 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

*** Student can opt digital fluency as SEC or the SEC of his/ her anyone DSCC selected**

Name of Course (Subject): BOTANY

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in BOTANY students will be able to:

PSO 1: Skill development for the proper description using botanical terms, identification, naming, and classification of life forms especially plants and microbes.

PSO 2: Acquisition of knowledge on the structure, life cycle, and life processes that exist among plant and microbial diversity through certain model organism studies.

PSO 3: Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.

PSO 4: Ability to explain the diversity and evolution based on the empirical evidence in morphology, anatomy, embryology, physiology, biochemistry, molecular biology, and life history.

PSO 5: Skill development for the collection, preservation, and recording of information after observation and analysis- from simple illustration to molecular database development.

PSO 6: Making aware of the scientific and technological advancements- Information and Communication, Biotechnology, and Molecular Biology for further learning and research in all branches of Botany.

PSO 7: To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC, and others.

PSO 8: To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.

PSO 9: The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies, etc at the right opportunity.

PSO 10: The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and their professional career.

B.Sc. Semester – I

Subject: Fungi, Microbiology and Plant Pathology
Discipline-Specific Course (DSC)

The course Fungi, Microbiology and Plant Pathology in I semester has two papers (Theory Paper –I for 04 credits & Practical Paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-1 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.1 (Theory): Title of the Course (Theory)**: Fungi, Microbiology and Plant Pathology**

Course Outcome (CO):

After completion of the course (Theory), students will be able to:

CO 1: Develop an understanding of the concept of microbial nutrition, Classify viruses based on their characteristics and structures.

CO 2: Develop a critical understanding of plant diseases and their remediation. Examine the general characteristics of bacteria and their cell reproduction/recombination.

CO 3: Increase the awareness and appreciation of human-friendly viruses, bacteria, algae, and their economic importance. Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.

CO 4: Demonstrate skills in laboratory, field, and glasshouse work related to mycology and plant pathology.

CO 5: Develop an understanding of microbes, fungi, and lichens and appreciate their adaptive strategies Identify the common plant diseases according to geographical locations and device control measures. Conduct experiments using skills appropriate to subdivisions

Syllabus- Course 1(Theory): Title- **Fungi, Microbiology and Plant Pathology**	**Total Hrs: 56**
Unit-I Introduction to fungi and classification: Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota, Oomycota and allied fungi	**14 hrs**
General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification (Alexopoulos). **Chytridiomycota and Zygomycota:** Characteristic features; Ecology and significance; Thallus organization; Reproduction; Life cycle with reference to *Synchytrium, Rhizopus*. **Ascomycota:** General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis, and parasexuality; Life cycle and classification with reference to *Saccharomyces, Penicillium, Alternaris* and *Peziza*. **Basidiomycota, Allied fungi, and Oomycota:** General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat *Puccinia* (Physiological Specialization), loose and covered smut (symptoms only), *Agaricus*; Bioluminescence, Fairy Rings and Mushroom Cultivation. Allied fungi: General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies. **Oomycota:** General characteristics; Ecology; Life cycle and classification with reference to *Phytophthora, Albugo*.	
Unit-II Symbiotic associations and Applied Mycology	**14 hrs**
Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza- Ectomycorrhiza, Endomycorrhiza, and their significance. Role of fungi in biotechnology; Application of fungi in the food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical Mycology.	

Unit-III Introduction to the microbial world, Viruses, and Bacteria	**14 hrs**
Microbial nutrition, nutritional types, growth, and metabolism. Economic importance of viruses with reference to vaccine production, role in research, medicine, and diagnostics, as causal organisms of plant diseases. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine). **Viruses and Bacteria:** General characteristics; classification (Baltimore), structure and replication of DNA virus (T4 and λ), lytic and lysogenic cycle; RNA virus (TMV), viroids, and prions. General characteristics; Archaebacteria, Eubacteria, wall-less forms (mycoplasmas); Cell structure; Reproduction and recombination (conjugation, transformation, and transduction). Binary fission and endospore.	
Unit-IV Phytopathology	**14 hrs**
Phytopathology: Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine. Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Late blight of potato, Black stem rust of wheat, White rust of crucifers.	

Books recommended.

1. Agrios, G.N. (1997). Plant Pathology, 4th edition, Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology. 4th edition.John Wiley & Sons (Asia) Singapore.
3. Webster, J. and Weber, R. (2007). Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.
4. Sethi, I.K. and Walia, S.K. (2011). Textbook of Fungi and Their Allies, Macmillan Publishers India Ltd.
5. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
6. Wiley, J.M, Sherwood, L.M. and Woolverton, C.J. (2013). Prescott's Microbiology. 9th Edition. McGraw Hill International.
7. Sharma T.A., Dubey, R.C. and Maheshwari, D.K. (1999). A Text-Book of Microbiology. S Chand and Co, New Delhi.
8. Pelczar, M.J. (2001). Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi. Agrios, G.N. (1997). Plant Pathology, 4th edition, Academic Press, U.K.

9. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

B.Sc. Semester – I

Subject: Fungi, Microbiology and Plant Pathology

Discipline-Specific Course (DSC)

Course No.-1 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.1 (Practical): Title of the Course (Practical): **Fungi, Microbiology and Plant Pathology**

Course Outcome (CO):

After completion of the course (Practical), students will be able to:

CO 1: Develop an understanding of the concept of microbial nutrition, Classify viruses based on their characteristics and structures.

CO 2: Develop a critical understanding of plant diseases and their remediation. Examine the general characteristics of bacteria and their cell reproduction/recombination.

CO 3: Increase the awareness and appreciation of human-friendly viruses, bacteria, algae, and their economic importance. Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.

CO 4: Demonstrate skills in laboratory, field, and glasshouse work related to mycology and plant pathology.

CO 5: Develop an understanding of microbes, fungi, and lichens and appreciate their adaptive strategies Identify the common plant diseases according to geographical locations and device control measures. Conduct experiments using skills appropriate to subdivisions

List of the Experiments for 52 hrs / Semesters

1. *Rhizopus*: a study of the asexual stage from temporary mounts and sexual structures through permanent slides.

2. *Aspergillus* and *Penicillium*: a study of the asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs.

3. *Peziza*: sectioning through ascocarp.

4. *Alternaria:* Specimens/photographs and temporary mounts.

5. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts.

6. *Agaricus*: Specimens of button stage and full-grown mushroom; sectioning of gills of *Agaricus*, fairy rings, and bioluminescent mushrooms are to be shown.

7. *Phytophthora infestnas* – vegetative structure and reproduction.

8. *Albugo:* Study of symptoms of plants infected with *Albugo*; asexual phase study through section/temporary mounts and sexual structures through permanent slides.

9. Lichens: Study of growth forms of lichens (crustose, foliose, and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs).

10. Electron micrographs/Models of viruses – T4 and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.

11. Gram-staining of root nodule and curd.

12. Phytopathology: Herbarium and live specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early blight of potato, Black stem rust of wheat, and White rust of crucifers.

General instructions:

Q1. Give specimens A, B, and C from fungi

Q2. Give root nodule/curd for simple/Gram staining of bacteria (D)

Q3. Diseased specimen E-viral disease/bacterial disease; F-fungal disease

Q4. Give slide 'G' Fungi/mycorrhizae; 'H' slide/specimen from fungi

Q5. Study tour report

Q5. Viva voce

Q6. Journal

Scheme of Practical Examination (distribution of marks): 25 marks for the Semester end examination

1. Identify, classify and write the salient features observed of specimen A, B, C **6 Marks**
2. Perform simple/Gram staining using material 'D'. Show the preparation to the examiners **4 Marks**
3. Identification of the disease and explain symptoms observed in specimen E and F 4 **Marks**
4. Identify and describe the features observed in the slides/specimen G, and H 4 **Marks**
5. **Study Tour Report 2 Marks**
6. **Viva voce 2 Marks**
7. **Journal 3 Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Ashok Bendre and Ashok Kumar (2009) A textbook of practical botany, Rostakge Publications.
2. Sharma, O.P., and Sharma, K. D. (2017) Practical Botany-I, Pragathi Prakashan, Meerut.
3. Raghuram, M, and Rao, M. V. (2018) B. Sc. Practical Book of Botany First Year, Technical Publishers.
4. Verghese, N., Joy, P.P. Microbiology Laboratory Manual, Kerala Agricultural University.

B.Sc. Semester – I

Subject: Mushroom Cultivation
Open Elective Course (OEC-1)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-1	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-1: Title of the Course: **Mushroom Cultivation**

Course Outcome (CO):

After completion, of course, students will be able to:

CO 1 : Identification of various types and categories of mushrooms

CO 2 : Demonstrate various types of mushroom cultivating technologies

CO 3 : Examine various types of food technologies associated with the mushroom industry

CO 4 : Value the economic factors associated with mushroom cultivation

CO 5 : Device new methods and strategies to contribute to mushroom production

Syllabus- OEC: Title: Mushroom Cultivation	**Total Hrs: 42**
Unit-I Introduction, Cultivation technology	**14 hrs**
Introduction, history. Nutritional and medicinal value of edible mushrooms; Nutrition and nutraceuticals – Proteins, amino acids, mineral elements nutrition, carbohydrates, crude fiber content, vitamins; Poisonous mushrooms. **Cultivation Technology**: Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low-cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, Sterilization, Preparation of spawn, Multiplication.	
Unit-II Cultivation	**14 hrs**
Cultivation practices of *Agaricus bisporus*, *Pleurotus* sp. and *Volvoriella volvacea*. Composting technology in mushroom production, Low-cost technology, Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation.	
Unit-III Storage and Food preparation, Food preparation	**14 hrs**
Short-term storage (Refrigeration - up to 24 hours) Long-term Storage (canning, pickles, papads), drying, storage in salt solutions. **Food Preparation:** Types of foods prepared from the mushroom. Research Centres - National level and Regional level. Cost-benefit ratio - Marketing in India and abroad, Export Value	

Books recommended.

1. Biswas, S., Datta, M. and Ngachan, S.V. 2012. Mushrooms: A Manual for Cultivation. PHI Learning Private Limited, New Delhi.

2. Kapoor, J.N. 2010. Mushroom Cultivation. ICAR, New Delhi.

3. Nita Bahl (2000) Handbook of Mushrooms. Oxford & IBH Publishing Co. Pvt. Ltd.

4. Singh, M., Vijay, B., Kamal, S., and Wakchaure (Eds.) 2011. Mushrooms: Cultivation, Marketing, and Consumption. Directorate of Mushroom Research (ICAR), Solan

5. Tewari, Pankaj, and Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.

B.Sc. Semester - I

Subject: Gardening and landscaping
SKILL ENHANCEMENT COURSE (SEC)-I

Title of Paper: Gardening and landscaping

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Mode of Examination	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
SEC-I	Theory + Practical	02	03hrs	30	Practical	2hr	25	25	50

Course Outcome (CO):

After completion of the Skill Enhancement course, students will be able to:

CO 1: Apply the basic principles and components of gardening

CO 2: Conceptualize flower arrangement and bio-aesthetic planning

CO 3: Design various types of gardens according to the culture and art of bonsai

CO 4: Establish and maintain special types of gardens for outdoor and indoor landscaping

List of the Experiments for 52 hrs / Semesters

1. Tools, implements, and containers used for propagation and nursery techniques.
2. Propagation by cutting, layering, budding, and grafting.
3. Seed propagation - preparation of portable trays, seed treatments, sowing, and seedling production.
4. Identification and description of annuals, herbaceous perennials, climbers, creepers, foliage, and flowering shrubs, trees, palms, ferns, ornamental grasses; cacti, and succulents.
5. Planning and designing of gardens, functional uses of plants in the landscape.
6. Preparation of land for lawn and planting.
7. Identification of commercially important flower crops and their varieties.
8. Propagation practices in flower crops, sowing of seeds, and raising of seedlings of annuals.
9. Use of chemicals and other compounds for prolonging the vase life of cut flowers.
10. Grading, packing, and marketing of cut flowers.
11. Visit commercial nurseries and commercial tissue culture laboratories.

General instructions:

Theoretical Knowledge of the following is essential**:**

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs, and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses, and cacti succulents.
Flower arrangement: importance, production details, and cultural operations, constraints, postharvest practices. Bioaesthetic planning, definition, need round country planning, urban planning, and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, riverbanks, planting material for playgrounds.

Vertical gardens, roof gardens. Culture of bonsai, the art of making bonsai. Parks and public gardens. Landscape designs, Styles of the garden, formal, informal, and freestyle gardens, types of gardens, Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, dam sites, IT parks, corporate.

Scheme of Practical Examination (distribution of marks): 25 marks for the Semester end examination

1. Identify and describe the uses of tools **6 Marks**
2. Perform experiment – **Seed viability/Seed germination 6 Marks**
3. Identification of specimen **6 Marks**
4. **Study tour report 2 Marks**
5. **Viva 2 Marks**
6. **Journal 3Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
3. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.
4. Hartmann and Kester, 2010. Plant Propagation: Principles and Practices. Pearson Publisher.
5. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.
6. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
7. Thakur, A.K., Kashyap, B., Bassi, S.K. and Sharma, M. 2018. Floriculture. S. Dinesh & Co., Jalandhar.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions: 20 marks

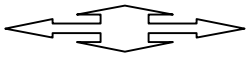
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight-age shall be given to each unit based on number of hours prescribed.



B.Sc. Semester – II

Subject: Algae, Bryophytes, Pteridophytes and Gymnosperms
Discipline-Specific Course (DSC)

The course Algae, Bryophytes, Pteridophytes, and Gymnosperms in I semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-2 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.2 (Theory): Title of the Course (Theory)**: Algae, Bryophytes, Pteridophytes, and Gymnosperms**

Course Outcome (CO):

After completion of the course (Theory), students will be able to:

CO 1: Demonstrate an understanding of Algae, Bryophytes, Pteridophytes, and Gymnosperms.

CO 2: Develop a critical understanding of morphology, anatomy, and reproduction of Algae, Bryophytes, Pteridophytes, and Gymnosperms.

CO 3: Understanding of plant evolution and their transition to land habitat.

CO 4: Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Alage, Bryophytes, Pteridophytes, Gymnosperms

CO 5: Economic importance of Alage, Bryophytes, Pteridophytes, Gymnosperms

Syllabus- Course 2(Theory): Title- Algae, Bryophytes, Pteridophytes, Gymnosperms	**Total Hrs: 56**
Unit-I Algae: Cyanophyta, Xanthophyta, Chlorophyta and Phaeophyta and Rhodophyta	**14 hrs**
Algae, Cyanophyta and Xanthophyta: Life histories of algae, commonly found algae in India, Classification (by Fritsch), Algal cultivation methods, Phylogenetic systematics of red, brown and green algae, Dinoflagellates, Diatoms, Cryptomonads and other unicellular algae, Algal evolution, Algal bioprospecting. Ecology and occurrence; Range of thallus organization; Cell structure; Morphology and reproduction in *Nostoc* and *Vaucheria*.	

Chlorophyta and Phaeophyta and Rhodophyta: General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Morphology and life-cycles of *Volvox, Oedogonium, Chara, Ectocarpus,* and *Batrachospermum* Red tides and other algal adaptations. Commercial cultivation and economic importance of green algae, Brown and Red algae.	
Unit-II Bryophytes and type of bryophytes	**14 hrs**
Unifying features of and adaption of archegoniates; Transition to land habit; Alternation of generations. General characteristics; Classification (Smith/Fritsch); Range of thallus organization. Morphology, anatomy, reproduction and evolutionary trends in *Riccia, Marchantia, Anthoceros, and Funaria*; Common mosses of India, Ecological and economic importance of bryophytes with special reference to *Sphagnum*.	
Unit-III Pteridophytes	**14 hrs**
Unifying features, morphology, anatomy, and reproduction of *Psilotum*, *Selaginella*, *Equisetum,* and *Pteris* (Developmental details not to be included). Apogamy and apospory, heterospory and seed habit, telome theory, stellar evolution; Common ferns of India, Ecological and economic importance.	
Unit-IV Gymnosperms	**14 hrs**
Unifying features, general characteristics, classification (Smith/Fritsch), morphology, anatomy, and reproduction of *Cycas*, *Pinus,* and *Gnetum* (excluding developmental details); *Cycas* and *Pinus* of India, Ecological and economic importance.	

Books recommended.

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.

2. Vashishta B.R., Sinha A.K. and Singh V. P. (2008). Botany for Degree Students. Algae. S Chand and Co, New Delhi.

3. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.

4. Campbell, N.A., Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky P.V. and Jackson, R.B. (2008). Biology, 8th edition. Pearson Benjamin Cummings, USA.

5. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.

6. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International Publishers, New Delhi, India.

7. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot, Allahabad.

8. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, New Delhi.

9. Vanderpoorten, A. and Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press, Cambridge

B.Sc. Semester – II

Subject: Algae, Bryophytes, Pteridophytes and Gymnosperms

Discipline-Specific Course (DSC)

Course No.-2 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.2 (Practical): Title of the Course (Practical)**: Algae, Bryophytes, Pteridophytes, and Gymnosperms**

Course Outcome (CO):

After completion of the course (Practical), students will be able to:

CO 1: Demonstrate an understanding of Algae, Bryophytes, Pteridophytes, and Gymnosperms.

CO 2: Develop a critical understanding of morphology, anatomy, and reproduction of Algae, Bryophytes, Pteridophytes, and Gymnosperms.

CO 3: Understanding of plant evolution and their transition to land habitat.

CO 4: Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Alage, Bryophytes, Pteridophytes, Gymnosperms

CO 5: Economic importance of Alage, Bryophytes, Pteridophytes, Gymnosperms

List of the Experiments for 52 hrs / Semesters

1. Microscopic observation of vegetative and reproductive structures of *Nostoc, Volvox*, *Oedogonium, Chara, Vaucheria, Ectocarpus, Fucus, and Batrachospremum* through temporary preparations and permanent slides.

2. *Riccia* – Morphology of the thallus.

3. *Marchantia*- Morphology of thallus, whole-mount of rhizoids and Scales, vertical section of thallus through Gemma cup (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).

4. *Anthoceros*- Morphology of thallus, dissection of the sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of the thallus (permanent slide).

5. *Funaria*- Morphology, whole-mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of a capsule; whole mount of protonema.

6. *Psilotum*- Study of the specimen, transverse section of synangium (permanent slide).

7. *Selaginella*- Morphology, whole-mount of the leaf with a ligule, transverse section of stem, whole-mount of strobilus, whole-mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).

8. *Equisetum*- Morphology, transverse section of internode, longitudinal section of strobilus, whole-mount of sporangiophore, whole-mount of spores (temporary slide), transverse section of rhizome (permanent slide).

9. *Pteris*- Morphology, transverse section of rachis, vertical section of sporophyll, whole-mount of the sporangium, whole-mount of spores (temporary slides), transverse section of rhizome, whole-mount of prothallus with sex organs, and young sporophyte (permanent slide).

10. *Cycas*- Morphology (coralloid roots, leaf), the whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of the leaflet, vertical section of microsporophyll, whole-mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).

11. *Pinus*- Morphology (long and dwarf shoots, whole-mount of dwarf shoot, male and female cones), transverse section of the needle, transverse section of stem, longitudinal section of / transverse section of a male cone, whole-mount of microsporophyll, whole-mount of Microspores (temporary slides), longitudinal section of a female cone, tangential longitudinal section and radial longitudinal sections stem (permanent slide).

12. *Gnetum*- Morphology (stem, male and female cones), transverse section of stem, vertical section of the ovule (permanent slide).

General instructions:

Q1. Give specimen from Algae, Bryophytes, Pteridophytes, and Gymnosperms (A, B, C, and D)

Q2. Preparation and analysis of material Algae/Bryophytes/Pteridophytes/ Gymnosperms (E and F)

Q3. Specimen or Slides from Algae/Bryophytes/Pteridophytes/Gymnosperms (H, I, and J)

Q4. Study Tour Report

Q5. Viva

Q6. Journal

Scheme of Practical Examination (distribution of marks): 25 marks for the Semester end examination

1. Identify, classify and describe features observed in specimen **8 Marks**
2. Describe the internal structures of the given specimen **4 Marks**
3. Identification of Specimen/slides **6 Marks**
4. **Study Tour Report 2 Marks**
5. **Viva 2 Marks**
6. **Journal 3 Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Ashok Bendre and Ashok Kumar (2009) A textbook of practical botany, Rostakge Publications.
2. Sharma, O.P., and Sharma, K. D. (2017) Practical Botany-I, Pragathi Prakashan, Meerut.
3. Raghuram, M, and Rao, M. V. (2018) B. Sc. Practical Book of Botany First Year, Technical Publishers.
4. Verghese, N., Joy, P.P. Microbiology Laboratory Manual, Kerala Agricultural University.

B.Sc. Semester – II

Subject: Biofertilizers
Open Elective Course (OEC-2)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-2	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-2: Title of the Course**: Biofertilizers**

Course Outcome (CO):

After completion, of course, students will be able to:

CO 1: Develop their understanding of the concept of bio-fertilizer

CO 2: Identify the different forms of biofertilizers and their uses

CO 3: Compose the Green manuring and organic fertilizers

CO 4: Develop the integrated management for better crop production by using both nitrogenous and phosphate biofertilizers and vesicular-arbuscular mycorrhizal (VAM).

CO 5: Interpret and explain the components, patterns, and processes of bacteria for growth in crop production

Syllabus- OEC: Title- Biofertilizers	**Total Hrs: 42**
Unit-I	**14 hrs**
The general account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier-based inoculants, Actinorrhizal symbiosis. *Azospirillum:* isolation and mass multiplication – carrier-based inoculant, the associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance, and mass multiplication.	
Unit-II	**14 hrs**
Cyanobacteria (blue-green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue-green algae, and *Azolla* in rice cultivation. Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.	
Unit-III	**14 hrs**
Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural, and industrial wastes – bio compost making methods, types, and method of vermicomposting – field Application.	

Books recommended.

1. Dubey, R.C. (2005). A Textbook of Biotechnology S.Chand & Co, New Delhi.

2. John Jothi Prakash, E. (2004). Outlines of Plant Biotechnology. Emkay Publication, New Delhi.

3. Kumaresan, V.(2005). Biotechnology, Saras Publications, New Delhi.

4. NIIR Board. (2012). The Complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.

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6. Subba Rao N.S. (2017). Biofertilizers in Agriculture and Forestry. Fourth Edition. Medtech.

7. Vayas, S.C, Vayas, S. and Modi, H.A. (1998). Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme: 2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

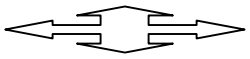
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight-age shall be given to each unit based on number of hours prescribed.



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

Tele: 0836-2215224
e-mail: academic.st@kud.ac.in
Pavate Nagar,Dharwad-580003
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ – 580003

NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಬಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. (Hons.) Program

***

SYLLABUS

Subject: Chemistry

[Effective from 2021-22]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,

OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and

SKILL ENHANCEMENT COURSE (SEC) FOR SEM I

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in Chemistry for B.Sc. (Hons.)

Effective from 2021-22

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	DSCC 1	Theory	04hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-1	Theory	03 hrs	42	02 hrs	40	60	100	03
	*SEC-1	Practical	03 hrs	30	02 hrs	25	25	50	02
II	DSCC2	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-2	Theory	03 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

*** Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected**

Name of Course (Subject): Chemistry

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in Chemistry students will be able to:

PO 1 Demonstrate, solve and an understanding of major concepts in all the disciplines of chemistry.

PO 2 Provide students with broad and balanced knowledge and understanding of key chemical concepts.

PO 3 Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.

PO 4 To apply standard methodology to the solutions of problems in chemistry.

PO 5 Provide students with knowledge and skill towards employment or higher education in chemistry or multi-disciplinary areas involving chemistry.

PO 6 Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.

PO 7 Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.

PO 8 Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.

PO 9 To prepare students effectively for professional employment or research degrees in chemical sciences.

PO 10 To cater to the demands of chemical industries of well-trained graduates.

PO 11 To build confidence in the candidate to be able to work on his own in industry and institution of higher education.

PO 12 To develop an independent and responsible work ethics.

B.Sc. Semester – I

Subject: Chemistry
Discipline Specific Course (DSC)

The course Chemistry in I semester has two papers (Theory Paper –I for 04 credits & Practical Paper -II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-1 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.1 (Theory): Title of the Course (Theory) **CHEMISTRY: CHM T-1**

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1 Describe the dual nature of radiation and matter; dual behavior of matter and radiation, de Broglie's equations, Heisenberg uncertainty principle and their related problems. Quantum mechanics. Derivation of Schrodinger's wave equation. Orbital shapes of *s, p, d and f* atomic orbitals, nodal planes. Electronic configurations of the atoms.

CO 2 Define periodicity, explain the cause of periodicity in properties, classify the elements into four categories according to their electronic configuration. Define atomic radii, ionisation energy, electron affinity and electronegativity, discuss the factors affecting atomic radii, describe the relationship of atomic radii with ionization energy and electron affinity, describe the periodicity in atomic radii, ionization energy, electron affinity and electronegativity.

CO 3 Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). steric effect and their applications in explaining acidic strength of carboxylic acids, basicity of amines. Understand basic concept of organic reaction mechanism, types of organic reactions, structure, stability and reactivity of reactive intermediates.

CO 4 Describe important characteristics of configurational and conformational isomers. Practice and write conformational isomers of ethane, butane and cyclohexane. Understand the various concepts of geometrical isomerism and optical isomerism. Describe CIP rules to assign E,Z notations and R& S notations. Explain D and L configuration and *threo* and *erythro* nomenclature. Explain racemic mixture and racemisation, resolution of racemic mixture through mechanical separation, formation of diastereomers, and biochemical methods, biological significance of chirality.

CO 5 Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion. Describe the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquid state. Explain properties of liquids in terms of intermolecular attractions.

CO 6 Understand principles of titrimetric analysis. Understand principles of different type's titrations. Titration curves for all types of acids – base titrations. Gain knowledge about balancing redox equations, titration curves, theory of redox indicators and applications.

CO 7 Understand titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences. Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water.

Syllabus- Course 1(Theory): Title- Chemistry	Total Hrs: 56
Unit-I ATOMIC STRUCTURE & PERIODICITY OF ELEMENTS	**14 hrs**
Atomic Structure: Review of Rutherford's atomic model, Bohr's theory, Hydrogen atomic spectra. Derivation of radius and energy of an electron in hydrogen atom, limitations of Bohr's theory, dual behavior of matter and radiation, de Broglie's equations, Heisenberg Uncertainty principle and their related problems. Quantum mechanics. Derivation of Schrodinger's wave equation for hydrogen atom and meanings of various terms in it. Significance of ψ and ψ^2. Radial and angular wave functions (atomic orbitals) and their distribution curves for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance. Quantum numbers and their significance. Orbital shapes of *s*, *p, d and f* atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms (atomic number up to 54). Concept of exchange energy. Anomalous electronic configurations. IUPAC nomenclature of elements with atomic number greater than hundred. **(10 Lectures)** **Periodicity of elements:** Brief account on the following properties of elements with reference to s and p-block and trends in groups and periods. Effective nuclear charge, screening effect, Slater's rules, atomic and ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, Pauling/ Allred-Rochow scales**.** Numerical problems are to be solved wherever applicable. **(04 Lectures)**	
Unit-II FUNDAMENTALS OF ORGANIC CHEMISTRY & STEREOCHEMISTRY	**14 hrs**
Fundamentals of Organic Chemistry: Review of hybridization, *sigma* and *pi* bonds. IUPAC Nomenclature of poly functional organic compounds, comparative study of bond lengths, bond angles, bond energies and dihedral angles, bond polarity, dipole moment and illustration with examples of organic compounds, delocalization, electron displacement effects and their applications: inductive effect, electrometric effect, resonance effect, hyperconjugation, and steric effect. **Organic reaction Mechanism**: Definition, classification of organic reactions: substitution, addition, elimination, rearrangement, oxidation and reduction reactions with suitable examples. Use of curved arrows, types of bond fission, electrophiles, nucleophiles, nucleophilicity, nucleofugacity and basicity. Reactive intermediates: Energy profile diagrams, structure, formation and stability and reactions of carbocations, carbanions, free radicals and carbenes. **(7 Lectures)** **Stereochemistry:** **Stereoisomersim**: Definition of stereoisomerism, conformational isomers and configurational isomers (distinction between conformation and configuration). Newman, Sawhorse and Fischer projection formulae and their interconversions. **Geometrical isomerism:** Definition, reason for geometrical isomerism, E and Z notation -CIP rules and examples, determination of configuration of geometric isomers by dipole moment method and anhydride formation method, *syn* and *anti* isomers in compounds containing C=N. **Optical isomerism:** Chirality/asymmetry, enantiomerism, diastereomerism and meso compounds. R and S notations (compounds with two asymmetric centers), D and L configurations and *threo* and *erythro* nomenclature, racemic mixture and racemization, Resolution: Definition, Resolution of racemic mixture by: i) Mechanical separation ii) Formation of diastereomers iii) Biochemical methods. Biological significance of chirality. Problems are to be solved wherever applicable. **(7 Lectures)**	
Unit-III GASES & LIQUIDS	**14 hrs**

Gaseous state: Review of kinetic theory of gases, van der Waals equation of state Boyle temperature. Molecular velocity: Maxwell's Boltzmann distribution law of molecular velocities (most probable, average and root mean square velocities). Relation between RMS, average and most probable velocity and average kinetic energies (derivation not required), law of equipartition of energy. Collision frequency, collision diameter, Collision cross-section, collision number and mean free path and coefficient of viscosity, calculation of σ and η , variation of viscosity with temperature and pressure. Critical phenomena: Andrews isotherms of CO_2, critical constants and their determination Relation between critical constants and van der Waals equation (Derivation), continuity of states, law of corresponding states. Numerical problems are to be solved wherever applicable. **(7 Lectures)** **Liquid state:** Molecular forces and general properties of liquids**.** **Surface tension:** surface tension, surface energy, effect of temperature on surface tension, shapes of liquid drops and soap bubbles, capillary action, determination of surface tension by capillary rise method, drop weight and drop number methods using stalagmometer. Effect of temperature on surface tension. Parachor, Additive and constitutive properties: atomic and structural parachor. Elucidation of structure of benzene and benzoquinone. **Viscosity**: Definition, viscosity coefficient, fluidity, molecular viscosity, relative viscosity and absolute viscosity, determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces. **Refractive index**: Definition, Specific and molar refraction. Determination of refractive index using Abbe's refractometer. Additive and constitutive properties: Elucidation of structure of molecules. Numerical problems are to be solved wherever applicable. **(7 Lectures)**	
Unit-IV ANALYTICAL CHEMISTRY	**14 hrs**
Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Accuracy, precision, selectivity and sensitivity. Method validation. Types and sources of errors in analytical measurements. Presentation of experimental data and results from the point of view of significant figures. **Titrimetric analysis**: Principle, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparation and dilution of reagents/solutions using $N_1V_1 = N_2V_2$, preparation of ppm level solutions from source materials (salts). **Acid-base titrimetry**: Theory, titration curves for all types of acids – base titrations. **Redox titrimetry**: Theory, balancing redox equations, titration curves, theory of redox indicators and applications. **Precipitation titrimetry:** Theory, titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences. **Complexometric titrimetry:** Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water. Numerical problems are to be solved wherever applicable. (**14 Lectures)**	

Recommended Books/References

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
5. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
6. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
7. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.
8. Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012) Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
9. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
10. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
11. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).
2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
8. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).
11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.
12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.
14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
15. Organic Chemistry- Mehta and Mehta, 2005.

Physical Chemistry

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill, 2007.
2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa, 2004.
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi, 2009.
4. P.W. Atkins: Physical Chemistry, 2002.
5. W.J. Moore: Physical Chemistry, 1972.
6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co. 1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.
10. Physical Chemistry - G. M. Barrow, McGraw Hill, 1986.
11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House, 1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York, 1981.

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
2. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.
4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.
6. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.

B.Sc. Semester – I

Subject: Chemistry
Discipline Specific Course (DSC)

Course No.-1 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.1 (Practical): Title of the Course (Practical) **CHEMISTRY LAB: CHM P -1:**

Inorganic and Organic chemistry practicals

Course Outcome (CO):

After completion of course (Practical), students will be able to:

CO1: Understand and practice the calibration of glasswares (burette, pipette, volumetric flask).

CO2: Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standard solutions.

CO3: Explain the principles of acid-base, redox and iodometric titrations.

CO4: Work out the stoichiometric relations based on the reactions involved in the titrimetric analysis.

CO5: Based on principles of titrimetric analysis student can perform

CO6: Describe the significance of organic quantitative analysis.

CO7: Determine the amount of phenol, aniline, amide, ester and formaldehyde in a given solution by performing blank titration and main titrations.

CO8: Determine aspirin in the tablet by hydrolysis method.

List of the Experiments for 52 hrs / Semester

Inorganic chemistry experiments

Calibration of glasswares (burette, pipette, volumetric flask)

(Primary and Secondary standard solutions, normality, molarity, molality, equivalent mass).

1. Determination of sodium carbonate using standard HCl solution (Standardize HCl solution using standard sodium carbonate solution).
2. Determination of carbonate and hydroxide present together in amixture.
3. Determination of Mohr's salt and oxalic acid using standardized $KMnO_4$ solution.
4. Determination of ferrous and ferric ions in a solution using standard solution of $K_2Cr_2O_7$ by internal indicator method (diphenylamine or N- phenylanthranilic acid).
5. Determination of Magnesium using standard EDTA solution (Standardize EDTA solution using standard zinc sulphate solution).
6. Determination of iodine using sodium thiosulphate (Standardize sodium thiosulphate solution using standard potassium dichromate solution).

Organic chemistry experiments

7. Determination of phenol by bromination method
8. Determination of aniline by bromination method.
9. Determination of acetamide by hydrolysis method.
10. Determination of ethyl benzoate by hydrolysis method.
11. Determination of aspirin in the tablet by hydrolysis method.
12. Determination of amount of formaldehyde in the given solution by sodium sulphite method.

General instructions:

Standard solution is to be prepared by the students for both in regular and in practical examination.

In the practical examination, in a batch of ten students, five students each will be performing inorganic and organic experiments. At least two experiments from inorganic and two experiments from organic may be given. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the examination.*

Scheme of Practical Examination (distribution of marks):

For Internal and Semester end examination

1. Accuracy:	**12 Marks**
2. Technique and presentation :	**02Marks**
3. Reactions and Calculations:	**03 Marks**
4. Viva:	**05 Marks**
5. Journal:	**03 Marks**
Total	**25 marks**

Deduction of marks for accuracy(Inorganic and Organic Practicles) : : ±0.2 CC -12 marks, ± 0.4 CC- 09 marks, ±0.6 CC- 06 marks, ±0.8 CC- 03 marks, ±0.9 CC or above - 01 marks.

Recommended Books/References

1. Vogel's Textbook of Qualitative Chemical Analysis – J Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS, 1986
2. Inorganic Semi-micro Qualitative Analysis V. V. Ramanujam, The National Pub. Co., 1974
3. Practical Inorganic Chemistry G. Marr and B. W. Rackett, Von Nostrand Reinhold, 1972
4. Laboratory manual of Organic Chemistry Day, Sitaraman and Govindachai 1998
5. Text book of Practical Organic Chemistry, A. I. Vogel, 1996
6. A Handbook of Organic Analysis, Clarke and Hayes,1964
7. An introduction to practical Biochemistry, David Plummer,McGraw-Hill Publishing Co.,1992

B.Sc. Semester – I

Subject: Chemistry
Open Elective Course (OEC-1)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-1	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-1: Title of the Course **CHEMISTRY: CHM OEC-1 Chemistry in daily life**

Course Outcome (CO):

After completion of course, students will be able to:

CO1: Understand the chemical constituents in various day to day materials used by a common man like Tooth paste, Cosmetics, Soaps and detergents and Biomolecules .
CO2: Understand the chemical constituents and applications in Food additives, adulterants and contaminants, Artificial food colorants**.**

CO3: Understand the scientific reasons in various aspects and chemotherapy and its applications.

CO4: Understand the basic constituents and applications in polymers, surface coatings, fertilizers, insecticides and pesticides, chemical explosives etc.

Syllabus- OEC: Title- Chemistry in daily life	**Total Hrs: 42**
Unit-I	**14 hrs**
Household chemicals: Common chemicals used at home. **Tooth paste** – Contents of toothpaste, chemical name, ingredients, flavor and its role. **Cosmetics** – Contents and uses of Face powder, snow, lipsticks and perfumes. Toxic household chemicals and their effects (antifreeze, bleach, drain cleaners, carpet cleaners, ammonia, air fresheners). **Soaps and detergents-** Types of soaps, synthetic detergents (neutral, anionic and cationic), cleansing action of detergents. Advantages and disadvantages of detergents over soaps. **Biomolecules:** Composition and uses of Carbohydrates, proteins, oils and fats minerals and vitamins. Functions of enzymes and hormones in the human body.	
Unit-II	**14 hrs**
Food additives, adulterants and contaminants: Definition types and applications - Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. Flavours: Vanillin, alkyl esters (fruit flavours) and monosodium glutamate. **Artificial food colorants:** Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food. **Science behind** emotions, sunscreen, rust formation, rainbow, motion sickness, salt harvesting, crystallization of sugar and kidney stones. **Chemotherapy:** Drugs and their classification. Therapeutic action of different classes of the drugs *viz*. analgesics, antibiotics, antacids, antihistamines, antimicrobials, contraceptives, antipyretics, antiseptics and neurologically active drugs.	

Unit-III	14 hrs
Polymers: Examples of synthetic polymers and their uses (LDPE, HDPE, PVC, Polypropylene, nylon, teflon, polysiloxanes, polyphosphazenes and polybutadiene). **Surface Coatings:** Classification and brief introduction to surface coatings. Paints and pigments - formulation, composition and related properties. Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, Metallic coatings (electrolytic and electroless), metal spraying and anodizing. **Fertilizers:** Composition of fertilizers, uses of Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime. **Insecticides, weedicides and pesticides**: Examples, content and uses. **Chemical explosives:** Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.	

Recommended Books/References

1. Hawley's Condensed Chemical Dictionary by Richard J. Lewis. Call Number: REF 540.3 H31.
2. Van Nostrand's Encyclopedia of Chemistry by Glenn D. Considine, Call Number: REF 540.3 V33C 2005.
3. Macmillan Encyclopedia of Chemistry by Joseph J. Lagowski.
4. NCERT 12^{th} Standard Book and references therein.
5. Chemistry in Daily Life: Third Edition Paperback – 1 January 2012 by Singh K.

B.Sc. Semester - I

Subject: Chemistry
SKILL ENHANCEMENT COURSE (SEC)-I

Title of Paper: CHM SEC-1 Soil Analysis

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Mode of Examination	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
SEC-I	Theory + Practical	02	03hrs	30	Practical	2hr	25	25	50

Course Outcome (CO)

After completion of Skill Enhancement course, students will be able to:

CO1: Acquire skills for Laboratory management and routine analysis of Soil.

CO2: Improve working ability in analytical laboratory.

CO3: Helpful for obtaining jobs in various fields.

CO4: The student can start his own business /laboratory or can associate with any kind of laboratory or associated jobs with confidence.

List of the Experiments for 52 hrs / Semesters (Theory and Practical= 3Hours/Week)

Theory

1. Introduction: Definition of soil, concept of lithosphere, soil as a natural body.
   Soil Components: Air, Water, inorganic and organic solids. Formation of Soil, Types of soils & basic concepts.
2. Physical properties of Soil: Soil separates, texture, aggregation and structure, temperature and colour. Properties of soil mixture, pore space, bulk density, particle density, aeration and drainage, compaction, surface area, soil water relationships.
3. Chemical Properties of soil: Morphology of colloids, chemistry of clays, ionic exchange, acidity, alkalinity, pH, salinity, reactions in liming and acidification.
4. Biological Properties: Soil organic matter, C: N relationships, nitrogen-transformation, soil organisms, sulfur transformation.
5. Fertility of soil. Soil deficiency with respect to macro and micro nutrient components, brief study of micronutrient & macronutrient sources & importance

Practical

6. Visit to soil testing laboratory & report writing. Visit to farmers fields for collection of different types of soil samples.
7. Determination of pH and electrical conductivity of different types of soil samples
8. Determination of alkalinity and salinity of the soil sample and determination of total organic matter in the given soil Sample.
9. Determination of Ca (II) and Mg(II) ions from soil sample
10. Determination of Fe (II) and Fe (III) ions from soil sample.
11. Determination of Na and K from soil sample by flame photometry.

General instructions:

In the practical examination, in a batch of ten students, minimum three sets of experiments may be given. Selection of experiment may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the examination*

Scheme of Practical Examination (distribution of marks)

For internal and Semester end examination

1. **Three questions on the theory may be given.**
   Student has to answer any two questions: 06 Marks
2. **Accuracy in the practical : 08 Marks**
3. **Reactions and Calculations: 03 Marks**
4. **Viva: 05 Marks**
5. **Journal: 03 Marks**

Total 25 marks

Deduction of marks for accuracy: : ±0.2 CC -08 marks, ± 0.4 CC- 06 marks, ±0.6 CC- 04 marks, ±0.8 CC- 02 marks, ±0.9 CC or above - 01 marks.

Recommended Books/References

1. Laboratory manual for Environmental Chemistry: Sunita Hooda and Sumanjeet Kaur by S. Chand & Company 1999.
2. Soils and soil fertility, Troch, F.R. And Thompson, L.M. Oxford Press.
3. Fundamentals of soil science, Foth, H.D. Wiley Books.
4. Soil Science and Management, Plaster, Edward J., Delmar Publishers.
5. Principles of Soil Chemistry (2Wed.) Marcel Dekker Inc., New York.
6. Handbook of Agricultural Sciences, S.S. Singh, P. Gupta, A. K. Gupta, Kalyani Publication.
7. Introduction to soil laboratory manual - J. J. Harsett Stipes.
8. Introduction to soil science laboratory manual, Palmer and troch – Iowa State.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme: 2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – II

Subject: Chemistry
Discipline Specific Course (DSC)

The course Chemistry in I semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-2 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.2 (Theory): Title of the Course (Theory) **CHEMISTRY: CHM T-2**

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO1: Explain ionic bond, Born Lande equation ,Born Haber cycle and Fajan's rules. State VSEPR theory, hybridisation and shapes of various molecules. Understand the concept of resonance and write resonating structures of NO_3^-, CO_3^{2-} and SO_4^{2-}.

CO2: Explain MO Theory and draw the MO diagrams for homonuclear diatomic molecules and ions of 1^{st} and 2^{nd} periods and heteronuclear diatomic molecules such as CO, NO and NO^+. Compare MO and VB theory.

CO3: Learn preparation and reactions of alkanes, alkenes and alkynes. Clear the concept learning mechanism of Free radical mechanism of halogenations of alkanes. Understand the mechanisms of addition reactions of alkenes and alkynes.

CO4: Learn the concept of polymerization, ozonolysis in alkenes and alkynes. Learn acidity of alkynes, formation of metal acetylides and their applications. Explain cycloalkanes and their relative stability. Explain conformational analysis of cyclohexane with Karplus energy diagram. Axial and equatorial bonds. Relative stability of mono substituted cycloalkanes.

CO5: Expected to learn symmetry elements, unit cells, crystal systems. Learn Bravais lattice, types and identification of lattice planes. Explain laws of crystallography - law of constancy of interfacial angles, law of rational indices.

CO6: Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Explain defects in crystals. Learn the applications of liquid crystals. Learn the concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates.

CO7: Understand the concept of order and molecularity of a reaction and their applications. Define half–life of a reaction. Explain methods for determination of order of a reaction by half life period and differential equation method. Understand the concept of activation energy and its calculation from Arrhenius equation. Explain theories of reaction rates: Collision theory and activated complex theory of bimolecular reactions.

CO8: Learn principles of gravimetric analysis. Learn the precipitation, mechanism of precipitation, factors influencing precipitation, co-precipitation and post-precipitation. Learn structure, specificity, conditions and applications of organic reagents. Advantages of organic reagents over inorganic reagents.

CO9: Learn about quality of surface water, ground water. Impurities in water, standards of water quality (color, pH, hardness, TDS, sulphate, fluoride, chloride) for potable, domestic, industrial and agricultural purpose. Learn Water treatment technologies – house hold water treatment, municipal water treatment, industrial treatment (primary and secondary treatment of industrial effluent), softening of water, and disinfection of water. Determinations of DO, BOD and COD, and their significance.

Syllabus- Course 2(Theory): Title- CHEMISTRY: CHM T-2	**Total Hrs: 56**
Unit-I CHEMICAL BONDING & MOLECULAR STRUCTURE	**14 hrs**
Ionic Bonding: General characteristics of ionic compounds. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Landé equation and calculation of lattice energy. Born-Haber cycle and its applications. **Polarizing power and polarizability**: Fajan's rules, ionic character in covalent compounds and percentage of ionic character. **Covalent bonding:** General characteristics of covalent compounds. VB approach, shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures of NO_3^-, CO_3^{2-} and SO_4^{2-}. **Molecular Orbital Theory:** LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules and ions of 1^{st} and 2^{nd} periods and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches. Numerical problems are to be solved wherever applicable.	
Unit-II ALIPHATIC HYDROCARBONS	**14 hrs**
Alkanes: Methods of preparation by catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis and from Grignard reagent. Free radical mechanism of halogenations, relative reactivity and selectivity of halogenation. Conformational analysis of ethane and butane. **Alkenes**: Methods of preparation by dehydration of alcohols and dehydrohalogenation of alkyl halides. Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. *cis* Alkenes by partial catalytic hydrogenation and *trans* alkenes by Birch reduction. Reactions: Addition of HX (Markownikov's and anti-	

Markownikov's addition) Stereospecificity of halogen addition, regioselectivity and relative rates of addition reaction. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes. Oxidative cleavage of alkenes with $KMnO_4$. Ozonolysis, mechanism of ozonolysis in propene and polymerization. **Alkadienes:** Classification, mechanism of addition of halogen and hydrogen halides in 1,3-diene, kinetically and thermodynamically controlled addition of HBr to 1,3-butadiene, polymerization and Diels-Alder reaction. **Alkynes:** Preparation: Acetylene from CaC_2 and conversion into higher alkynes by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: Acidity of 1-alkynes and formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. **(11 Lectures)** **Cycloalkanes:** Types of cycloalkanes and their relative stability. Baeyer strain theory and theory of strainless rings. Conformational analysis of cyclohexane with Karplus energy diagram. Axial and equatorial bonds. Relative stability of mono substituted cyclohexanes. **(3 Lectures)**	
Unit-III SOLIDS & CHEMICAL KINETICS	**14 hrs**
Solids: Types of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X-Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl. Defects in crystals. Liquid Crystals: Explanation, classification with examples- Smetic, nematic, cholesteric, disc shaped and polymeric. Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing. Numerical problems are to be solved wherever applicable. **(7 Lectures)** **Chemical Kinetics:** Review of reaction rates, order and molecularity. Factors affecting rates of reaction: concentration pressure, temperature, catalyst, etc. Examples for different orders of reactions. Derivation of integrated rate equations for zero and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction (numerical problems). Methods for determination of order of a reaction by half life period and differential equation method. Effect of temperature on reaction rates, temperature coefficient, Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Numerical problems are to be solved wherever required. **(7 Lectures)**	
Unit-IV ANALYTICAL CHEMISTRY	**14 hrs**
Gravimetric Analysis: Stages in gravimetric analysis, requisites of precipitation, theories of precipitation, factors influencing precipitation, co-precipitation and post-precipitation. Structure, specificity, conditions and applications of organic reagents such as salcylaldoxime, oxine, dimethyl glyoxime, cupron and cupferron in inorganic analysis. Advantages of organic reagents over inorganic reagents. **(6 Lectures)** **Water analysis:** Water availability, requirement of water. Quality of surface water and ground water. Impurities in water. Standards of water quality for potable, domestic, industrial and agricultural purpose (color, pH, alkalinity, hardness, TDS, sulphate, fluoride, chloride etc.) Water treatment technologies – house hold water treatment, municipal water treatment and industrial treatment (primary and secondary treatment of industrial effluent). Softening of water. Disinfection of water. Definition and determinations of DO, BOD and COD, and their significance. Numerical problems are to be solved wherever required. **(8 Lectures)**	

Recommended Books/References

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
5. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
6. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
7. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.
8. Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012) Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
9. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
10. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
11. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).
2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
8. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).
11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.
12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.
14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
15. Organic Chemistry- Mehta and Mehta, 2005.

Physical Chemistry

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill, 2007.
2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa, 2004.
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi, 2009.
4. P.W. Atkins: Physical Chemistry, 2002.
5. W.J. Moore: Physical Chemistry, 1972.
6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co. 1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.
10. Physical Chemistry - G. M. Barrow, McGraw Hill, 1986.

11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House, 1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York, 1981.

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
2. Environmental Chemistry-A K De
3. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.
4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.

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B.Sc. Semester – II

Subject: Chemistry
Discipline Specific Course (DSC)

Course No.-2 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.2 (Practical): Title of the Course (Practical)

CHEMISTRY LAB CHM P- 2 :Analytical and Physical chemistry practicales

Course Outcome (CO)

After completion of course (Practical), students will be able to:

CO1: Learn regarding errors, types of errors, accuracy, precision, significant figures and standard deviation. To determine the total alkalinity in antacids, Vitamin C in lemon juice/formulations. To determine free alkali present in different soaps/detergents. Learn analysis of DO in waste water sample.

CO2: To determine Chemical Oxygen Demand (COD) in waste water sample.

CO3: To determine temporary, permanent and total hardness of water by collecting different samples of water.

CO4: Enable to understand the applications of experiments like methods of determination of viscosity, surface tension, refractive index.

List of the Experiments for 52 hrs / Semesters

Analytical chemistry experiments

Explanation regarding errors, types of errors, accuracy, precision, significant figures and standard deviation (students should write in the journal regarding the above).

1. Determination of total alkalinity in antacids.
2. Determination of Vitamin C in lemon juice/formulations.
3. Determination of free alkali present in different soaps/detergents.
4. Analysis of DO in waste water sample / pond water / river water etc.
5. Determination of Chemical Oxygen Demand (COD) in waste water sample.
6. Determination of temporary, permanent and total hardness of water using standard EDTA solution
7. Determination of Ni (II) using DMG by gravimetric method.

Physical chemistry experiments

1. Determination of surface tension and parachor of alcohol series.
2. Determination of surface tension of soap solutions for various concentrations.
3. Determination of the viscosity of liquids (ethylacetate & ethyl alcohol /toluene, & chlorobenzene or any other two non hazardous liquids) using Ostwald's viscometer.
4. Study of the variation of viscosity of sucrose solution with different concentrations.
5. Determination of specific and molar refraction by Abbes refractometer (ethyl acetate, methyl acetate, ethylene chloride)
6. Determination of the composition of liquid mixture by refractometry (toluene & alcohol, water & sucrose solution).

General instructions:

In the practical examination, in a batch of ten students, five students each will be performing analytical and physical experiments. At least two experiments from analytical and two experiments from physical may be given. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. *Manual is not allowed in the examination.*

Scheme of Practical Examination (distribution of marks):

For Internal and Semester end examination

For Analytical chemistry practicals

1. Accuracy:	**12 Marks**
2. Technique and presentation :	**02Marks**
3. Reactions and Calculations:	**03 Marks**
4. Viva:	**05 Marks**
5. Journal:	**03 Marks**
Total	**25 marks**

Deduction of marks for accuracy: : ±0.2 CC -12 marks, ± 0.4 CC- 09 marks, ±0.6 CC- 06 marks, ±0.8 CC- 03 marks, ±0.9 CC or above - 01 marks.

For Physical chemistry practicals

1. Accuracy:	**12 Marks**
2. Graphs and Calculations:	**05 Marks**
3. Viva:	**05 Marks**
4. Journal:	**03 Marks**
Total	**25 marks**

Deduction of marks for accuracy: Error up to 5% - 12 marks, 6 - 10% 09 marks, 11-15% 6 marks, 16 or above 3 marks.

Recommended Books/References

1. Findlay 's practical physical chemistry revised by levitt, Longman's, London, 1968
2. Experiments in Physical Chemistry, Shoemaker and Garland, McGraw Hill International, 1996
3. Colorimetric Determination of Traces of metals B. Sandell
4. Analytical Chemistry G. D. Christian, 4th ed., Wiley, 1986

B.Sc. Semester – II

Subject: Chemistry
Open Elective Course (OEC-2)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-2	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-2: Title of the Course: **CHEMISTRY: CHM OEC-2 Molecules of Life**

Course Outcome (CO)

After completion of course, students will be able to:

CO1: Acquire knowledge about different types of sugars and their chemical structures. Identify different types of amino acids and determine the structure of peptides.

CO2: Explain the actions of enzymes in our body and interpret enzyme inhibition. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism. Differentiate RNA and DNA and their replication. Explain production of energy in our body.

Syllabus- OEC: Title- CHEMISTRY: CHM OEC-2 Molecules of Life	**Total Hrs: 42**
Unit-I	**14 hrs**
Carbohydrates: Sugars, non sugars, reducing and non-reducing sugars. Occurrence and general properties of glucose and fructose. Open chain and Haworth ring structures of glucose and fructose. Epimers, mutarotation and anomers. Disaccaharides: Occurance of disaacharides (Sucrose, Maltose and Lactose). Glycosidic linkage in disaccharides. Ring structures of sucrose, maltose and lactose. Polysaccharides: Starch – monomer units, glycosidic linkage, components-difference in their structure (explanation only) and solubility in water. Cellulose and glycogen– monosaccharide, glycosidic linkage, structure (explanation only). Biological importance of carbohydrates. **(8 Lecturers)** **Amino Acids, Peptides and Proteins :**α- amino acids , general formula, zwitter ion form of α- amino acid, general formula. Isoelectric point and its importance. Classification of amino acids as essential and non-essential- examples. Configuration of optically active α-amino acids (found in proteins). Peptide bond. Proteins: classification based molecular shape –fibrous and globular, examples. Structure of protein – qualitative idea about primary, secondary, tertiary, and quaternary structures (diagrams not required). Denaturation of protein. **(6 lectures)**	

Unit-II	14 hrs
Enzymes and correlation with drug action: Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Noncompetitive inhibition including allosteric inhibition). **(6 lectures)** **Drug action**- Receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH_2 group, double bond and aromatic ring. **(3 lectures)** **Oils and fats** Biological Importance of oils and fats. Fatty acids (saturated, unsaturated fatty acids, formation of triglycerides and general formula of triglycerides. Chemical nature of oils and fats-saponification, acid hydrolysis, rancidity and its prevention methods, refining of oils, hydrogenation of oils, drying of oils. Iodine value. Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol). **(5 lecturers)**	
Unit-III	**14 hrs**
Nucleic Acids : Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation. **(8 lectures)** **Vitamins and Hormones:** Classification and biological significance, source and structure of Vitamin A, B1 (thiamine), B2 (riboflavin), B6 (pyridoxine), α-tocopherol, K1 (phylloquinone), C (ascorbic acid). Deficiency diseases of vitamins. **Hormones:** definition, classification with examples, functions and deficiency diseases of hormones. **(6 lectures)**	

Recommended Books/References

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed.,
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, 2002.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

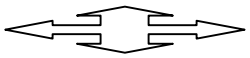
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



KARNATAK UNIVERSITY, DHARWAD

B. Sc. CHEMISTRY SEMESTER I

Name of College: **Code No. :**

Key to distribution format for practical Examinations (Inorganic Chemistry and Organic Chemistry)

Month and Year: **Date:** **Time:** **Batch No. :**

TABLE No.	Exam. Reg. No.	Vol. of solution / amount of substance given	Expected result (B. R / amount)	Found result (B. R / amount)	Difference or % of error	Marks for Accuracy (Max. 12)	Marks for Reactn. and calctn. (Max. 3)	Marks for Tech. and Presnt. (Max. 2)	Marks for Journal (Max. 3)	Marks for Viva (Max. 5)	Total (Max. 25)

Name and Signature of internal Examiner

Name and Signature of External examiner

KARNATAK UNIVERSITY, DHARWAD

B. Sc. CHEMISTRY SEMESTER II

Name of College: **Code No. :**

Key to distribution format for practical Examinations (Analytical Chemistry and Physical Chemistry)

Month and Year: **Date:** **Time:** **Batch No. :**

TABLE No.	Exam. Reg. No.	Vol. of solution / experiment given	Expected result (B. R / values)	Found result (B. R / values)	Difference or % of error	Marks for Accuracy (Max. 12)	Marks for Reactn. and calculations (Max. 5)	Marks for Tech. and Presnt. (Max. 5)	Marks for Journal (Max. 5)	Marks for Viva (Max. 5)	Total (Max. 35)

Name and Signature of internal Examiner

Name and Signature of External examiner

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

Tele: 0836-2215224
e-mail: academic.st@kud.ac.in
Pavate Nagar,Dharwad-580003
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ – 580003

NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಿಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಬಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

Practical Subject

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. (Hons.) Program

***

SYLLABUS

Subject: ZOOLOGY

[Effective from 2021-22]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,

OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and

SKILL ENHANCEMENT COURSE (SEC) FOR SEM I

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in Zoology for B.Sc. (Hons.)

Effective from 2021-22

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	DSCC 1	Theory	04hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-1	Theory	03 hrs	42	02 hrs	40	60	100	03
	*SEC-1	Practical	03 hrs	30	02 hrs	25	25	50	02
II	DSCC2	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-2	Theory	03 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

*** Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected**

Name of Course (Subject): ZOOLOGY

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in Zoology students will be able to:

PS0 1:

1.The structure and functions ofanimal cell, cell organelles, cell- cell interactions, process of reproduction leading to new organisms.

2.The principles of inheritance,Mendel's laws and the deviations.Inheritance of chromosomal aberrations inhumans by pedigree analysisin families.

3.Acquaint the knowledge about basic procedure and methodology of integrated animal rearing.Students can start their own business i.e. self employments.

4.To get employment in different sectors of Applied Zoology.

PSO 2: .

1. In depth understanding of structure of biomolecules like proteins, lipids and carbohydrates.
2. The thermodynamics of enzyme catalyzed reactions.
3.To know various physiological processes of animals.

B.Sc. Semester – I

Subject: ZOOLOGY
Discipline Specific Course (DSC)

The course Zoology in I semester has two papers (Theory Paper –I for 04 credits & Practical Paper -II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-1 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.1 (Theory): Title of the Course (Theory): **Cytology, Genetics and Infectious Diseases**

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1 :The structure and function of the cell organelles.
CO 2 : The chromatin structure and its location.
CO 3 :The basic principle of life, how a cell divides leading to the growth of an Organism and also reproduces to form a new organisms.
CO 4: How a cell communicates with its neighboring cells.
CO 5: The principles of inheritance, Mendel's laws and the deviations.
CO 6: How environment plays an important role by interacting with genetic factors.
CO 7: Detect chromosomal aberrations in humans and study of pedigree analysis.

Syllabus- Course 1(Theory): Title- Cytology, Genetics and Infectious Diseases	**Total Hrs: 56**
Unit-I Structure and Function of Cell Organelles I in Animal cell	**14 hrs**
Plasma membrane: chemical structure—lipids and proteins Endomembrane system: protein targeting and sorting, transport, endocytosis and exocytosis Cytoskeleton: microtubules, microfilaments, intermediate filaments, Mitochondria: Structure, oxidative phosphorylation; electron transport system, Peroxisome and Ribosome: structure and function.	
Unit-II Nucleus, Chromatin Structure, Cellcycle,Cell Division and Cell Signaling	**14 hrs**
Structure and function of nucleus in eukaryotes,Chemical structure and base composition of DNA and RNA DNA supercoiling, chromatin organization, structure of chromosomes,Types of DNA and RNA , Cell division: mitosis and meiosis Introduction to Cell cycle and its regulation, apoptosis,Signal Transduction: intracellular 11 signaling and cell surface receptors, via G-protein linked receptors Cell-cell interaction: cell adhesion molecules, cellular junctions.	

Unit-III Mendelism, Sex Determination, Extensions of Mendelism, Genes and Environment	**14 hrs**
Basic principles of heredity: Mendel's laws- monohybrid cross and hybrid cross,Complete and Incomplete Dominance,Penetrance and expressivity,Genetic Sex-Determining Systems, Environmental Sex Determination, Sex Determination and mechanism in *Drosophila melanogaster.* Sex-linked characteristics in humans and dosage compensation Extensions of Mendelism: Multiple Alleles, Gene Interaction.The Interaction Between Sex and Heredity: Sex-Influenced and Sex-Limited Characteristics Cytoplasmic Inheritance, Genetic Maternal Effects.Interaction between Genes and Environment: Environmental Effects on Gene Expression, Inheritance of Continuous Characteristics.	
Unit IV Human Chromosomes, Patterns of Inheritance and Infectious Diseases	**14 hrs**
Patterns of inheritance: autosomal dominance, autosomal recessive, X-linked recessive, X-linked dominant. Chromosomal anomalies: Structural and numerical aberrations with examples. Human karyotyping and Pedigree analysis Introduction to pathogenic organisms: viruses, bacteria, fungi, protozoa and Worms. Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of common parasites: *Trypanosoma,Giardia and Wuchereria.*	

Books recommended.

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA(2004).
2. Alberts et al: Molecular Biology of the Cell: Garland(2002).
3. Cooper: Cell: A Molecular Approach: ASM Press(2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman(2004).
5. Lewin B. Genes VIII. Pearson (2004).
6. Watson et al. Molecular Biology of the Gene. Pearson(2004).
7. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby Immunology. W H Freeman (2007).
8. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. Roitt's Essential Immunology, 13th Edition. Wiley Blackwell(2017).
9. Principles of Genetics by B. D. Singh
10. Cell-Biology by C. B. Pawar, Kalyani Publications
11. Economic Zoology by Shukla and Upadhyaya

B.Sc. Semester – I

Subject: ZOOLOGY
Discipline Specific Course (DSC)

Course No.-1 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.1 (Practical): Title of the Course (Practical): **Cytology, Genetics and Infectious Diseases**

Course Outcome (CO):

After completion of course (Practical), students will be able to:

CO 1:To use simple and compound microscopes.
CO 2:To prepare stained slides to observe the cell organelles.
CO 3:To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.
CO 4:The chromosomal aberrations by preparing karyotypes.
CO 5;How chromosomal aberrations are inherited in humans by pedigree analysis in families. The antigen-antibody reaction.

List of the Experiments for 52 hrs / Semesters

1. Understanding of simple and compound microscopes.
2. To study different cell types such as buccal epithelial cells, neurons, striated muscle cells using 3. Methylene blue/any suitable stain (virtual/ slaughtered tissue).
3. To study the different stages of Mitosis in root tip of *Allium cepa*.
4. To study the different stages of Meiosis in grasshopper testis (virtual).
5. To check the permeability of cells using salt solution of different concentrations.
6. Study of parasites in humans (e.g. Protozoans, Helminthes in compliance with examples beingstudied in theory) permanent microslides.
7. To learn the procedures of preparation of temporary and permanent stained slides, with available mounting material.
8. Study of mutant phenotypes of *Drosophila* sp. (from Cultures or Photographs).
9. Preparation of polytene chromosomes (Chironomus larva or Drosophila larva).
10. Preparation of human karyotype and study the chromosomal structural and numerical aberrations from the pictures provided. (Virtual/optional).
11. To prepare family pedigrees.
12. https://www.vlab.co.in
13. https://zoologysan.blogspot.com
14. www.vlab.iitb.ac.in/vlab
15. www.onlinelabs.in
16. www.powershow.com

https://vlab.amrita.eduhttps://sites.dartmouth.edu/

General instructions:

1.Perform all the experiments as per the instructions in each questions.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. **Major Experiments** **08 Marks**
2. **Minor Experiments** **05 Marks**
3. **Identifications (A-C)** **06 Marks**
4. **Viva** **03 Marks**
5. **Journal** **03 Marks**

Total 25 marks

Note: Same Scheme may be used for IA(Formative Assessment) examination

B.Sc. Semester – I

Subject: ZOOLOGY
Open Elective Course (OEC-1)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-1	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-1: Title of the Course: Economic Zoology

Course Outcome (CO):

After completion of course, students will be able to:

CO 1: Gain knowledge about silkworms rearing and their products.
CO 2 :Gain knowledge in Bee keeping equipment and apiary management.
CO 3: Acquaint knowledge on dairy animal management, the breeds and diseases of cattle and learn the testing of egg and milk quality.
CO 4:Acquaint knowledge about the culture techniques of fish and poultry.
CO 5:Acquaint the knowledge about basic procedure and methodology of vermiculture.
CO 6:Learn various concepts of lac cultivation.
CO 7:Students can start their own business i.e. self-employments.
CO 8:Get employment in different applied sectors

Syllabus- OEC: Title- Economic Zoology	**Total Hrs: 42**
Unit-I Sericulture, Apiculture and Aquaculture	**14 hrs**
History and present status of sericulture in India,Mulberry and non-mulberry species in Karnataka and India,Mulberry cultivation,Morphology and life cycle of *Bombyxmori*,Silkworm rearing techniques: Processing of cocoon, reeling,Silkworm diseases and pest control Introduction and present status of apiculture,Species of honey bees in India, life cycle of *Apisindica,*Colony organization, division of labour and communication, Bee keeping as an agro based industry; methods and equipments: indigenous methods, extraction appliances, extraction of honey from the comb and processing,Bee pasturage, honey and bees wax and their uses,Pests and diseases of bees and their management Aquaculture in India: An overview and present status and scope of aquaculture, Types of	

aquaculture: Pond culture: Construction, maintenance and management; carp culture, shrimp culture, shellfish culture, composite fish culture and pearl culture	
Unit-II Live Stock Management: Dairy, Poultry. And Vermiculture	**14 hrs**
Introduction to common dairy animals and techniques of dairy management**,**Types, loose housing system and conventional barn system; advantages and limitations of dairy farming**,**Establishment of dairy farm and choosing suitable dairy animals-cattle**,**Cattle feeds, milk and milk products**,**Cattle diseases Types of breeds and their rearing methods,Feed formulations for chicks,Nutritive value of egg and meat,Disease of poultry and control measures Scope of vermiculture.Types of earthworms.Habit categories - epigeic, endogeic and anecic; indigenous and exotic species.Methodology of vermicomposting:containers for culturing, raw materials, required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of vermicompost,Advantages of vermicomposting.,Diseases and pests of earthworms.	
Unit-III Fish culture, Prawn culture and Lac Culture	**14 hrs**
Common fishes used for culture.Fishing crafts and gears.Ornamental fish culture: Fresh water ornamental fishes- biology, breeding techniques,Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality. control of snail and algal growth.Modern techniques of fish seed production. Culture of fresh and marine water prawns.Preparation of farm.Preservation and processing of prawn, export of prawn. History of lac and its organization, lac production in India.Life cycle, host plants and strains of lac insect.Lac cultivation: Local practice, improved practice,	

propagation of lac insect, inoculation period, harvesting of lac.Lac composition, processing, products, uses and their pests.	

Books recommended.

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk
5. Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping, Kindle Edition.
7. Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
8. YadavManju (2003). Economic Zoology, Discovery Publishing House.
9. JabdePradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
10. Cherian &Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
11. Sathe, T.V. Vermiculture and Organic farming.
12. Bard. J (1986). Handbook of Tropical Aquaculture.
13. Santhanam, R. A. Manual of Aquaculture.
14. Zuka. R.1 and Hamiyn (1971). Aquarium fishes and plants
15. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.
16. Animal Disease- Bairagi K. N. Anmol Publications Pvt.Ltd 2014
17. Economics Of Aquaculture - Singh(R.K.P) - Danika Publishing Company 2003
18. Applied and Economic Zoology (SWAYAM) web https://swayam.gov.in/nd2_cec20_ge23/preview

B.Sc. Semester - I

Subject: ZOOLOGY

SKILL ENHANCEMENT COURSE (SEC)-I

Title of Paper : VERMICULTURE

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Mode of Examination	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
SEC-I	Theory + Practical	02	03hrs	30	Practical	2hr	25	25	50

Course Outcome (CO):

After completion of Skill Enhancement course, students will be able to:

CO 1 :Understands the importance of earthworms in maintaining soil quality.

CO 2:Learns that the vermicomposting is an effective organic solid waste management method.

CO 3:Gets acquainted with the importance of earthworms in agro-based economic activity.

CO 4:Vermicomposting leads to organic farming and healthy food production.

CO 5:Vermicomposting may be taken up as a small scale industry by the farmers and unemployed youth.

CO 6:Get jobs in teaching institutions or vermiculture units as technicians.

CO 7:Learn the concept of vermicomposting as bio fertilizers thus student can become an entrepreneur after completion of the course.

CO 8:Best opportunity for self-employment and lifelong learning with farmers.

List of the Experiments for 52 hrs / Semesters

1. **INSTRUCTIONS FOR ALL THE EXPERIMENTS :** Biology and life cycle of earthworm, Types of earthworms. Establishment of vermiculture unit, Preparation of bed, inoculation , composting process, harvesting of vermicompost and worms, Economic importance of vermicompost, vermiwash, vermi-protein. Natural enemies of earthworms and their control measures

2.Visit to vermiculture farm to acquaint latest field techniques

3.Collection of native earthworm species to study habit and habitat.

4.Keys to identify different species of earthworms

5.Study of vermicomposting equipment and devices.

6.Preparation of vermibeds and their maintenance

7. Study of different vermicomposting methods.

8.Harvesting of compost and separation of worms,

9. Establishment of vermiwash unit,

10.Packaging, transport and storage of varmicompost.

11. Worm meal preparation, preservation and packing

12. Physico-chemical and estimation of vermicompost , vermiwash and vermi protein

General instructions:Perform all the experiments as per the instructions in each questions.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. **Major Experiments** **08 Marks**
2. **Minor Experiments** **05 Marks**
3. **Identifications (A-C)** **06 Marks**
4. **Viva** **03 Marks**
5. **Journal** **03 Marks**

Total 25 marks

Note: Same Scheme may be used for IA(Formative Assessment) examination

Books recommended.

1. Bhatt J.V. &S.R. Khambata (1959)-Role ofEarthworms in Agriculture ▫Indian Council of Agricultural Research, New Delhi
2. Edwards, C.A. and J.R. Lofty(1977) -BiologyofEarthworms▫ Chapmanand Hall Ltd.,London.
3. Lee, K.E. (1985) -Earthworms:Their ecologyand Relationship with Soilsand Land Use▫Academic Press, Sydney.
4. Dash,M.C.,B.K.Senapati,P.C.Mishra(1980)—VermsandVermicomposting▫ Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, JyotiVihar, Orissa.
5. Kevin,AandK.E.Lee(1989)—EarthwormforGardenersandFisherman▫ (CSIRO,Australia, Division ofSoils)
6. Satchel, J.E. (1983)-Earthworm Ecology▫Chapman Hall,London.
7. Wallwork, J.A. (1983)-EarthwormBiology‖Edward Arnold(Publishers)Ltd. London

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22
GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

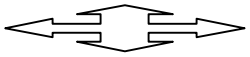
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



B.Sc. Semester – II

Subject: ZOOLOGY
Discipline Specific Course (DSC)

The course Zoology in I semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-2 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.2 (Theory): Title of the Course (Theory) **:** Biochemistry and Physiology

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1:To develop a deep understanding of structure of biomolecules like proteins, lipids and carbohydrates.
CO 2:How simple molecules together form complex macromolecules.
CO 3:To understand the thermodynamics of enzyme catalyzed reactions.
CO 4:Mechanisms of energy production at cellular and molecular levels.
CO 5:To understand various functional components of an organism.
CO 6:To explore the complex network of these functional components.
CO 7:To comprehend the regulatory mechanisms for maintenance of function in the body.

Syllabus- Course 2(Theory): Title- Biochemistry and Physiology	**Total Hrs: 56**
Unit-I Structure, Function of Biomolecules,Enzyme Action and Regulation	**14 hrs**
Nomenclature and classification of enzymes; Cofactors; pecificity of enzyme action.Structure and Biological importance of carbohydrates (Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates). Lipids (saturated and unsaturated Fatty acids, Tri-acylglycerols, Phospho lipids, Glycolipids and Steroids)Structure, Classification and General Properties of a-amino acids; Essential and non-essential amino acids, Levels of organization in proteins; Simple and conjugate proteins. Isozymes; Mechanism of enzyme action**,**Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions ; Equation of Michaela's – Mendon, Concept of Km and V max, Enzyme inhibition**,**Allosteric enzymes and their kinetics; Regulation of enzyme action.	

Unit-II Metabolism of Carbohydrates, Lipids Metabolism, Proteins and Nucleotides	**14 hrs**
Metabolism of Carbohydrates: glycolysis, citricacid cycle, gluconeogenesis, phosphate pentose pathway Glycogenolysis and Glycogenesis Lipids- Biosynthesis of palmiticacid; Ketogenesis,β-oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbonatoms Catabolism of amino acids: Transamination, Deamination, Ureacycle, Nucleotides and vitamins**,**Peptide linkages**.**	
Unit-III Digestion, Respiration, Circulation and Excretion in humans	**14 hrs**
Structural organization and functions of gastrointestinal tract and associated glands.Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Physiology of trachea and Lung. Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood, Respiratory pigments, Dissociation curves and the factors influencing it;Control of respiration. Components of blood and their functions; hemopoiesis**,**Blood clotting: Blood clotting system, Blood groups: Rh-factor, ABO and MN**,**Structure of mammalian heart**,**Cardiac cycle; Cardiac output and its regulation,Electrocardiogram, Blood pressure and its regulation,Structure of kidney and its functional unit; Mechanism of urine formation.	
Unit-IV Nervous System,Endocrinology and Muscular System in humans	**14 hrs**
Structure of neuron, resting membrane potential(RMP)**,**Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers. Types of synapse Endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas and adrenal; hormones secreted by them.Classification of hormones; Mechanism of Hormone action. Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus	

Books recommended.

I. Nelson & Cox: Leininger's Principles of Biochemistry: McMillan (2000)

2. Zubay et al: Principles of Biochemistry: WCB (1995)

3. Voet&Voet: Biochemistry Vols l & 2: Wiley (2004)

4. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press

5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, Xl Edition, Hercourt Asia PTE Ltd. /W.B.Saunders Company. (2006).

6. Tortora, G.J. &Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).

7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).

8. Hill, Richard W., et al. Anima l physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).

9. Chatterjee CC Human Physiology Volume l & 2, 11th edition, CBS Publishers (20 I 6).

B.Sc. Semester – II

Subject: ZOOLOGY
Discipline Specific Course (DSC)

Course No.-2 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.2 (Practical): Title of the Course (Practical) : Biochemistry and Physiology

Course Outcome (CO):

After completion of course (Practical), students will be able to:

CO 1:At the end of the course the student should be able to understand Basic structure of biomolecules through model making.

CO 2:Develop the skills to identify different types of blood cells.

CO 3:Enhance basic laboratory skill like keen observation, analysis and discussion. Learn the functional attributes of biomolecules in animal body.

CO 4:Know uniqueness of enzymes in animal body and their importance through enzyme kinetics.

List of the Experiments for 52 hrs / Semesters

1. Preparation of models of nitrogenous bases- nucleosides and nucleotides.
2. Preparation of models of amino acids and dipeptides.
3. Preparation of models of DNA and RNA.
4. Qualitative analysis of Carbohydrates, Proteins and Lipids.
5. Qualitative analysis of Nitrogenous wastes – Ammonia, Urea and Uric acid.
6. Separation of amino acids or proteins by paper chromatography.
7. Determination of the activity of enzyme (Urease)-Effect of [S] and determination of Km and Vmax.
8. Determination of the activity of enzyme (Urease) - Effect of temperature and time.
9. Action of salivary amylase under optimumconditions.
10. Quantitative estimation of Oxygen consumption by fresh water Crab.
11. Quantitative estimation of salt gain and salt loss by fresh water.
12. Estimation of Hemoglobin in human blood using Sahli'shaemoglobinometer.
13. Counting of RBC in blood using Hemocytometer.
14. Counting of WBC in blood using Hemocytometer.
15. Differential staining of human blood corpuscles using Leishman stain.
16. Recording of blood glucose level by using glucometer.

Virtual Labs (Suggestive sites)

https://www.vlab.co.in
https://zoologysan.blogspot.com www.vlab.iitb.ac.in/vlab
www.onlinelabs.inwww.powershow.com https://vlab.amrita.edu
https://sites.dartmouth.edu

General instructions:

1. Perform all the experiments as per the instructions in each questions.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination.

1. **Major Experiments** **08 Marks**
2. **Minor Experiments** **05 Marks**
3. **Identifications (A-C)** **06 Marks**
4. **Viva** **03 Marks**
5. **Journal** **03 Marks**

Total 25 marks

Note: Same Scheme may be used for IA(Formative Assessment) examination

Books recommended.

1. Nelson & Cox: Leininger‘s Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet&Voet: Biochemistry Vols l & 2: Wiley (2004)
4. Murray et al: Harper‘s Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, Xl Edition, Hercourt Asia PTE Ltd. /W.B.Saunders Company. (2006).
6. Tortora, G.J. &Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
8. Hill, Richard W., et al. Anima l physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume l & 2, 11th edition, CBS Publishers (20 l 6).

B.Sc. Semester – II

Subject: ZOOLOGY
Open Elective Course (OEC-2)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-2	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-2: Title of the Course: Parasitology

Course Outcome (CO):

After completion of course, students will be able to:

CO 1:Know the stages of the life cycles of the parasites and infective stages.
CO 2:Develop ecological model to know population dynamics of parasite, establishment of parasite population in host body, adaptive radiations and methods adopted by parasite to combat with the host immune system.
CO 3:Develop skills and realize significance of diagnosis of parasitic infection and treatment.
CO 4;Understand about diseases caused by Protozoa, Helminthes, Nematodes and Arthropods at molecular level.
CO 5:Develop their future career in medical sciences and related administrative services.

Syllabus- OEC: Title- Parasitology	**Total Hrs: 42**
Unit-I General Concepts Parasitic Platyhelminthes and Parasitic Protists	**14 hrs**
Introduction, Parasites, parasitoids, host, zoonosis**,**Origin and evolution of parasites**,** Basic concept of Parasitism, symbiosis, phoresis, commensalisms and mutualism**,** Host-parasite interactions and adaptations**,** Life cycle of human parasites**,**Occurance, mode of infection and prophylaxis Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of *Fasciolopsisbuski***,***Schistosomahaematobium***,***Taeniasolium***,***Hymenolepis nana* Study of morphology, life cycle, pathogenicity, prophylaxis and control *measures* of**,** *Entamoebahistolytica***,***Giardia intestinalis, Trypanosomagambiense, Plasmodium vivax.*	
Unit-II Parasitic Nematodes, Arthropods and Vertebrates	**14 hrs**
Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of *Ascarislumbricoides,Ancylostomaduodenale,Wuchereriabancrofti, Trichinellaspiralis,* Nematode plant interaction ; Gall formation Biology, importance and control of Ticks (Soft tick *Ornithodoros*, Hard tick *Ixodes*)**,**Mites(*Sarcoptes*)**,**Lice (*Pediculus*)**,**Flea (*Xenopsylla*)**,**Bug (*Cimex*)**,**Parasitoid (Beetles) Cookicutter Shark**,** Hood Mocking bird and Vampire bat and their parasitic behavior and effect on host.	

Unit-III Molecular diagnosis and clinical parasitology	14 hrs
General concept of molecular diagnosis for parasitic infection,Advantages and disadvantages of molecular diagnosis Fundamental techniques used in molecular diagnosis of endoparasites Immunoassay or serological techniques for laboratory diagnosis of endoparasites on the basis of marker molecules like G.intestinalis, B. coli, E. histolytica, L.donovani, Malaria parasite using ELISA, RIA,Counter Current Immunoelectrophoresis (CCI),Complement Fixation Test (CFT) PCR, DNA, RNA probe.	

Books recommended.

1. Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributors.
2. E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition, Lea &Febiger.
3. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and Francis Group.
4. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
5. Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers.
6. K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBS Publishers & Distributors (P) Ltd.
7. Gunn, A. and Pitt, S.J. (2012). Parasitology: an Integrated Approach. Wiley Blackwell.
8. Noble, E. R. and G.A.Noble (1982) Parasitology: The biology of animal parasites. V th Edition, Lea &Febiger.
9. Paniker, C.K.J., Ghosh, S. [Ed} (2013). Paniker‘s Text Book of Medical Parasitology. Jaypee, New Delhi.
10. Parija,S.C.Textbookofmedicalparasitology,protozoology&helminthology(Textand color Atlas),II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
11. Roberts, L.S and Janovy, J. (2009). Smith & Robert‘s Foundation of Parasitology. 8th. Edn. McGraw Hill.
12. Bogitsh, B. J. and Cheng, T. C. (2000). Human Parasitology. 2nd Ed. Academic Press, New York.
13. Chandler, A. C. and Read. C. P. (1961). Introduction to Parasitology, 10th ed. John Wiley andSons Inc.
14. Cheng, T. C. (1986). General Parasitology. 2nd ed. Academic Press, Inc. Orlando.U.S.A.
15. Schmidt, G. D. and Roberts, L. S. (2001). Foundation of Parasitology. 3rd ed. McGraw Hill Publishers.
16. Schmidt, G. D. (1989). Essentials of Parasitology. Wm. C. Brown Publishers (Indian print1990, Universal Book Stall).
17. John Hyde (1996) Molecular Parasitology Open University Press.
18. J Joseph Marr and Miklos Muller (1995) Biochemistry and Molecular Biology of Parasites 2 ndEdn Academic Press.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

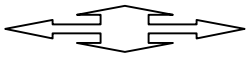
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

Tele: 0836-2215224
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No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಆಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

04 - Year (Hons.) B.Sc., BCA.,

B.Sc.(Pulp & Paper Science)

B.A.S.L.P (Hon) Programs

***

AECC SYLLABUS

Subject: English

[Effective from 2021-22]

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

FOR SEM I & II

Karnatak University, Dharwad

Four Years Under Graduate Program in **English** for

B.Sc., BCA., B.Sc.(Pulp & Paper Science) B.A.S.L.P (Hon)

Effective from 2021-22

AECC

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
II	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
III	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
IV	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

Name of Course (Subject): English (AECC)

B.Sc., BCA., B.Sc.(Pulp & Paper Science) B.A.S.L.P (Hon)

Semester – I

Subject: Generic English-1
Ability Enhancement Compulsory Course (AECC)

AECC-1

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	AECC	Theory	03	04	42 hrs	2hrs	40	60	100

Title of the AECC: **Generic English -1**

Course Outcome (CO):

After completion of course -1, students will be able to:

1. This paper aims at introducing English poetry and prose to develop reading skills
2. It teaching them the basics of English grammar.
3. Aims to develop communicative grammar skills
4. Learn to understand basics of writing

Syllabus- AECC 1: Title- Shalmala	**Total Hrs: 42**
Unit –1 Prose	**14 hrs**
Chapter No. 1 Playing the English Gentleman - Mahatma Gandhi **Chapter No. 2**. Let's Go Home - Kewlin Sio **Chapter No.3.** Marriage is a Private Affair - Chinua Achebe	
Unit – 2 Poetry	**14 hrs**
Chapter No.4. River - A. K. Ramanujan **Chapter No.**5. The Road not Taken - Robert Frost **Chapter No. 6**. If - Rudyard Kipling	
Unit – 3: Grammar and Vocabulary	**14 hrs**
Chapter No -7. Parts of Speech with special emphasis on Articles and Prepositions **(Focus may be on the following prepositions:** On, in, of, off, for, into, with, beside, besides, under, over, by, from, to, at, across, since, between, among, above, up, after, before, through) **Chapter No -8.**Tenses (with focus on the use of simple present tense and simple past tense) **Chapter No -9.**Words used in different parts of speech **Chapter No -10.**Functional vocabulary	

1. **Text Books: Timeless Wisdom,** Board of Editors, Orient Blackswan, Hyderabad Hyderabad
2. **Suggested Reading: R. P. Singh's *Functional Skills in Language and Literature*, OUP**

B.Sc., BCA., B.Sc.(Pulp & Paper Science) B.A.S.L.P (Hon)

Semester – II

Subject: Generic English 2
Ability Enhancement Compulsory Course (AECC)

AECC-2

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	AECC	Theory	03	04	42 hrs	2hrs	40	60	100

Title of the Course: **Generic English 2**

Course Outcome (CO):

After completion of course, students will be able to:

1. This paper aims at introducing English poetry and prose to develop reading and comprehension skills.
2. It teaches them the basics of communicative English.
3. Speaking Skills
4. Vocabulary development

Syllabus- AECC- 2: Title- Shalmala	**Total Hrs: 42**
Unit –1 Prose	**14 hrs**
Chapter No 1. Sparrows - K. A. Abbas **Chapter No** 2. An Astrologer's Day - R. K. Narayan **Chapter No** 3. The Function of Education - J. Krishnamurti	
Unit – 2 Poetry	**14 hrs**
Chapter No 4. The World is Too Much With Us - William Wordsworth Chapter No 5. Prayer Before God - Louis MacNeice Chapter No 6. Gandhi - Niranjan Mohanty	
Unit – 3: Grammar and Speaking Skills	**14 hrs**
Chapter No 7. Correction of Errors, Chapter No 8. Combining sentences with appropriate conjunctions Chapter No 9.Use of adverbs and adjectives, Chapter No 10. Dialogue Writing: Common situations Short speeches for welcoming, introducing, proposing vote of thanks and Teachers Day, Gandhi Jayanti, Independence Day and Republic Day etc. Chapter No 11. One-word substitution (See Annexture-2) Chapter No 12.Collocations (See Annexture-2)	

1. **Text Books: Timeless Wisdom,** Board of Editors, Orient Blackswan, Hyderabad Hyderabad
2. **Suggested Reading: R. P. Singh's *Functional Skills in Language and Literature*, OUP**

Details of Formative assessment (IA) for DSCC/OEC/SEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration
Written test-1	10%	1 hr
Written test-2	10%	1 hr
Seminar	10%	10 minutes
Case study / Assignment / Field work / Project work/ Activity	10%	------
Total	40% of the maximum marks allotted for the paper	

Faculty of Social Science
04 - Year UG Honors programme: 2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

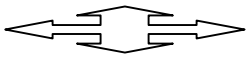
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

Tele: 0836-2215224
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Pavate Nagar,Dharwad-580003
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ – 580003

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'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/JS-131/Comp.Sub/2022-23/97 Date: 4/2/2023

ಅಧಿಸೂಚನೆ

ವಿಷಯ: ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿಯ NEP ಅಡಿಯಲ್ಲಿ 2 / 4ನೇ ಸೆಮಿಸ್ಟರ್ ಸ್ನಾತಕ ಪದವಿ ತರಗತಿಗಳಿಗೆ ಕಡ್ಡಾಯವಾಗಿರುವ ಪಠ್ಯಕ್ರಮಗಳ ಪ್ರಕಟಣೆ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಕಚೇರಿ ಪತ್ರ ಸಂ. KU/Aca(S&T)/OS-Gen/2022-23/1488, ದಿ. 21.01.2023.
2. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ 4/2/2023

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳಿಗೆ ಸಂಬಂಧಿಸಿದಂತೆ, ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿಯ NEP ಅಡಿಯಲ್ಲಿ ಎಲ್ಲ ಸ್ನಾತಕ ಪದವಿ ತರಗತಿಗಳ 2 / 4ನೇ ಸೆಮಿಸ್ಟರ್‌ಗಳಿಗೆ ಈ ಕೆಳಗಿನ ವಿಷಯಗಳ ಪಠ್ಯಕ್ರಮವನ್ನು 2022–23ನೇ ಸಾಲಿನಿಂದ ಕಡ್ಡಾಯವಾಗಿ ಅಳವಡಿಸಿಕೊಳ್ಳಲು ಸಂಬಂಧಪಟ್ಟ ಎಲ್ಲ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಈ ಮೂಲಕ ತಿಳಿಸಲಾಗಿದೆ.

1. Environmental Studies (Revised for 3 credits) : 2nd Semester
2. Financial Education and Investment Awareness (For 2 credits): 4th Semester
3. India & Indian Constitution (For 3 credits) : 4th Semester

ಮುಂದುವರೆದು, ಸದರ ಮಾಹಿತಿಯನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳ ಗಮನಕ್ಕೆ ತರಲು ಮಹಾವಿದ್ಯಾಲಯದ ಸೂಚನಾ ಫಲಕದಲ್ಲಿ ಲಗತ್ತಿಸಬೇಕೆಂದು ಈ ಮೂಲಕ ತಿಳಿಸಲಾಗಿದೆ ಹಾಗೂ ಈ ಮೇಲಿನ NEP-2020 ಪಠ್ಯಕ್ರಮವು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಬಿತ್ತರಿಸಲಾಗಿದೆ ಎಂದು ಈ ಮೂಲಕ ಸೂಚಿಸಲಾಗಿದೆ.

3/2/23
ಕುಲಸಚಿವರು

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು.

ಪ್ರತಿ ಮಾಹಿತಿಗಾಗಿ:

1. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ), ಕ.ವಿ.ವಿ. ಧಾರವಾಡ ಇವರಿಗೆ ಮಾಹಿತಿಗಾಗಿ.
2. ಡೀನರು, ವಾಣಿಜ್ಯಶಾಸ್ತ್ರ ನಿಖಾಯ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ನೊಡಲ್ ಅಧಿಕಾರಿಗಳು, ಯು.ಯು.ಸಿ.ಎಂ.ಎಸ್. ಘಟಕ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ನೊಡಲ್ ಅಧಿಕಾರಿಗಳು, NEP ಘಟಕ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ಡಾ. ಕಿರಣಕುಮಾರ ಬನ್ನಿಗೋಳ, ವಿಶ್ವವಿದ್ಯಾಲಯದ ಸಂಯೋಜಕರು ಹಾಗೂ ಸಹಾಯಕ ಪ್ರಾಧ್ಯಾಪಕರು, ಸ್ನಾತಕೋತ್ತರ ವಾಣಿಜ್ಯಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

ಸಾದರಪೂರ್ವಕವಾಗಿ ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ನಿರ್ದೇಶಕರು, ಐ.ಟಿ. ಶಾಖೆ, ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ಸಿಸ್ಟಮ್ ವಿಶ್ಲೇಷಕರು (System Analysist), ಗಣಕಯಂತ್ರ ಶಾಖೆ, ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
6. ಅಧೀಕ್ಷಕರು, ಪರೀಕ್ಷಾ ಗೌಪ್ಯ/ ಸ್ನಾತಕೋತ್ತರ / ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಸಾಮಾನ್ಯ ಆಡಳಿತ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
7. ಅಧೀಕ್ಷಕರು, ಸಿ.ಡಿ.ಸಿ. (ಸಂಯೋಜನೆ) ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ .

KARNATAK UNIVERSITY
SYLLABUS OF ENVIRONMENTAL STUDIES (Revised)
ABILITY ENHANCEMENT COMPULSORY COURSE (AECC) under NEP-2020
EFFECTIVE FROM 2022-2023

Total Contact Hours: 42	Course Credits: **3**
No. of Teaching Hours/week: **3**	Duration of ESA/Exam: **2** Hours
Formative assessment Marks: **40**	Semester end assessment Marks: **60**

Course Outcome (CO):

After completion of course, students will be able to:

CO 1. Define environmental studies and ecology with basic principles.
CO 2. To examine the natural resources and their types and utility.
CO 3. To outline the diversity and explain the conservation and its significations.
CO 4. To identify the environmental issues, types of pollutions and their impact.

Content of ENVIRONMENTAL STUDIES – AECC		**42 Hours**
Unit 1	**Chapter 1: Introduction to Environmental Studies:** • Multidisciplinary nature of environmental studies. • Scope and importance; Concept of sustainability and sustainable development.	**2**
	Chapter 2: Ecosystems • What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, foodwebs and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers,oceans, estuaries)	**5**
	Chapter 3: Natural Resources: Renewable and Non-Renewable Resources • Land resources and land-use change; Land degradation,soil erosion and desertification. • Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribalpopulations. • Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (International& Inter-state). • Energy resources: Renewable and non-renewable energysources, use of alternate energy sources, growing energy needs, case studies.	**7**

Unit 2	**Chapter 4: Biodiversity and Conservation** • Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hotspots. • India as a mega-biodiversity nation; Endangered and endemic species of India.	**7**
	• Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity • Ecosystem and biodiversity services: Ecological, economic,social, ethical, aesthetic and Informational value.	
	Chapter 5: Environmental Pollution • Environmental Pollution: Types, causes, effects and controls; Air, water, soil and noise pollution. • Nuclear hazards and human health risks. • Solid waste management, Control measures of urban and industrial waste. • Pollution case studies.	**7**
Unit 3	**Chapter 6: Environmental Policies and Practices** • Climate change, global warming, ozone layer depletion,acid rain and impacts on human communities and agriculture. • Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Preventionand Control of Pollution) Act; Wildlife (Protection) Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). • Nature reserves, tribal populations and rights, and humanwildlife conflicts in Indian context.	**7**
	Chapter 7: Human Communities and the Environment • Human population growth: Impacts on environment,human health and welfare. • Resettlement and rehabilitation of project affected persons; case studies. • Disaster management: Floods, Earthquake, Cyclones and Landslides. • Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. • Environmental ethics: Role of Indian and other religionsand cultures in environmental conservation. • Environmental communication and public awareness, casestudies (e.g., CNG vehicles in cities).	**5**
	Chapter 8: Field work (Any two) • Visit to an area to document environmental assets: river/forest/flora/fauna, etc. • Visit to a local polluted site- urban/Rural/Industrial/ Agricultural. • Study of common plants, insects, birds, and basic principlesof identification. • Study of simple ecosystems – pond, lake and river.	**2**

Reference

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14. Rosencranz, A., Divan, S., & Noble, M. L. (2001). *Environmental law andpolicy in India*.
15. Sengupta, R. (2003). *Ecology and economics: An approach to sustainable development*. OUP.
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19. World Commission on Environment and Development. (1987). *OurCommon Future*. Oxford University Press.

Details of Formative assessment (IA) for AECC theory: 40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%(10 Marks)	1 hr	8th Week
Written test-2	10%(10 Marks)	1 hr	12th Week
Seminar	10%(10 Marks)	10 minutes	--
Case study / Assignment / Field work / Projectwork/ Activity	10%(10 Marks)	------	--
Total	40%(40 marks) of the maximum marks allotted for the paper		

Pattern of Semester end examination:

Semester end exam for 60 marks with MCQ type for 60 questions. Each question carries 1 mark.

Duration of exam: 2 hours

Note to the teachers:

This module consists of 3 units, covering 42 hours of classroom based and field work intended to create awareness, enhance knowledge, develop skills and attitudes necessary to understand the Environment in its totality and enables students to participate proactively for the cause of the environment.

1. Environmental Studies (AECC) is made compulsory core module syllabus framed by UGC for all the Indian Universities/Colleges as per the directions given by the Honorable Supreme Court, which believed that, conservation of environment should be a national way of life and to be included into the education process. As suggested by NEP-2020 State Level Environmental Science Subject Expert Committee, Chairpersons of Board of Studies, Board of Examiners and subject experts it is proposed to implement **mandatorily**.
2. **Qualifications to teach Environmental Studies (AECC):** A candidate with minimum qualifications of M.Sc. in Environmental Science subject is eligible to teach Environmental Studies (AECC) at the under graduate level at all Universities, Deemed to be Universities, Autonomous Institutions, Government, Aided and Private Colleges. Preference be given to candidates with UGC-NET/K-SET/Ph.D. in Environmental Science.

However, when such candidates are not available, teachers of the subjects listed below are to be preferred to teach **ENVIRONMENTAL STUDIES – AECC** paper in the following order:

a. **Biological Sciences**:
   Botany/Zoology/Microbiology/Biotechnology/Life Sciences
b. **Chemical Sciences and Earth Sciences**:
   Chemistry/Geology/Earth Sciences

The teachers **NOT ELIGIBLE** to teach Environmental Studies (AECC) paper are - Humanities (Economics, Geography, History, Sociology, Political Science, Rural Development, Philosophy and others), Commerce, Management, English & others languages, Communication, Performing Arts, Fine Arts, Social work, Women Studies, Psychology, Home Science, Fashion Technology, Travel & Tourism and other similar subjects

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಆಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

04 - Year (Hons.) B.Sc., BCA.,

B.Sc.(Pulp & Paper Science)

B.A.S.L.P (Hon) Programs

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AECC SYLLABUS

Subject: English

[Effective from 2021-22]

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

FOR SEM I & II

Karnatak University, Dharwad

Four Years Under Graduate Program in **English** for

B.Sc., BCA., B.Sc.(Pulp & Paper Science) B.A.S.L.P (Hon)

Effective from 2021-22

AECC

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
II	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
III	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
IV	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

Name of Course (Subject): English (AECC)

B.Sc., BCA., B.Sc.(Pulp & Paper Science) B.A.S.L.P (Hon)

Semester – I

Subject: Generic English-1
Ability Enhancement Compulsory Course (AECC)

AECC-1

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	AECC	Theory	03	04	42 hrs	2hrs	40	60	100

Title of the AECC: **Generic English -1**

Course Outcome (CO):

After completion of course -1, students will be able to:

1. This paper aims at introducing English poetry and prose to develop reading skills
2. It teaching them the basics of English grammar.
3. Aims to develop communicative grammar skills
4. Learn to understand basics of writing

Syllabus- AECC 1: Title- Shalmala	**Total Hrs: 42**
Unit –1 Prose	**14 hrs**
Chapter No. 1 Playing the English Gentleman - Mahatma Gandhi **Chapter No. 2**. Let's Go Home - Kewlin Sio **Chapter No.3.** Marriage is a Private Affair - Chinua Achebe	
Unit – 2 Poetry	**14 hrs**
Chapter No.4. River - A. K. Ramanujan **Chapter No.**5. The Road not Taken - Robert Frost **Chapter No. 6**. If - Rudyard Kipling	
Unit – 3: Grammar and Vocabulary	**14 hrs**
Chapter No -7. Parts of Speech with special emphasis on Articles and Prepositions **(Focus may be on the following prepositions:** On, in, of, off, for, into, with, beside, besides, under, over, by, from, to, at, across, since, between, among, above, up, after, before, through) **Chapter No -8.**Tenses (with focus on the use of simple present tense and simple past tense) **Chapter No -9.**Words used in different parts of speech **Chapter No -10.**Functional vocabulary	

1. **Text Books: Timeless Wisdom,** Board of Editors, Orient Blackswan, Hyderabad Hyderabad
2. **Suggested Reading: R. P. Singh's *Functional Skills in Language and Literature*, OUP**

B.Sc., BCA., B.Sc.(Pulp & Paper Science) B.A.S.L.P (Hon)

Semester – II

Subject: Generic English 2
Ability Enhancement Compulsory Course (AECC)

AECC-2

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	AECC	Theory	03	04	42 hrs	2hrs	40	60	100

Title of the Course: **Generic English 2**

Course Outcome (CO):

After completion of course, students will be able to:

1. This paper aims at introducing English poetry and prose to develop reading and comprehension skills.
2. It teaches them the basics of communicative English.
3. Speaking Skills
4. Vocabulary development

Syllabus- AECC- 2: Title- Shalmala	**Total Hrs: 42**
Unit –1 Prose	**14 hrs**
Chapter No 1. Sparrows - K. A. Abbas **Chapter No** 2. An Astrologer's Day - R. K. Narayan **Chapter No** 3. The Function of Education - J. Krishnamurti	
Unit – 2 Poetry	**14 hrs**
Chapter No 4. The World is Too Much With Us - William Wordsworth Chapter No 5. Prayer Before God - Louis MacNeice Chapter No 6. Gandhi - Niranjan Mohanty	
Unit – 3: Grammar and Speaking Skills	**14 hrs**
Chapter No 7. Correction of Errors, Chapter No 8. Combining sentences with appropriate conjunctions Chapter No 9.Use of adverbs and adjectives, Chapter No 10. Dialogue Writing: Common situations Short speeches for welcoming, introducing, proposing vote of thanks and Teachers Day, Gandhi Jayanti, Independence Day and Republic Day etc. Chapter No 11. One-word substitution (See Annexture-2) Chapter No 12.Collocations (See Annexture-2)	

1. **Text Books: Timeless Wisdom,** Board of Editors, Orient Blackswan, Hyderabad Hyderabad
2. **Suggested Reading: R. P. Singh's *Functional Skills in Language and Literature*, OUP**

Details of Formative assessment (IA) for DSCC/OEC/SEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration
Written test-1	10%	1 hr
Written test-2	10%	1 hr
Seminar	10%	10 minutes
Case study / Assignment / Field work / Project work/ Activity	10%	------
Total	40% of the maximum marks allotted for the paper	

Faculty of Social Science
04 - Year UG Honors programme: 2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

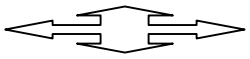
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

Tele: 0836-2215224
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Pavate Nagar,Dharwad-580003
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ – 580003

NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.A./B.Music/B.VA / B.Sc. Hotel Management/ BTTM/ BSW (Hons.) Program

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AECC SYLLABUS

Subject: Hindi

[Effective from 2021-22]

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

FOR SEM I & II

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in Hindi for B.A./B.Music/ B.VA / B.Sc. Hotel Management/ BTTM./ BSW (Hons.)

Effective from 2021-22

AECC

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
II	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
III	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
IV	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

Student shall choose two AECC, out of which Kannada as AECC is mandatory.

Name of Course (Subject): Hindi

B.A./B.Music/ B.VA / B.Sc. Hotel Management/ BTTM /BSW

Semester – I

Subject: Hindi
Ability Enhancement Compulsory Course (AECC)

AECC-1

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	AECC	Theory	03	04	42 hrs	2hrs	40	60	100

Title of the AECC : Short Story & Grammar

Course Outcome (CO):

After completion of course -1, students will be able to:

CO 1 : भाषायी क्षमता का निर्माण होगा।
CO 2 : भाषायी शुद्धता के प्रति सजगता निर्माण होगी

CO 3 : कहानी के पठन पाठन में रुचि उत्पन्न होगी।

CO 4 : कहानी लेखन की क्षमता उत्पन्न होगी

CO 5 : कल्पना और स्मरण शक्ति का विकास करना

Syllabus- AECC 1: Title- Hindi Kahaniya	**Total Hrs: 42**
Unit-I	**14 hrs**
कफन-प्रेमचंद, ममता-जयशंकर प्रासाद, ताई-विश्वंभरनाथ कौशिक, हार की जीत-सुदर्शन, कच्चे धागे-उषा प्रियंवदा.	
Unit-II	**14 hrs**
पत्नी- जैनेंद्र कुमार, **आदमी का बच्चा-यशपाल.** बैल की बिक्री- सियारामशरण। गुप्त, मैं हार गई-मन्नु भण्डारी,पहाड-निर्मल वर्मा.	
Unit-III	**14 hrs**
शब्द भेद- विकारी शब्द : संज्ञा, सर्वनाम, विशेषण, लिंग, वचन **अविकारी : क्रिया विशेषण, संबंध बोधक, समुच्छय बोधक, विस्मयादि बोधक आदि**	

Books recommended.

1. **कहानी पुष्प**
   सं. डॉ. शालिवाहन बी. कोल्लुरे त
   अमन प्रकाशन, कानपुर
2. **हिन्दी व्याकरण (शब्द भेद)**

B.A./B.Music/ B.VA / B.Sc. Hotel Management/ BTTM /BSW

Semester – II

Subject: Hindi
Ability Enhancement Compulsory Course (AECC)

AECC-2

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	AECC	Theory	03	04	42 hrs	2hrs	40	60	100

Title of the Course : Novel & Functional Hindi

Course Outcome (CO):

After completion of course, students will be able to:

CO 1 : भाषा के प्रयोजनमूलक स्वरूप को समझ पायेंगे।
CO 2: हिंदी के व्यावहारिक स्वरूप को समझ पायेंगे
CO 3 :रचनात्मकता में रुचि निर्माण होगी

Syllabus- AECC- 2: Title- DeekShant Upanyas Aur Prayojanmulak Hindi	**Total Hrs: 42**
Unit-I	**14 hrs**
सूर्यबाला का जीवन परिचय तथा दीक्षांत की **संक्षिप्त** कथावस्त, उपन्यास वाचन ।	
Unit-II	**14 hrs**
दिक्षांत उपनयास का तात्विक विवेचन : कथावस्तु, पात्र और चरित्र चित्रण, कथोपकथन, देशकाल वातावरण, भाषा शैली एवं उद्देश्य	
Unit-III	**14 hrs**
प्रयोजनमूलक हिन्दी : प्रयोजनमूलक हिंदी की अवधारणा-स्वरूप और क्षेत्र का महत्व,डाक, तार विभाग, रेल-विभाग, हवाई अड्डे की हिंदी, बैंक में हिंदी आकाशवाणी दूरदर्शन हिंदी आदि।	

Books recommended.

1. दिक्षांत (उपन्यास)
-सूर्यबाला
अमन प्रकाशन, कानपुर
2. प्रयोजनमूलक हिन्दी

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc./B.C.A./ B.Sc.(Pulp & Paper)

B.A.S.L.P

(Hons.) Program

***

AECC SYLLABUS

Subject: Hindi

[Effective from 2021-22]

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

FOR SEM I & II

AS PER N E P - 2020

Karnatak University, Dharwad.

Four Years Under Graduate Program in Hindi for

B.Sc./B.C.A./ B.Sc.(Pulp & Paper) B.A.S.L.P (Hons.)

Effective from 2021-22

AECC

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
II	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
III	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
IV	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

Student shall choose two AECC, out of which Kannada as AECC is mandatory.

Name of Course (Subject): Hindi

B.Sc./B.C.A./ B.Sc.(Pulp & Paper) B.A.S.L.P (Hons.)

Semester – I

Subject: Hindi
Ability Enhancement Compulsory Course (AECC)

AECC-1

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	AECC	Theory	03	04	42 hrs	2hrs	40	60	100

Title of the AECC : Short Story & Grammar

Course Outcome (CO):

After completion of course -1, students will be able to:

CO 1 गद्य के तत्वों के आधार पर निबंध रचने की क्षमता प्राप्त करने का प्रयास होता है।

CO 2 छात्रों में पढने की आदत का विकास होता है।

CO 3 वाचन कौशल, लेखन कौशल एवं वक्तृत्व कौशल प्राप्त कर सकते हैं।

CO 4 व्याकरण से संबंधित सही जानकारी प्राप्त कर सकते हैं

Syllabus- AECC 1: Title- Kahani Sahity Aur Vyakarn	**Total Hrs: 42**
Unit-I	**14 hrs**
लॉकडौन, कोरोना सप्तपदी, घर बेचना है, पवित्र कार्य, कोरोना महिमा	
Unit-II	**14 hrs**
माता विमाता, मुक्ति, कन्हया, मास्क, वसीयत नामा	
Unit-III	**14 hrs**
शब्द भेद- विकारी शब्द : संज्ञा, सर्वनाम, विशेषण, लिंग, वचन अविकारी : क्रिया विशेषण, संबंध बोधक, समुच्छय बोधक, विस्मयादि बोधक आदि।	

Books recommended.

1. लॉकडौन- धन्यकुमार बिराजदार, भारतीय ज्ञानपीय प्रकाशन, नई दिल्ली

2. हिन्दी व्याकरण (शब्द भेद)

B.Sc./B.C.A./ B.Sc.(Pulp & Paper) B.A.S.L.P (Hons.)

. Semester – II

Subject: Hindi
Ability Enhancement Compulsory Course (AECC)

AECC-2

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	AECC	Theory	03	03	42 hrs	2hrs	40	60	100

Title of the Course : Modern Poetry & Translation

Course Outcome (CO):

After completion of course, students will be able to:

1. अनुवाद की सैद्धान्तिक समझ विकसित होगी
2. अनुवाद के क्षेत्रों की समझ विकसित होगी
3. अनुवाद जगत के विश्लेषण की क्षमता निर्माण होगी
4. अनुवाद के व्यावहारिक ज्ञान में वृद्धि होगी।
5. अनुवाद की उपयोगिता को समझ पायेंगे
6. ज्ञान के विभिन्न क्षेत्रों में अनुवाद करने कुशल होंगे

Syllabus- AECC- 2: Title- Adhunik Kavya Aur Anuvad	**Total Hrs: 42**
Unit-I	**14 hrs**
कैकेयी का अनुताप-मैथलीशरण गुप्त, हमारा प्यारा भारत वर्ष-जयशंकर प्रसाद, मैं नहीं चाहता चिर सुख-सुमित्रानंदन पन्त, जीवन संदेश-रामनरेश त्रिपाठी, मेरा नया बचपन- सुभद्राकुमारी चौव्हान	
Unit-II	**14 hrs**
जनतंत्र का जन्म-रामधारी सिंह दिनकर, वरदान माँगूगा नहीं-शिवमंगल सुमन, प्रेत का बयान-नागार्जुन, धानों के गीत-केदारनाथ सिंह.	
Unit-III	**14 hrs**
अनुवाद- कन्नड और अंग्रेजी से हिन्दी में अनुवाद	

Books recommended.

1 आधुनिक काव्य कौमुदी

सं : डॉ. बालचंद्र तोंडिहाल

भास्कर प्रकाशन, हुबली

2. अनुवाद (कन्नड या अंग्रेजी से हिन्दी में)

KARNATAK UNIVERSITY, DHARWAD

04 – Year B.Com./ B.Com (cs) / B.B.A. & Any others Programme

(Hons.) Program

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AECC SYLLABUS

Subject: Hindi

[Effective from 2021-22]

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

FOR SEM I & II

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in Hindi for **.Com./ B.Com (cs) / B.B.A. & Any others Programme** Effective from 2021-22

AECC

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
II	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
III	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
IV	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

Student shall choose two AECC, out of which Kannada as AECC is mandatory.

Name of Course (Subject): Hindi

.Com./ B.Com (cs) / B.B.A. & Any others Programme Semester – I

Subject: Hindi
Ability Enhancement Compulsory Course (AECC)

AECC-1

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	AECC	Theory	03	04	42 hrs	2hrs	40	60	100

Title of the AECC : Pros & Commercial Eassay

Course Outcome (CO):

After completion of course -1, students will be able to:

CO 1 हिंदी गद्य की विभिन्न विधाओं से परिचित होंगे।

CO 2 गद्य के अध्ययन से रचनात्मक लेखन में रुचि उत्पन्न होगी।

CO 3 हिंदी व्याकरण के अध्ययन से हिंदी भाषा के शुद्ध स्वरूप को समझेंगे

CO 4 भाषा कौशल का विकास होगा।

CO 5 सही जानकारी प्राप्त कर सकते हैं

Syllabus- AECC 1: Title- Gadyapravah Aur Vanijya nibandh	**Total Hrs: 42**
Unit-I	**14 hrs**
जिहाद-प्रेमचंद, योग्यता और व्यवसाय-माधव राव सप्रे, भोर का तारा-जगदीशचंद्र माथुर, मैं धोबी हूँ-शिवपूजन सहाय.	
Unit-II	**14 hrs**
शरणदाता-अज्ञेय, रजिया-रामवृक्ष बेनीपुरी, नया साल-अमृत राय, कर्नाटक के कबीर-संत शरीफ़-बालचंद्र तोंडिहाल आदि	
Unit-III	**14 hrs**
वाणिज्य निबंध-बैंक, बीमा निगम, लघु तथा कुटीर उद्योग, वस्तु एवं सेवा कर, विज्ञापन, आयात और निर्यात	

Books recommended.

1 गद्य प्रवाह, सं : डॉ. बालचंद्र तोंडिहाल, भास्कर प्रकाशन, हुबली

2. वाणिज्य निबंध

B.Com./ B.Com (cs) / B.B.A. & Any others Programme.

Semester – II

Subject: Hindi
Ability Enhancement Compulsory Course (AECC)

AECC-2

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	AECC	Theory	03	03	42 hrs	2hrs	40	60	100

Title of the Course : Poetry & Business Letter

Course Outcome (CO):

After completion of course, students will be able to:

1. हिंदी कहानी के स्वरूप को समझने की योग्यता निर्माण होगी
2. कहानी लेखन और पठन में रुचि निर्माण होगी।

Syllabus- AECC- 2: Title- Kavya kunj Aur Vanijya patrachar	Total Hrs: 42
Unit-I	**14 hrs**
अभी न होगा मेरा अंत, गहन है यह अंधकार-निराला नीर भरी दुख की बदली-महादेवी वर्मा मधुशाला, तूने क्या सपना देखा है?-हरिवंशराय बच्चन	
Unit-II	**14 hrs**
गीत अगीत, हमारे कृषक-रामधारी सिंह दिनकर कालिदास, अकाल और उसके बाद-नागार्जुन यह दीप अकेला-अज्ञेय	
Unit-III	**14 hrs**
वाणिज्य पत्राचार- एजेन्सी माँग पत्र, शिकायत पत्र, आवेदन पत्र, बचत खाता खोलने का पत्र, निविदा पत्र आदि।	

Books recommended.

books **1 काव्य कुंज और वाणिज्य पत्राचार**
सं : डॉ. प्रेमचंद चौव्हान, डॉ. अनुराधा
अमन प्रकाशन, कान्पुर

2 वाणिज्य पत्राचार

Details of Formative assessment (IA) for DSCC/OEC/SEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration
Written test-1	10%	1 hr
Written test-2	10%	1 hr
Seminar	10%	10 minutes
Case study / Assignment / Field work / Project work/ Activity	10%	------
Total	40% of the maximum marks allotted for the paper	

Faculty of Arts (Languages)
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

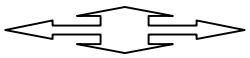
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

Tele: 0836-2215224
e-mail: academic.st@kud.ac.in
Pavate Nagar,Dharwad-580003
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ – 580003

NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಿಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಬಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

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KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. /BCA/ BASLP/

B.Sc.(Paper & Pulp) (Hons.)

Degree Programs

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AECC SYLLABUS

Subject: KANNADA

[Effective from 2021-22]

ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

FOR SEM I & II

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in Kannada for

B.Sc. /BCA/ BASLP/ B.Sc.(Paper & Pulp) (Hons.)

Effective from 2021-22

AECC

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
II	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
III	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
IV	AECC	Theory	04 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

Student shall choose two AECC, out of which Kannada as AECC is mandatory.

Name of Course (Subject) : Kannada

B.Sc. /BCA/ BASLP/ B.Sc.(Paper & Pulp) (Hons.)

Semester – I

Subject: Kannada
Ability Enhancement Compulsory Course (AECC)

AECC-1

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	AECC	Theory	03	03	42 hrs	2hrs	40	60	100

Title of the AECC: PÀ£ÀßqÀ ¨sÁµÁ¥ÀoÀå ªÀiÁ¯É 1

Course Outcome (CO):

After completion of course -1, students will be able to:

CO 1 : ¸Á»vÀåzÀ Nzï, w½ªÀ¼ÀPÉÌ ÁUÀ§gÀªÀiÁrPÉÆ¼ÀÄîvÀÛzÉ

CO 2 £ÁqÀÄ £ÀÄrAiÀÄ£ÀÄß PÀÄjvÀAvÀ ªÀiÁ»w ºÉÆA¢PÉÆ¼ÀÄîvÀÛzÉ

CO 3 ¸ÁªÀiÁfPÀ ºÁUÀÆ zÁ«ÄðPÀ zÀéAzÀéUÀ¼À PÀÄjvÀ Cj«£À ¸Á«ÄvÀPÀ ¸ÀA§AzsÀ ¸ÀÄzÀÄÛ

CO 4 ¸ÀAªÀºÀ£À PËªÀ®å ªÀÈ¢ÞAiÀiÁUÀ¯ÁUÀÄvÀÛzÉ.

CO 5 ¨sÁµÁPËµÀ® ªÀÈ¢ÞAiÀiÁUÀÄvÀÛzÉ

Syllabus- AECC 1: Title- PÀ£ÀßqÀ ¨sÁµÁ¥ÀoÀå ªÀiÁ¯É 1	**Total Hrs: 42**
Unit-I PÀ£ÀßqÀ £ÁqÀÄ £ÀÄr- aAvÀ£É	**14 hrs**
1. PÀ£ÀßqÀ zÉÃ¸ÀzÉÆ¼ï : ±ÁAvÀPÀ 2. £ÁrUÉ £ÀÄrUÉ ¸À§zÀ : zÀgÁ ¨ÉÃAzÉæ CA©PÁ¸ÀÄvÀ£À 3. PÀ£ÀßqÀ¥ÀæeÉ : f.¦. gÁdgÀvÀß (PÀvÉ) 4. ªÀÄ£ÀÄ¶å : dAiÀÄAvÀ PÁ¬ÄÌtÂ	
Unit-II ¨sÀQÛ	**14 hrs**
1. d£À¥ÀzÀ PÀªÀAiÀÄ ¨sÁUÀªÀvÀ : 2. PÁqÀÄªÀÄgÀ ªÀÄqÀÄ : PÀzÀ½ ±ÀªÀÄ ÚDvÀÄAvÀ ¨sÁUÀ 3. ¨sÀQÛ : ²ªÀgÁªÀÄ PÁgÀAvÀ 4. PÉ¥À V½ : ªÀÄzÀÄªÀÄzÀ PÀvÉ	
Unit-III ªÀÄ ÁPÀªÀÄ ÀfÃªÀzÀ	**14 hrs**
1. ¸ÀAd£ÀªÀÄ¼ÀUÀ : DAiÀÄ Lz 2. eÉÆÃwµÀå Cx¥ÀÆ ðªÀÄ Cx gÀvÀßÀ : J Zï. £ÀgÀ¹AºÀAiÀå 3. ªÀÄPÀÌ¼É ªÀÄ PÀ¯ÁAiÀÄ CUÀvÀå : PÀªÉ¥À 4. CªÀÄgÀUÀÀ (DAiÀÄ ¨sÁU) : ¹zÀÝ AUÀAiÀå	

Books recommended.

1. PÀ£ÁðI PÀ ¸À ¸ÀÌøw ¸ÀAÄÄPÉë: J Zï. w¥ÉàgÀÄzÀæ ¸Áé «Ä
2. ªÀÄºÀ ÉÆzÀAqÉ: PÁ¥À ÉÃgÀªÀÄ¥À
3. UÀgÀÄvÀºÁqÀÄ: ºÀ ¸ÀVAiÀÄZÉÃ¶ÃªÀÄ®¥Àà° AUÀÀ¥ÀgÀªÀÄ¥À
4. ²±ÀÄ£Á½±ÀjÃ¥ÀªÀÄ£ÀgÁgÀÄvÀÄÛªÀÄzÀÄÝ: C.gÁ.¸ÉÃ (¸À¥ÁzÀ£É)
5. ¥ÀjªÀÄ½(ªÉÆÃ PÀ¯ÉÃR£ÀUÀ¼À ¸ÀAPÀ®£À): ©.¦. ²ªÁ£ÀAzÀgÁªï

B.Sc. /BCA/ BASLP/ B.Sc.(Paper & Pulp) (Hons.)
Semester – II

Subject: KANNADA
Ability Enhancement Compulsory Course (AECC)

AECC-2

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	AECC	Theory	03	03	42 hrs	2hrs	40	60	100

Title of the Course : PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ 2

Course Outcome (CO):

After completion of course, students will be able to:

CO 1 : PÀ£ÀßqÀ£ÁqÀ£ÀÄ ¸ÀA¸ÀÌøw PÀÄjvÀÄ w½ÀÄ¼ÀÄªÀ£ÀÄß «¸ÀÛ¸ÀÄvÀÛzÉ.

CO 2 ªÉÊ¯ÉQ PÀ¸ÀÄ±ÉÃzÀ ¸ÀÄvÀÛ®ÄªÀ «ªÀÄ±ÁðvÀäPÀ zÀÈ¶×ÉÆÃ£À ¨É¼ÉAiÀÄÄvÀÛzÉ.

CO 3 ¸ÀÄ£ÀÄ®vÀÄªÀ GAiÀÄUÀ¼À ¸Á«ÄxÀåzÀ ¨É¼ÉAiÀÄÄvÀÛzÉ.

CO 4 ¸ÀªÀiÁdPÉÌ ¥Àj¸ÀgÀ ºÀæzÀAiÀÄvÀÛzÉ.

CO 5 PÀ£ÀßqÀzÀ ªÉÊ«zsÀå ¥ÀæPÁgÀUÀ¼À ¥ÀjZÀAiÀÄ GzÀÝÃ±À ºÉÆA¢zÉ.

Syllabus- AECC- 2: Title- PÀ£ÀßqÀ ¸Á»vÀå ¥ÀjZÀAiÀÄ 2	Total Hrs: 42
Unit-I f ÃªÀ£ÀPÀxÉ	**14 hrs**
1. AiÀÄÄzÀÞPÁAqÀzÀ PÉÆ£ÉAiÀÄ (DAiÀÝ ¨sÁUÀ) : ¨É¼ÀUÉgÉ PÀÈµÀÚ±Á¹Ûç 2. MqÀÄÆ½À(¥ÀÄ ÖÆ) AiÀÄ£À£ÀÄ : zÉÃªÀ£ÀÆgÀÄ ªÀÄºÁzÉÃªÀ 3. ªÀÄPÀÌ¼À ªÀÄ£À¸ÀÄ (DAiÀÝ ¨sÁUÀ) : r .«.f . 4. £Á½£À a AvÉ (DvÀäPÀxÉ DAiÀÝ ¨sÁUÀ) : ±ÁAvÁ ºÀA§½PÀgÀ	
Unit-II PÀ¸ÀÄ	**14 hrs**
1. CPÀÌ ªÀÄ£ÀÄUÀ¼ÀÄ : DAiÀÝ ¨sÁUÀ 2. wgÀÄPÀPÀ¸ÀÄ : ªÀÄ¼À®ÄµÀPÀ (vÀÄ¼ÀÄzÀ) 3. ºÀÄ®ÄUÀ¸ÀÄUÀ¼ÀÄ : J.J£ï. ªÀÄÆwðgÁªï (¥Àæ§AzsÀ) 4. ¸Á ªÉvÀÄzÀ ªÀÄ½ÀÄ (DAiÀÝ ¨sÁUÀ) : C£À ¦ . ¨sÁgÀwÃzÉ«	
Unit-III ªÀÄ½É	**14 hrs**
1. z¸ÀgÀ AqÀzÀ ªÀÄ½ÉÄ : Z£ÀßgÁAiÀÄ « 2. ªÀÄvÉÛ ªÀÄ½É§gÀ : ¸À§Äºà ÉÆ ÉÆiÁgÀ 3. §gÀCAz ÉÆ®ÉÆUÀ EµÀÖ (DAiÀÝ ¨sÁUÀ) : ¦ . ¸Á¬Ä£ÁxÀ 4. ªÀÄvÉÛ ªÀÄvÉÛ ºÀÄiÀÄåz É : AiÀÄÄDgï. C£ÀvÀªÀÄÆwð	

Books recommended.

1. PÀ£ÁðI PÀd£ÀªÀ ¨ÉUÉ PÀÈµÀ¬ÀÄ
2. avÀæ¥ÀvÀæ : J.J£ï. ªÀÄÆwðgÁªï
3. §¸ÀªÀAiÀÄÄUÀzÀ ªÀZÀ£ÀPÁgÀgÀÄ : §¸ÀªÀgÁdzÀ ¨ÉUÁgÀÄ
4. §gÀCAz ÉÆ®ÉÆUÀ EµÀÖ ¦ . ¸Á¬Ä£ÁxÀ
5. AiÀÄÄUÀzÀ ªÀÄ¸Á» vÀåzÀ£À QÃð£ÁxÀPÀÄvÀPÉÆÃn

Common for all 04-Year UG Programmes

Name of Course (Subject) : Kannada

Semester – I

Subject: Kannada for Non-Kannadigas (not studied Kannada at any stage up to PUC/10+2 level)
Ability Enhancement Compulsory Course (AECC)

AECC-1

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	AECC for Non-Kannadigas	Theory	03	03	42 hrs	2hrs	40	60	100

Title of the AECC: PÀ£ÀßqÀ ¨sÁµÁ¥ÀoÀå PÀ£ÀßqÀPÀ

Course Outcome (CO):

After completion of course -1, students will be able to:

- **CO 1** : Introducing spoken variety of Kannada
- **CO 2** : Introducing different parts of speech of Kannada
- CO 3 : Exposing different language contexts of Kannada.
- CO 4 : Introducing simple verb forms of Kannada.
- CO 5 : The Course enhances the speaking ability of the learner.

Syllabus- AECC 1: Title- PÀ£ÀßqÀPÀ	**Total Hrs: 42**
Unit-I	**14 hrs**
Introducing each other Personal Pronouns, Possive forms, Interrogative words. **Introducing each other 7** po personal pronouns, Possessive forms, Yes/ No Type interrogative **About Ramayana** Possessive forms of nouns, dubietie question, Relative nouns	
Unit-II	**14 hrs**
Enquiring about college. Qualitativeand quantitative adjectives. **Enquiring about room** Predicative forms, locative case. **Vegetable Market.** Dative case, basic numerals	
Unit-III	**14 hrs**
About Medical college Ordinal numerals, plural markers. **In a cloth shop.** Color adjectives, defective verbs **Plan to go for a picnic.** Imperative, permissive and hortative. **Enquiring about one's family** Verb iru, and corresponding negation.	

Books recommended.

1- PÀ£ÀßqÀPÀ : PÀ£ÀßqÀ«±ÀézÁå®AiÀÄ ºÀA¦

Details of Formative assessment (IA) for DSCC/OEC/SEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration
Written test-1	10%	1 hr
Written test-2	10%	1 hr
Seminar	10%	10 minutes
Case study / Assignment / Field work / Project work/ Activity	10%	------
Total	40% of the maximum marks allotted for the paper	

Faculty of Social Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

¨sÁUÀ J

1. C£ÀÄPÀæªÀÄ ¸ÀASÉå 1 jAzÀ 6 ¥Àæ±ÉßUÀ¼À°è AiÀiÁªÀÅzÁzÀgÀÆ 5 ¥Àæ±ÉßUÀ½UÉ GvÀÛj¸À¨ÉÃPÀÄ 2 X 5 =10

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

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2. C£ÀÄPÀæªÀÄ ¸ÀASÉå 7 jAzÀ 11 ¥Àæ±ÉßUÀ¼À°è AiÀiÁªÀÅzÁzÀgÀÆ 4 ¥Àæ±ÉßUÀ½UÉ GvÀÛj¸À¨ÉÃPÀÄ 4 X 5 =20

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

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3. C£ÀÄPÀæªÀÄ ¸ÀASÉå 12 jAzÀ 15 ¥Àæ±ÉßUÀ¼À°è AiÀiÁªÀÅzÁzÀgÀÆ 3 ¥Àæ±ÉßUÀ½UÉ GvÀÛj¸À¨ÉÃPÀÄ 3 X 10 =30

(¥Àæw WÀlPÀ¢AzÀ PÀ¤µÀ× 1 ¥Àæ±Éß §gÀ¨ÉÃPÀÄ ªÀÄvÀÄÛ CUÀvÀå«zÀÝ°è 10 CAPÀUÀ¼À ¥Àæ±ÉßAiÀÄ£ÀÄß G¥À ¥Àæ±ÉßUÀ¼ÁV 7+3 CxÀªÁ 6+4 CxÀªÁ 5+5 ªÀiÁzÀjAiÀÄ°è «¨sÁV¸À¨ÉÃPÀÄ)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

Tele: 0836-2215224
e-mail: academic.st@kud.ac.in
Pavate Nagar,Dharwad-580003
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ - 580003

NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SSL-394A/2022-23/1056 Date: 23 SEP 2022

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯ ಸಭೆಯ ಠರಾವುಗಳ ದಿನಾಂಕ: 06.09.2022
3. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂ. 01, ದಿನಾಂಕ: 17.09.2022
4. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 22-09-2022

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, **ವಿಜ್ಞಾನ** & **ತಂತ್ರಜ್ಞಾನ** ನಿಖಾಯದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ (NEP)-2020 ರಂತೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗಾಗಿ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. www.kud.ac.in ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತಾ, ವಿದ್ಯಾರ್ಥಿಗಳು ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ / ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERITY, DHARWAD

04 – Year B.Sc. (Hons.) Program

SYLLABUS

Subject: Botany

[Effective from 2022-2023]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM III AND IV AND OPEN ELECTIVE COURSE (OEC) FOR SEM III AND IV.

AS PER NEP- 2020

KARNATAK UNIVERITY, DHARWAD

Four Years Under Graduate Program in Botany for B.Sc. (Hons.)
Effective from 2022-23

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration Of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-3	Theory	03 hrs	42	02 hrs	40	60	100	03
IV	DSCC	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-4	Theory	03 hrs	42	02 hrs	40	60	100	03

B.Sc.: Semester – III
Subject: Botany
Theory: Discipline Specific Core Course (DSCC)

The Course Botany in III semester has two papers (Theory paper- 033 BOT 011 for 04 credits and Practical paper- 033 BOT 012 for 02 credits) for 06 credits: Both the papers are compulsory, Details of the courses are as

Course No.: 05
Course code (Theory): 033 BOT 011

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
033 BOT 011	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Title of the Course and Code:
DSSC 033 BOT 011: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course Outcomes:

On completion of this course, the students will be able to:

1. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
3. Induction of the enthusiasm on internal structure of locally available plants.
4. Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.
5. Observation and classification of the floral variations from the premises of college and house.
6. Understanding the various reproductive methods sub-stages in the life cycle of plants
7. Observation and classification of the embryological variations in angiosperms.
8. Enthusiasm to understand evolution based on the variations in reproduction among plants.

PLANT ANATOMY

Unit 1: ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES

14 Hrs

Introduction, objectives and scope of Plant Anatomy, Plant cell structure – nature of plant cell wall.

Tissue and tissue systems - meristematic tissue, permanent tissue and secretary cells.

Classification of meristem: (apical, intercalary and lateral), primary and secondary meristem.

Apical meristem: Theories on organization of meristem (apical cell theory, Tunica-Corpus theory, histogen theory and Korper-Kappe theory), quiescent centre, Root cap.

Evolution and concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory continuing meristematic residue, cytohistological zonation).

Unit II: MORPHOGENESIS AND DIFFERENTIATION 14 Hrs.

Morphogenesis in plants - Differentiation of root, stem and leaf.

Types of vascular bundles and Vascular cambium, Origin, development, arrangement and diversity in size and shape of leaves.

Structure of Dicot root: primary and secondary structures (Tridax/Sunflower), Structure of monocot root (Maize).

Structure of Dicot stem: Primary and secondary structures (Tridax/Sunflower), Structure of Monocot stem (Maize), Nodal anatomy.

Structure of Dicot leaf: primary structure (Tridax/Sunflower), primary structure of Monocot leaf (Maize), Stomatal types. Anomalous secondary growth: Aristolochia, Boerhaavia (dicot stem) Dracaena (monocot stem)

Applications in systematics, forensics and Pharmacognosy.

DEVELOPMENT BIOLOGY

Unit III: Morphogenesis and Differentiation 14 Hrs.

Differentiation and cell polarity in acellular (*Dictyostelium*), Unicellular (*Acetabularia*) and multicellular system (root hair and stomata formation) Shoot Apical meristem (SAM): Origin, structure and function, Cytohistological zonation and Ultrastructure of meristems. Organogenesis: Differentiation of root, stem, leaf and axillary buds, bud dormancy

Mechanism of leaf primordium initiation, development and Phyllotaxis (Diversity in size and shape of leaves)

Structure and function of root apical meristem (RAM): Root cap, quiescent centre and origin of lateral roots.

Transition from vegetative apex into reproductive apex

Developmental patterns at flowering apex: ABC model specification of floral organs. Modification of gene action by growth hormones and cellular differences between floral organs. Senescence – a general account.

Unit IV: Reproductive Biology 14 Hrs.

Introduction, Scope and contributions of Indian embryologists: P. Maheswari, B G L Swamy, P.Maheshwari, M.S. Swaminathan and K.C. Mehta.

Microsporangium: Development and structure of mature anther, Anther wall layers, Tapetum -types, structure and functions and sporogenous tissue.

Microsporogenesis - Microspore mother cells, microspore tetrads, Pollinia.

Microgametogenesis – Formation of vegetative and generative cells, structure of male gametophyte. Pollen embryosac (Nemec phenomenon).
Megasporangium – Structure of typical Angiosperm ovule. Types of ovule - Anatropous, Orthotropous, Amphitropous, Circinotropous. **Megagametogenesis –** Types of development of Female gametophyte/embryosac- monosporic- *Polygonum* type, bisporic – *Allium* type, tetrasporic - *Fritillaria* type. Structure of mature embryosac.
Pollination and fertilization: Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes.
Endosperm – Types and its biological importance. Free nuclear (*Cocos nucifera*) cellular (*Cucumis),* helobial types. Ruminate endosperm.
Embryogenesis – Structure and composition of zygote ,Dicot (*Capsella bursa-pastoris)*and Monocot (*Najas)* embryo development. A general account of seed development.

B.Sc. BOTANY: Semester - 3
Practical: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
DSCC 033 BOT 012: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
033 BOT 012	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

LIST OF EXPERIMENTS TO BE CONDUCTED

Practical No.1
i) Study of meristem (Permanent slides/ Photographs).
ii) Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma) and Complex Tissues (xylem and phloem).

Practical No.2
Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root, stem and leaf (Sunflower) and monocot root, stem and leaf (Maize).

Practical No.3
Study of Normal secondary growth structure in dicot stem and root (Sunflower) and Anomalous secondary growth: *Aristolochia, Boerhaavia* (dicot stem) *Dracaena* (monocot stem).

Practical No. 4
Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials.

Practical No. 5
Permanent slides of Microsporogenesis and male gametophyte Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis.

Practical No. 6
Pollen germination (hanging drop method) and Effect of Boron and Calcium on pollen germination.

Practical No. 7
Permanent slides of types of ovules, Megasporogenesis & embryosac development and types of placentation: Axile, Marginal and Parietal types. Sectioning of ovary, for the studied types of placentation.

Practical No. 8
Mounting of embryo: Tridax and Cyamopsis, Mounting of endosperm: Cucumis.

Practical No. 09
Histochemical localization of proteins/ carbohydrates.

Practical No. 10 and 11
Mini project work in groups of 3-5 students, from the following list
a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.
b) Pollen germination of different pollen grains and calculates percentage of germination.
c) Calculating percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.
d) Study of placentation of different flowers.
e) Any other relevant study related to Anatomy / Embryology.

Pedagogy
Scheme of Practical Examination (Distribution of Marks): 25 Marks for semester end Examination.

1. Practical: 15 (3X5 to cover all the Practicals) Marks/ Based on Nature of Practical/ Optional/Availability of specimen/ Infrastructure/ Sectioning and staining/ Mounting (may be modified).
2. Viva: 05 Marks.
3. Journal: 05 Marks.
   Total 25 Marks.
   Note: The same scheme may be used for IA (Formative assessment) Examination.

Text Books for Reference:

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms**,** Woong-Young Soh, Springer Netherlands,
3. Coutler E. G. , 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
4. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
6. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
10. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
11. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
12. Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
13. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
14. Pandey S.N. 1997, Plant Anatomy and Embryology. A. Chadha, Vikas Publication House Pvt Ltd;
15. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi

16. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
17. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
18. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
19. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
20. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publications.
21. N. N. Bhandari The Microsporangium.
22. F. Bouman The Ovule.
23. M. T. M. Willemse, J. L. van Went: The Female Gametophyte.
24. R. B. Knox :The Pollen Grain.
25. J. L. van Went, M. T. M. Willems :Fertilization.

B.Sc. – III Semester
Subject: Botany
Open Elective Course (OEC - 3)
(OEC for other students)
Code: OEC-003 BOT 051

Cou rse No.	Type of Cour se	Theory / Practical	Credi ts	Instructio n hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
003 BOT 051	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-3 (OEC for other students): 003 BOT 051
Title of the Paper: BOTANICAL GARDEN AND LANDSCAPING

Learning outcomes:

After the completion of this course the learner will be able to:

- Apply the basic principles and components of gardening
- Conceptualize flower arrangement and bio-aesthetic planning
- Design various types of gardens according to the culture and art of bonsai
- Distinguish between formal, informal and free style gardens
- Establish and maintain special types of gardens for outdoor and indoor land scaping

Keywords:

Gardening, Landscaping, Flower arrangement, Vertical gardens, Roof gardens,Computer aided designing

Unit I **14 lectures**

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Green house, Special types of gardens, trees, their design, values in land scaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, planting, climbers and creepers, palms, ferns, grasses and cacti succulents.

Unit II **14 lectures**

Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.

Unit III **14 lectures**

Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens. Land scape designs, Styles of garden, formal, informal and freestyle gardens, types of gardens, Urban land scaping, Land scaping for specific situations, institutions, industries, residents, hospitals, road sides, traffic islands, dam sites, IT parks, corporate. Establishment and maintenance, special types of gardens, Bio-aesthetic planning, eco- tourism, indoor gardening, therapeutic gardening, non-plant components, water-scaping, xeri-scaping, hardscaping; Computer Aided Designing (CAD) for outdoor and indoor scaping Exposure to CAD (Computer Aided Designing) components of a nursery, sowing, pricking, use of greenhouse for nursery production, propagation through cuttings, layering, grafting and budding.

Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethno-botany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India.

Suggested Readings

1. Berry, F. and Kress, J. (1991). Heliconia: An Identification Guide. SmithsonianBooks

2. Butts, E. and Stensson, K. (2012). Sheridan Nurseries: One hundred years ofPeople, Plans, and Plants. Dundurn Group Ltd.

3. Russell, T.(2012). Nature Guide: Trees: The world in your hands (Nature Guides).

Details of Formative Assessment (IA) For DSCC theory/OEC: 40% weightage for Total Marks

Type of Assessment	Weightage	Duration	Comment
Written Test- 1	10%	1 hrs	8th Week
Written Test- 2	10%	1 hrs	12th Week
Seminar	10%	10 minutes	-----
Case study/ Assignment/ Field work/ Project work/ Activity	10%	-----	-----
Total	40% of the Maximum marks allotted for the Paper		

Faculty of Science
04- Year UG Honors Programme: 2022-23

General Pattern of Theory Question paper for DSCC/ OEC
(60 Marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-6 carries 2 marks each. Answer any 5 questions. :10 marks

Part- B

2. Question number 7-11 carries 5 marks each. Answer any 4 questions. :20 marks

Part- C

3. Question number 12- 15 carries 10 marks each. Answer any 3 question. : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Format for Model Question paper Unit wise
DSCC 033 BOT 012: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----1 Unit III ----1 Unit IV ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----1 Unit IV ----1 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----1 Unit II ----1 Unit III ----1 Unit IV ----1 Total- 4	3	10	30

OEC-003 BOT 051
BOTANICAL GARDEN AND LANDSCAPING

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----2 Unit III ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----2 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----2 Unit II ----1 Unit III ----1 Total- 4	3	10	30

B.Sc.: Semester – IV
Subject: Botany
Discipline Specific Core Course (DSCC)
The Course Botany in III semester has two papers (Theory paper- 033 BOT 011 for 04 credits and Practical paper- 033 BOT 012 for 02 credits) for 06 credits: Both the papers are compulsory, Details of the courses are as

Course no: 7
Course Code: 034 BOT 011

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
04	56	02	56

Title of the course (theory): DSSC ECOLOGY AND CONSERVATION BIOLOGY

Course outcome
Students will be able to

- Know the principles and concept of ecosystems- Components, productions, Energy and limiting factors.
- Know the concepts of productivity, measurements of productivity, food chain, food webs and trophic levels
- Understand the diversity and characters of major ecosystems – Aquatic (Marine and Freshwater), Terrestrial and Agricultural ecosystems
- Know the Concept of biotic community with their Size and structure of biotic community- Physiognomy, Life-forms, stratification, ecotones and concept of edge-effect.
- Understand the causes and patterns of ecological succession, concept of climax.
- Know the Concept of ecological niches, species coexistence, overlapping and niche segregation.
- Know the concept of Eutrophication, Heavy metal pollution, Ozone depletion, greenhouse effect, Global warming and its effect, Acid rains. Pesticide, particulate and nuclear radiation.
- Understand the Solid wastes. Noise Pollution. Pest population and its biological control, invasive species and their effects on native species in aquatic and terrestrial ecosystems.
- Know the Patterns of diversity in a community, Diversity measurement and indices.
- Understand the Global distribution of organisms, concept of islands, biodiversity hotspots. Methods of conservation of biodiversity.Centers for origin of cultivator plants.
- Know the population density, Natality and mortality. Life table, population growth curves, carrying capacity.
- Know the positive and negative interactions among the organisms.

Contents of Theory Course		
Unit 1	**Topics**	**Teaching Hours**
I	**Introduction to Ecology and Conservation Biology:** Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organisation. **Ecological factors:** Climatic factors: light, temperature, precipitation and humidity. **Edaphic factors**: Soil and its types, soil texture, soil profile, soil formation; physico-chemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms. Topographic Factors: Altitude	14 hrs

	Ecological groups of plants and their adaptations: Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.	
II	**Ecosystem Ecology:** Introduction, types of ecosystems with examples -terrestrial and aquatic, natural and artificial. Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem. Ecosystem functions and processes: Food chain-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem. Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle-Phosphorus. Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere. **Community Ecology:** Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes. Intra-specific and Inter-specific interactions with examples. **Ecological methods and techniques:** Methods of sampling plant communities – transects and quadrates. Remote sensing as a tool for vegetation analysis, land use – land cover mapping. **Population Ecology:** Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves and dispersal.	14 hrs
III	**Phytogeography and Environmental issues:** Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov's concept, types. Phytogeographical regions – concept, phytogeographical regions of India. Vegetation types of Karnataka – Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shoal forests and grasslands. An account of the vegetation of the Western Ghats. Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment). Water pollution disasters – National mission on clean Ganga , Minimata, Pacific gyre garbage patch, Exxon valdez oil spill. Air pollution: Causes, effect, air quality standards, acid rain, control. Soil pollution: Causes, effect, solid waste management, control measures of soil pollution.	14hrs
IV	**Biodiversity and its conservation:** Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity. SDG's in biodiversity conservation. Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding plants. NTFP. Threats to biodiversity. Concept of Biodiversity Hotspots, Biodiversity hot spots of India. Concept of endemism and endemic species. ICUN plant categories with special reference to Karnataka/ Western Ghats. Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002). Conservation methods – *In-situ* and *ex-situ* methods	14 hrs

	In-situ methods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves. *Ex-situ* methods-Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.	
Total		**56 Hours**

SUGGESTED REFERENCE BOOKS:

1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.
3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
6. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.
7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
8. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel.
10. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers.

B.Sc. BOTANY: Semester - 4
Theory: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
DSSC 034 BOT 012: ECOLOGY AND CONSERVATION BIOLOGY

LIST OF PRACTICALS TO BE COUNDUCTED

Practical No.	Experiments
1	Determination of pH of different types of Soils, Estimation of salinity of soil/water samples.
2	Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc
3	Hydrophytes: Morphological adaptations in *Pistia, Eichhornia, Hydrilla, Nymphaea.* Anatomical adaptations in *Hydrilla*(stem) and *Nymphaea* (petiole).
4	Xerophytes: Morphological adaptations in *Asparagus, Casuarina, Acacia, Aloe vera, Euphorbiatirucalli.* Anatomical adaptations in phylloclade of *Casuarina* .
5	Epiphytes: Morphological adaptations in *Acampe, Bulbophyllum, Drynaria*.Anatomical adaptations in epiphytic root of *Acampe/ Vanda.* Halophytes: study of Viviparyin mangroves, Morphology and anatomy of Pneumatophores.
6	Study of a pond/forest ecosystem and recording the different biotic and abiotic components
7	Demonstration of different types of vegetation sampling methods – transects and quadrats. Determination of Density and frequency.
8	Application of remote sensing to vegetation analysis using satellite imageries
9	Field visits to study different types of local vegetations/ecosystems and the report to be written in practical record book.
10	Determination of water holding capacity of soil samples
11	Determination of Biological oxygen demand (BOD)
12	Determination of Chemical oxygen demand (COD)
13	Determination of soil texture of different soil samples.

Pedagogy
Scheme of Practical Examination (Distribution of Marks): 25 Marks for semester end Examination.

1. Practical: 15 (3X5 to cover all the Practicals) Marks/ Based on Nature of Practical/ Optional/Availability of specimen/ Infrastructure/ Sectioning and staining/ Mounting (may be modified).
2. Viva: 05 Marks.
3. Journal: 05 Marks.
   Total 25 Marks.
   Note: The same scheme may be used for IA (Formative assessment) Examination.

B.Sc. BOTANY – IV Semester
Open Elective Course (OEC - 4)
(OEC for other students)
Paper: MEDICINAL PLANTS IN HEALTH CARE
Code: OEC-004 BOT 051

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. ofLectures / Hours / Semester	Duration ofExam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC -004 BOT 051	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

Learning outcomes:

On completion of this course, the students will be able to:

- Recognize the basic medicinal plants
- Apply techniques of conservation and propagation of medicinal plants.
- Setup process of harvesting, drying and storage of medicinal herbs
- Propose new strategies to enhance growth of medicinal herbs considering thepractical issues pertinent to India

Keywords:

Medicinal plants, Traditional systems, endangered medicinal plants, Ethnobotany, Folk medicines, Ethnic communities

Unit I: History and Traditional System of Medicine **14 lectures**

History, Scope and Importance of Medicinal Plants; Traditional systems of medicine;Definition and Scope.

Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana,plants used in ayurvedic treatments,
Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine.
Unani: History, concept: Umoor-e-tabiya, tumors treatments / therapy, polyherbal formulations.

Unit II: Conservation, Augmentation and Ethnobotany and Folk Medicine 14 lectures

Conservation of Endemic and endangered medicinal plants, Red list criteria; *In situ* **conservation: Biosphere reserves, sacred groves, National Parks;** *Ex situ* **conservation: Botanic Gardens, Ethnomedicinal plant Gardens.**

Propagation of Medicinal Plants: Objectives of the nursery, its classification, important

Unit III Medicinal Plants **14 lectures**

Brief description of selected plants and derived drugs, namely Guggul (*Commiphora*) for hypercholesterolemia, *Boswellia* for inflammatory disorders, Arjuna (*Terminalia arjuna*) for cardioprotection, turmeric (*Curcuma longa*)f or wound healing, antioxidant and anticancer properties, Kutaki (*Picrorhiza kurroa*) for hepatoprotection, Opium Poppy for analgesic and antitussive, *Salix* for analgesic, *Cincona* and *Artemisia* for Malaria, *Rauwolfia* as tranquilizer, Belladona as anticholinergic, *Digitalis* as cardiotonic, *Podophyllum* as antitumor.

Suggested Readings:

1. Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press.
2. AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yogaand Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
3. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). *Aush Gyanya*: Handbook of Medicinal and Aromatic Plant Cultivation.
4. Dev, S. (1997). Ethno-therapeutics and modern drug development: The potential of Ayurveda. *Current Science* 73:909–928.
5. Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16thedn. Philadelphia, PA: Elsevier Saunders Ltd.
6. Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi
7. Kapoor, L.D. (2001). Handbook of Ayurvedic medicinal plants. Boca Raton, FL: CRC Press.
8. Saroya, A.S. (2017). Ethnobotany. ICAR publication.
9. Sharma, R.(2003). Medicinal Plants of India-An Encyclopaedia. Delhi: DayaPublishing House.
10. Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House,Delhi.
11. Thakur, R.S., H.S. Puri, and Husain, A.(1989). Major medicinal plants of India.Central Institute of Medicinal and Aromatic Plants, Lucknow, India.

Details of Formative Assessment (IA) For DSCC theory/OEC: 40% weightage for Total Marks

Type of Assessment	Weightage	Duration	Comment
Written Test- 1	10%	1 hrs	8th Week
Written Test- 2	10%	1 hrs	12th Week
Seminar	10%	10 minutes	-----
Case study/ Assignment/ Field work/ Project work/ Activity	10%	-----	-----
Total	40% of the Maximum marks allotted for the Paper		

Faculty of Science
04- Year UG Honors Programme: 2022-23

General Pattern of Theory Question paper for DSCC/ OEC
(60 Marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-6 carries 2 marks each. Answer any 5 questions. :10 marks

Part- B

2. Question number 7-11 carries 5 marks each. Answer any 4 questions. :20 marks

Part- C

3. Question number 12- 15 carries 10 marks each. Answer any 3 question. : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Format for Model Question paper Unit wise
DSCC 034 BOT 011: DSCC ECOLOGY AND CONSERVATION BIOLOGY

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----1 Unit III ----1 Unit IV ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----1 Unit IV ----1 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----1 Unit II ----1 Unit III ----1 Unit IV ----1 Total- 4	3	10	30

OEC-004 BOT 051
MEDICINAL PLANTS IN HEALTH CARE

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----2 Unit III ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----2 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----2 Unit II ----1 Unit III ----1 Total- 4	3	10	30

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

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No. KU/Aca(S&T)/SSL-394A/2022-23/1056 Date: 23 SEP 2022

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯ ಸಭೆಯ ಠರಾವುಗಳ ದಿನಾಂಕ: 06.09.2022
3. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂ. 01, ದಿನಾಂಕ: 17.09.2022
4. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 22-09-2022

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, **ವಿಜ್ಞಾನ** & **ತಂತ್ರಜ್ಞಾನ** ನಿಕಾಯದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ (NEP)-2020 ರಂತೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗಾಗಿ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. www.kud.ac.in ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತಾ, ವಿದ್ಯಾರ್ಥಿಗಳು ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ / ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

Four - Year B.Sc. (Hons.) Program

SYLLABUS FOR SEM III & IV

Course: CHEMISTRY

SEMESTER - III:

DISCIPLINE SPECIFIC CORE COURSE(DSCC)

DSCC – 5 : Chemistry (Theory) - I (Code:033CHE011)

DSCC – 6 : Chemistry (Practical) - II (Code:033CHE012)

OEC- 3 : Chemistry in daily life (Code: 003CHE051)

SEMESTER - IV:

DSCC – 7 : Chemistry (Theory) - III (Code:034CHE011)

DSCC - 8 : Chemistry (Practical) - IV (Code:034CHE012)

OEC- 4 : Molecules of life (Code:004CHE051)

Effective from 2022-23

AS PER N E P - 2020

Karnatak University, Dharwad

Sem	Type of Course	Course Code	Instruction hour per week (hrs)	Total hours of Syllabus / Sem	Duration of Exam (hrs)	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC -5 Chemistry (Theory) - V	033CHE011	04	56	02	40	60	100	04
	DSCC -6 Chemistry (Practical) - VI	033CHE012	04	52	03	25	25	50	02
	OEC- 3 Industrial & Environmental Chemistry	003CHE051	03	42	02	40	60	100	03
IV	DSCC -7 Chemistry (Theory) - VII	034CHE011	04	56	02	40	60	100	04
	DSCC -8 Chemistry (Practical) - VIII	034CHE012	04	52	03	25	25	50	02
	OEC- 4 Analytical Chemistry	004CHE051	03	42	02	40	60	100	03
Details of the other Semesters will be given later									

Programme Specific Outcome (PSO):

After the completion of 03/ 04 years Degree in Chemistry , students will be able to:

PO 13 : Demonstrate, solve and an understanding of major concepts in all the disciplines of chemistry.

PO 14 : Provide students with broad and balanced knowledge and understanding of key chemical concepts.

PO 15 : Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.

PO 16 : Apply standard methodology to the solutions of problems in chemistry.

PO 17 : Provide students with knowledge and skill towards employment or higher education in chemistry or multi-disciplinary areas involving chemistry.

PO 18 : Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.

PO 19 : Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.

PO 20 : Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.

PO 21 : To prepare students effectively for professional employment or research degrees in chemical sciences.

PO 22 : To cater to the demands of chemical industries of well-trained graduates.

PO 23 : To build confidence in the candidate to be able to work on his own in industry andinstitution of higher education.

PO 24 : To develop an independent and responsible work ethics.

B.Sc. Semester – III

DSCC-5 : Chemistry (Theory) V (Code: 033CHE011)

Course Outcomes (CO):

After completion of course, Chemistry (Theory) - V students will be able to:

CO1: Explain free electron theory, physical properties of metals, distinguish between conductors, insulators, extrinsic and intrinsic semi conductors, Appreciate the importance of Hydrogen bond, applications of hydrogen bonding, van der Waals forces and factors affecting the strength and magnitude of van der Waals forces.

CO2 : Explain anomalous properties of lithium, diagonal relationship among elements preparation, uses, structure and bonding in diborane, borazine, boron nitride, carboranes, classification of silicates and their structures, oxides and oxyacids of nitrogen, oxoacids of phosphorus, sulphur and chlorine, inter halogen compounds and xenon compounds.

CO3: Understand preparation, general mechanism and named reactions of benzene and alkyl benzenes.

CO4: Describe theory of orientation, explanation on the basis of stability of sigma complex using electron withdrawing and electron donating groups.

CO5: Understand relative synthesis, mechanisms and reactivities of halogen in alkyl halides, vinyl halides, allyl halides, aryl halides and aryl-alkyl halides.

CO6: Know different methods of synthesis of primary, secondary and tertiary their reactions and mechanisms.

CO7:. Understand different thermodynamic processes, first law of thermodynamics, work done, significance of enthalpy, Joule-Thomson effect and applications Kirchhoff's equation

CO8: Derive Nernst distribution law and under different molecular states.

CO9: Acquaint with the industrial applications of Nernst distribution law.

CO10: Learn the law of chemical equllibrium, Le-Chatelier's principle, relations between Kp, Kc and Kx, ionic equilibria, hydrolysis, pH, common ion effect, solubility and solubility product.

CO11: Understand the principles and processes of metallurgy, extraction of d and f block elements and powder metallurgy.

CO12: Aware of alloys, purpose of making, composition and significance of alloys.

Syllabus DSCC-5: Chemistry (Theory) - V (Code: 033CHE011)	Total Hrs: 56
UNIT-I : CHEMICAL BONDING & CHEMISTRY OF s- & p- BLOCK ELEMENTS	**14 hrs**
Metallic Bond: Explanation of physical properties of metals (conductivity, lustre, malleability, ductility and cohesive force) based on free electron theory. Band theory of metals to explain conductors, insulators, extrinsic and intrinsic semi conductors. **Hydrogen bond:** Definition, properties and types of hydrogen bond. Consequences of hydrogen bonding. **van der Waals forces**: Definition and types of van der Waals forces. Factors affecting the strength and magnitude of van der Waals forces. **(4 Lectures)** **Chemistry of s- and p- block elements**: General characteristics, anomalous properties of lithium. Diagonal relationship of Li with Mg, and Be with Al. Preparation, uses, structure and bonding in diborane, borazine, boron nitride and carboranes. Silicates-Classification and structures. Preparation, properties and structure of oxides and oxyacids of nitrogen. Preparation and bonding in oxoacids of phosphorus, sulphur and chlorine. Inter halogen compounds (preparation and bonding in ClF_3, BrF_5 and IF_7), Xenon compounds- XeF_2, XeF_4, XeF_6 , $XeOF_4$ and XeO_3 (preparation and bonding). **(10 Lectures)**	
UNIT-II AROMATIC HYDROCARBONS , ALKYL HALIDES, ARYL HALIDES & ALCOHOLS	**14 hrs**
Aromatic Hydrocarbons Preparation of benzene and alkyl benzenes (Aromatization, cyclic polymerization of ethyne, hydrodealkylation, Wurtz-Fittig reaction). General mechanism for electrophilic aromatic substitution, examples of halogenation, nitration, sulphonation and Friedel-Craft alkylation and acylation reaction. Limitations of Friedel Craft's alkylation. Theory of orientation, explanation on the basis of stability of sigma complex using electron withdrawing and electron donating groups (explain with the energy profile diagram). Oxidation of side chain (Benzene with alkyl groups $-CH_3$, $-CH_2CH_2CH_3$ and 1,4-dimethyl benzene) **(5 Lectures)** **Alkyl and Aryl halides:** Alkyl Halides**:** Relative reactivities of halogen in alkyl halides, vinyl halides, allyl halides, aryl halides and aralkyl halides. Nucleophilic substitution reactions : S_N1 and S_N2 reactions and their mechanisms, stereochemistry and comparison. S_Ni reaction and mechanism. Aryl-halides: Synthesis of aryl halide from phenols, Sandmeyer's reaction, Gattermann reaction, Raschig-Hooker process and Balz-Schiemann reaction. Aromatic Nucleophilic Substitution reactions : S_NAr, S_N1 and *via* Benzyne intermediate along with mechanisms. Effect of nitro substitution on aromatic nucleophilic substitution reactions. **(5 Lectures)** **Alcohols:** Synthesis of primary, secondary and tertiary alcohols using Grignard reagent, ester hydrolysis. Reduction of aldehydes and ketones, carboxylic acids and	

esters.Reactions of alcohols with halo acids, esterification reaction and oxidation of alcohols with PCC, $KMnO_4$, Conc. HNO_3 and dichromate salt and Oppenauer oxidation. Diols**:** Oxidation of diols, Mechanism of Pinacol-Pinacolone rearrangement. **(4 Lectures)**	
UNIT-III: THERMODYNAMICS I, DISTRIBUTION LAW AND SURFACE CHEMISTRY	**14 hrs**
Thermodynamics I: Thermodynamic processes, heat, work and internal energy, first law of thermodynamics. Concept of enthalpy, derivation of work done in isothermal and adiabatic expansion (T-V and P-V relationships) of an ideal gas for reversible and irreversible processes, numerical problems, Joule-Thomson effect and its derivation. Joule-Thomson co-efficient and its derivation. Effect of temperature on enthalpy of reaction (Kirchhoff's equation). **(5 Lectures)** **Distribution law:** Nernst distribution law and thermodynamic derivation of partition co-efficient. Distribution law for changes in molecular state. (association and dissociation). Applications in solvent extraction- simple and multiple extractions. Derivation for multiple extractions, numerical problems. **(4 Lectures)** **Chemical and Ionic Equilibria:** Law of chemical equilibrium and its thermodynamic derivation. Factors affecting equilibria (Le-Chatelier's principle). Relations between Kp, Kc and Kx for reactions involving ideal gases. Ionization of acids and bases, hydrolysis of three types of salts and derivation for determination of pH of their solutions. Numerical problems. Common ion effect, solubility and solubility product of sparingly soluble salts. **(5 Lectures)**	
UNIT-IV: INDUSTRIAL CHEMISTRY-I	**14 hrs**
Principles and processes of metallurgy: Minerals, ores, steps in metallurgy (crushing, concentration, calcination, roasting, smelting/reduction, refining). Characteristics, uses and limitations of Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy. Extraction of titanium from ilmenite, chromium from chromite, nickel by Mond's process and tungsten from wolframite, Extraction of thorium from monazite sand, and uranium from pitchblende. Powder metallurgy-preparation, uses and advantages. **(11 Lectures)** **Alloys-**Purpose of making alloys, preparation of alloys. Alloy steels-(ferrous alloys) specific effect of alloying elements, applications of alloy steels. Non- Ferrous alloys: composition, characteristics and uses of copper, nickel, zinc and aluminum alloys. **(3 Lectures)**	

Recommended Books/References

1. Modern Inorganic Chemistry: R.D.Madan, S.Chand and Co.Ltd, New Delhi, 2019
2. Chemistry of degree students, R.L.Madan, S.Chand and Co.Ltd, New Delhi.
3. Concise Inorganic Chemistry: J. D. Lee, , 5th Edn, New Age International (1996)
4. Basic Inorganic Chemistry, Cotton, F.A., Wilkinson, G. & Gaus, P.L., 3rd Ed., Wiley.
5. University Chemistry Mahan, B.H. 3rd Ed. Narosa (1998).
6. A Guidebook to Mechanism in Organic Chemistry Peter Sykes, Orient Longman, New Delhi (1988).
7. Advanced Organic Chemistry, Bahl, A. & Bahl, B.S., S. Chand publications, 2010.
8. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
9. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
10. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
11. Organic Chemistry- Mehta and Mehta, 2005.
12. Physical Chemistry W.J. Moore:, 1972.
13. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
14. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
15. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co. 1987.
16. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.
17. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpad Rai and Sons, Delhi, Jalandhar, 1995.
18. Synthetic Organic Chemistry: Gurudeep R. Chatwal. Himalaya Publishing House – 1990.
19. Industrial Chemistry, Clerk Ranken MJP Publisher.
20. Industrial Chemistry, Vijay Varma, Arjun Publishing House.
21. Industrial Chemistry, B.K.Sharma, 9th Edn. Krishna Prakashan Media (P) Ltd. Meerut (1997-98)

B.Sc. Semester – III

DSCC-6: Chemistry (Practical) - VI (Code: 033CHE012)

Course Outcomes (CO):

After completion of Chemistry (Practical) – VI, students will be able to:

CO1: Understand solubility, solubility product, common ion effect, their applications. Physico-chemical principles of separation of cations into groups in qualitative analysis of inorganic salts

CO2: Develop the skill to perform Semi-micro qualitative analysis of mixtures of two simple inorganic salts containing two anions and two cations.

CO3: Able to write the chemical reactions involved in the analysis.

CO6: Study the preparation and mechanism of reactions, recrystallization, determination of melting point and calculation of quantitative yields.

CO7: Prepare the organic compound with bromination, nitration, acetylaton, hydrolysis oxidation and reduction

Syllabus **DSCC-6: Chemistry (Practical) - VI (033CHE012)**	**Total Hrs: 52**
INORGANIC CHEMISTRY EXPERIMENTS	
Explanation of solubility, solubility product, common ion effect and their applications in separation of cations into groups in qualitative analysis of inorganic salts (students should write in the journal regarding the above). **Experiments 1 to 6:** Systematic semi-micro qualitative analysis of mixtures of two simple inorganic salts containing two anions and two cations. Anions: CO_3^{2-}, Cl^-, Br^-, NO_3^-, SO_4^{2-}, $C_2O_4^{2-}$ and BO_3^{3-} Cations: Cu^{2+}, Al^{3+}, Fe^{2+}, Mn^{2+}, Ni^{2+}, Zn^{2+}, Ca^{2+}, Ba^{2+}, Mg^{2+}, Na^+, K^+ and NH_4^+. Note: Student has to write ionic reactions for group test and CT for anions and cations **Distribution of Marks:** Preliminary tests and presentation - 03 marks , Anions (group test + C.T +ionic reactions) (1+1+1)×2=6 marks, Cations (group test + C.T+ ionic reactions) (1+2+1)×2=8 marks, Journal-3 marks, Viva-Voce-5 marks, Total=25 marks.	
ORGANIC CHEMISTRY EXPERIMENTS	
Experiment No 7 to 12: Preparation of organic compounds 7. Acetylaton - Synthesis of acetanilide from aniline using Zn Dust/AcOH. (Green method) 8. Bromination – Acetanilide to p-bromo acetanilide. 9. Nitration – Acetanilide to p-nitro acetanilide. 10. Hydrolysis - Benzamide to benzoic acid. 11. Oxidation – Benzaldehyde to benzoic acid.	

12. Reduction – m-dinitrobenzene to m- nitro aniline. Note: Student has to write mechanism of reactions, calculation of quantitative yield, determination of melting point and to perform recrystallization. **Distribution of Marks:** Reaction & Mechanism-04 marks, calculation of theoretical yield – 02 mark, observed yield -08 marks, M.P- 03 marks, Journal – 03 marks , Viva-Voce-5 marks,(Total=25 marks.) **Deduction of marks for observed yield:** Less than 10% - 8 marks, 11-15% - 6 marks, 16-20% - 4 marks, 21-25 % - 2 marks & above 25% - zero mark.	
I **General instructions:** In the practical examination, in a batch of ten students, five students each will be performing inorganic and organic experiments. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the Examination*.	

Books recommended:

1. Vogel's Qualitative Inorganic Analysis, G.Svehla, 7th Ed, Longman (2001).
2. Advanced Practical Chemistry, agadamba Singh, R.K.P. Singh, Jaya Singh, L.D.S.Yadav, I.R. Siddiqui, Pragati prakashan, 7th edition, 2017.
3. College Practical Chemistry: V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati. University Press-2011.
4. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.
5. Comprehensive Practical Organic Chemistry: V K Ahluwalia, and Renu Aggarwal, University Press-2000.

B.Sc. Semester – III

OEC- 3: Industrial & Environmental Chemistry (Code: 003CHE051)

Course Outcome (CO):

After completion of course, Industrial Chemistry, students will be able to:

CO1: Understand minerals, ores, steps in metallurgy, extraction of metals of d & f block elements and powder metallurgy-preparation,

CO2: Appreciate purpose of making, preparation, composition and applications of alloys.

CO3: Explain manufacture of glass, ceramics, Portland cement, chemical composition of cement, setting and hardening of Portland cement, Electroplating of nickel and chromium, Primary and secondary batteries, battery components and their role.

CO4: Explain sources of energy, nuclear fusion/fission, solar energy, hydrogen and geo-thermal energy.

CO5: Know air pollutants, control measures of air pollution, photochemical smog, green house effect, global warming and ozone depletion.

CO6: Aware of water pollutants and their sources, industrial effluents and their treatment, sludge disposal, water quality parameters for waste water, industrial water and domestic water, disposal of nuclear waste, nuclear disaster and its management.

Syllabus **OEC- 3: Industrial & Environmental Chemistry (Code: 003CHE051).**	**Total Hrs:** **42**
UNIT-I METALLURGY & ALLOYS	**14 hrs**
Metallurgy: Minerals, ores, steps in metallurgy (crushing, concentration, calcination, roasting, smelting/reduction, refining), Extraction of titanium from ilmenite, chromium from chromite, nickel by Mond's process and uranium from pitchblende. Powder metallurgy-preparation, uses and advantages. **(10 Lectures)** **Alloys-** Purpose of making alloys, preparation of alloys. Alloy steels-(ferrous alloys) specific effect of alloying elements, applications of alloy steels. Non- Ferrous alloys: composition, characteristics and uses of copper, nickel, zinc and aluminum alloys. **(4 Lectures)**	
UNIT-II GLASS, CERAMICS, CEMENT, PROTECTIVE COATINGS & BATTERY	**14 hrs**
Glass and Ceramics: General properties, silicate and non silicate glasses, raw materials used, manufacture, types of glass and their applications**.** Types and manufacture, high-technology ceramics and their applications, super conducting and semi-conducting oxides. **(4 Lectures)** **Cement:** Classification with properties of cement, raw materials used in the manufacture of cement and their functions. Manufacture of Portland cement, chemical composition of cement, setting and hardening of Portland cement. RCC and quick setting cements.	

(3 Lectures) **Carbon materials:** Fullerenes, carbon nanotubes and their applications. **(2 Lectures)** **Protective Coatings:** Metallic coating, electroplating of nickel and chromium. **Battery:** Primary and secondary batteries, battery components and their role. Characteristics of battery. Working of Lead-acid battery, Lithium battery, solid-state electrolyte battery, fuel cells and solar cells. **(5 Lectures)**	
UNIT-III ENERGY AND ENVIRONMENT, AIR, WATER & NUCLEAR POLLUTION AND WATER QUALITY STANDARDS	**14 hrs**
Energy and Environment: Sources of energy: coal, petrol and natural gas. Nuclear fusion/fission, solar energy, hydrogen and geo-thermal energy. **(3 Lectures)** **Air pollution**: Major regions of atmosphere, chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature. Control measures of air pollution. Photochemical smog: its constituents and photochemistry. green house effect, global warming and ozone depletion. **(4 Lectures)** **Water pollution, water quality standards:** Water pollutants and their sources. Industrial effluents and their treatment (primary and secondary treatment). Sludge disposal. Water quality parameters for waste water, industrial water and domestic water. **Nuclear pollution:** Disposal of nuclear waste, nuclear disaster and its management. **(7 Lectures)**	

Recommended Books/References

1. Environmental Chemistry, A. K. De, 6th Edn. New Age International (P) Ltd.,(2008).
2. Environmental Chemistry-S. K. Banerji, (Prentice Hall India), 1993
3. Industrial Chemistry, B.K.Sharma, 9th Edn. Krishna Prakashan Media (P) Ltd. Meerut (1997-98)
4. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Organic Chemistry Morrison, R.T. & Boyd, R.N., Pearson, 2010.
7. Advanced Organic Chemistry Bahl, A. & Bahl, B.S., S. Chand, 2010.
8. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
9. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
10. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
11. Organic Chemistry- Mehta and Mehta, 2005.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

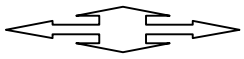
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



B.Sc. Semester – IV

DSCC- 7: Chemistry (Theory) - VII (Code: 034CHE011)

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO1: Understand the general characteristics of d and f- block elements with reference to electronic configuration, colors, variable oxidation states, magnetic properties etc., separation of lanthanoids by ion-exchange method and preparation of trans-uranic elements (up to Z=103).

CO2: Acquaint with general properties and types of inorganic polymers, silicones and phosphazines.

CO3: Learn Bronsted-Lowry concept, Lux-flood concept, Lewis concept and Usanvich-sandvich concept and their limitations. HSAB concept and its applications.

CO4: Gain knowledge of acidic character, comparative acid strengths of alcohols and phenols and mechanism of named reactions.

CO5: Familiar with Williamson's ether synthesis, epoxides and Crown Ethers formation and properties

CO6: Understand the synthesis of aldehydes and ketones, their properties, named reactions mechanism.

CO7: Appreciate the significance of entropy, second law of thermodynamics, change in entropy and other thermodynamic parameters with respect temperature.

CO8: Know types of **a**dsorption isotherms, types of catalysis and their theories with examples and autocatalysis.

CO9: Know the manufacture, properties and applications of glass and cement.

CO10: Understand types, composition and manufacture of fertilizers.

CO11: Appreciate the paints and pigments formulations, composition and related properties.

CO12: Learn the types, manufacture of soaps, detergents and their cleansing actions.

Syllabus **DSCC- 7: Chemistry (Theory) - VII (Code: 034CHE011)**	**Total Hrs: 56**
UNIT-I : CHEMISTRY OF d- & f- BLOCK ELEMENTS, INORGANIC POLYMERS AND THEORIES OF ACIDS AND BASES	**14 hrs**
Chemistry of d- and f- block elements: General characteristics with reference to electronic configuration, colors, variable oxidation states, magnetic, catalytic properties and ability to form complexes. General characteristics of f-block elements with reference to electronic configuration, oxidation states, colors and magnetic properties. Lanthanide contraction and its consequences. Separation of lanthanoids by ion-exchange method. Preparation of trans-uranic elements (up to Z=103). **(6 Lectures)** **Inorganic Polymers:** General properties and types of inorganic polymers. Comparison with organic polymers. Silicones: Classifications, preparation, properties,	

uses and structure. Phosphazines: Preparation, properties, uses and structure. **(4 Lectures)** Modern concepts of acids and bases, Bronsted-Lowry concept, Lux-Flood concept, Lewis concept and Usanvich-Sandvich concept and their limitations. HSAB concept and its applications. **(4 Lectures)**	
UNIT-II : PHENOLS, ETHERS & CARBONYL COMPOUNDS	**14 hrs**
Phenols: Acidic character, comparative acid strengths of alcohols and phenols, Kolbe's reaction, Claisen rearrangement, Fries rearrangement, Ledrer-Mannase reaction, Reimer-Tiemann reaction. Houben–Hoesch reaction, Schotten – Baumann Reaction. (Mechanism to be discussed for all named reactions**)** **(4 Lectures)** **Ethers:** Preparation of ethers, mechanism of Williamson's ether synthesis, mechanism of synthesis of ethers by inter and intra molecular dehydration of alcohols. Reaction of ethers- mechanism of ether cleavage by strong acids. **Epoxides:** Synthesis from alkenes using peroxides, acid and base catalyzed ring opening of epoxides with mechanism and polyether formation. Crown Ethers: Formation and properties (Phase Transfer Catalyst). **(3 Lectures)** **Carbonyl Compounds:** Structure of carbonyl compounds, synthesis of aldehydes and ketones by oxidation of alcohols, aldehydes by reduction of acyl chloride, esters, nitriles and ketones from Gillmann's reagent. General mechanism of nucleophilic addition to the carbonyl compounds, mechanism of addition of hydrogen cyanide and hydroxyl amine, addition of alcohol, amines and phosphorus ylids. Acidity of α-hydrogens, mechanism of aldol condensation, crossed aldol condensation, Perkin's reaction, Claisen's condensation, Dieckman condensation and Darzen's condensation. Reactions of compounds with no α-hydrogens -mechanism of Benzoin condensation and Cannizaro's reaction, crossed Cannizaro's reaction. Reduction of carbonyl groups via Wolf-Kishner reduction and Meerwein-Pondorff Verley reduction. **(7 Lectures)**	
UNIT-III THERMODYNAMICS-II & SURFACE CHEMISTRY	**14 hrs**
Thermodynamics II: Concept of entropy and its physical significance, thermodynamic scale of temperature, statements of second law of thermodynamics, molecular and statistical interpretation of entropy, calculation of entropy change for reversible and irreversible processes. Free energy functions: Gibbs and Helmholtz energy, variation of S, G, A with T, V and P. Gibbs-Helmholtz equation, free energy change and spontaneity. Numerical problems. Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules. **(8 Lectures)** **Surface chemistry:** Adsorption: Types of adsorption isotherms, Freundlich adsorption isotherm (only equation), its limitations. Langmuir adsorption isotherm and its derivation. BET equation and its derivation, numerical problems. Catalysis**:** Types of catalysis and their theories with examples. Theory of acid-base catalysis, Michaelis-Menten mechanism. Heterogeneous catalysis (unimolecular and bimolecular surface reactions). Applications of heterogeneous catalysts. Autocatalysis with examples. **(6 Lectures)**	

UNIT-IV : INDUSTRIAL CHEMISTRY -II	14 hrs
Glass and Cement: General properties, silicate and non silicate glasses, raw materials used and manufacture. Composition, properties and applications of soda lime glass, lead glass, armored glass, safety glass, borosilicates glass, coloured glass, photosensitive glass.Classification with properties of cement, raw materials used in the manufacture of cement and their functions. Manufacture of Portland cement, chemical composition of cement, setting and hardening of Portland cement. RCC and quick setting cements. **(5 Lectures)** **Fertilizers:** Types of fertilizers, composition of fertilizers, manufacture and uses of urea, calcium ammonium nitrate, ammonium phosphate and super phosphate of lime. Mixed fertilizers (NPK). **(3 Lectures)** **Surface coatings:** Classification of surface coatings. Paints and pigments-formulations, composition and related properties, fillers, thinners, enamels and emulsifying agents. Special paints (heat resistant, fire resistant, eco-friendly and plastics paints). Dyes and wax polishing. **(2 Lectures)** **Soaps and detergents: Composition of soaps, t**ypes of soaps, manufacture of soap(Hot process and modern continuous process. Detergents: Comparison of soaps and detergents, classification of detergents (anionic, cationic and non-ionic). Preparation of detergents (sodium alkyl sulphate, sodium alkyl benzene sulphonates). Mechanism of cleansing action of soap and detergents (Concept of micelles and CMC). Detergents builders and additives (only examples). **(4 Lectures)**	

Recommended Books/References

1. Concise Inorganic Chemistry-J. D. Lee, 5th Edn, New Age International (1996)
2. Modern Inorganic Chemistry Sathya Prakash's by R.D.Madan, S.Chand and Co.Ltd, New Delhi.
3. Inorganic Chemistry-Principles of Structure and Reactivity, 4thEdn-J. E. Huheey, E.A. Keiter, R. L. Keiter and O.K. Medhi. Pearson Education (2009).
4. A Guidebook to Mechanism in Organic Chemistry Sykes, P., Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Organic Chemistry Morrison, R.T. & Boyd, R.N., Pearson, 2010.
7. Advanced Organic Chemistry Bahl, A. & Bahl, B.S., S. Chand, 2010.
8. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
9. Organic Chemistry- Mehta and Mehta, 2005.
10. Physical Chemistry P.W. Atkins:, 2002.
11. Physical Chemistry W.J. Moore:, 1972.
12. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
13. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
14. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co. 1987.
15. Engineering Chemistry, P.C.Jain and Monika Jain, Dhanpad Rai and Sons, Delhi, Jalandhar.
16. Industrial Chemistry, Clerk Ranken MJP Publisher.
17. Industrial Chemistry, Dr. Vijay Varma, Arjun Publishing House.
18. Industrial Chemistry, B.K.Sharma, 9th Edn. Krishna Prakashan Media (P) Ltd. Meerut (1997-98)

B.Sc. Semester – IV

DSCC-8: Chemistry (Practical) - VIII (Code: 034CHE012)

Course Outcomes (CO)

After completion of course (Practical), students will be able to:

CO1: Explain regarding errors, types of errors, accuracy, precision, significant figures, standard deviation, and Use of log table

CO2: Determine the percentage of chlorine in bleaching powder, free acidity in ammonium sulphate fertilizer, phosphoric acid in super phosphate fertilizer, calcium in CAN fertilizer/dolomite ore by complexometric method, copper in brass by iodometric method/ calcium in cement by oxalate method.

CO3: Understand the effect of acid strength on hydrolysis of methyl acetate using HCl and H_2SO_4 , for the pseudo first order reaction.

CO4: Determine the change in enthalpy of solution and ionization.

CO5: Learn the concepts of degree of dissociation, adsorption and distribution law.

Syllabus **DSCC-8: Chemistry (Practical) - VIII (034CHE012)**	**Total** **Hrs: 52**
Unit-I Industrial chemistry experiments	
1. Determination of percentage of available chlorine in bleaching powder (two samples). 2. Determination of free acidity in ammonium sulphate fertilizer (two samples) 3. Determination of phosphoric acid in super phosphate of lime fertilizer (two samples) . 4. Determination of calcium in CAN fertilizer (two samples) /dolomite ore (in duplicate) by complexometric method 5. Determination of copper in brass by iodometric method (two samples) / calcium in cement (in duplicate) by oxalate method 6. Determination of iron in haematite ore (in duplicate) by reduction method ($SnCl_2$) using $K_2Cr_2O_7$ solution **Distribution of marks** 1. Accuracy: (06+06) Marks 2. Technique and presentation : 02Marks 3. Reactions and Calculations: 03 Marks 4. Viva: 05 Marks 5. Journal: 03 Marks Total 25 marks **Deduction of marks for accuracy:** : ±0.4 CC -06 marks, ± 0.6 CC- 04 marks, ±0.8 CC- 02 marks, ±1.0 CC- above 1.0 CC - 01 marks.	
Physical chemistry experiments	
Explanation regarding errors, types of errors, accuracy, precision, significant figures, standard deviation, and Use of log table (students should write in the journal regarding the above). 1. Study the effect of acid strength of HCl and H_2SO_4 on hydrolysis of methyl acetate. 2. Study the effect of concentration on velocity constant of second order reaction:	

$KI + K_2S_2O_8$ (a = b). 3. Study the adsorption of acetic acid on animal charcoal (Freundlich adsorption isotherm). 4. Study the distribution of acetic acid/ benzoic acid between water and toluene. 5. Determination of enthalpy of ionization of acetic acid/enthalpy of solution of KNO_3 by calorimetric method. 6. Determination of degree of dissociation of KCl by Landsberger's method. **Distribution of Marks:** Accuracy-10 marks, Technique and Presentation-3marks Calculation and graph- 4 marks, Journal-3 marks, Viva-Voce-5 marks, Total=25 marks. **Deduction of Marks for accuracy:** Error up to 5% - 10 marks, 6 - 10% - 08 marks, 11-15% - 06 marks, 16-20% - 04 marks, above 20% - zero (0) marks	
General instructions: In the practical examination, in a batch of ten students, five students each will be performing Industrial and physical experiments. . Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. *Manual is not allowed in the examination.*	

Recommended Books/References

1. Vogel's Qualitative Inorganic Analysis, G.Svehla, 7th Ed, Longman (2001).
2. Advanced Practical Chemistry, agadamba Singh, R.K.P. Singh, Jaya Singh, L.D.S.Yadav, I.R. Siddiqui, Pragati prakashan, 7th edition, 2017.
3. College Practical Chemistry: V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati. University Press-2011.
4. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.
5. Comprehensive Practical Organic Chemistry: V K Ahluwalia, and Renu Aggarwal, University Press-2000.

B.Sc. Semester – IV

OEC – 4 : Analytical Chemistry (004CHE051).

Course Outcomes (CO)

After completion of course, Analytical Chemistry students will be able to:

CO1: Understand the principle, classification of volumetric analysis, different methods of expression of concentration term, titration curves of all type of acid-base titrations.

CO2: Understand the theory, titration curves, indicators of precipitation and complexometric titration.

CO3: Acquaint with steps involved in gravimetric analysis and advantages of organic reagents over inorganic reagents.

CO4: Learn the Composition of soil and the determination of pH of soil samples. Estimation of Calcium and Magnesium in the soil.

CO3: Identify pure and contaminated water, water sampling & water purification methods and water quality measurements.

CO4: Understand the principle, techniques and applications of chromatography, paper chromatography, Gas chromatography and High Performance Liquid Chromatography.

CO5 : Learn the ion-exchange chromatography. Resins, types with examples, mechanism of cation and anion exchange processes and applications of ion-exchange chromatography in softening of hard water, separation of lanthanides and industrial applications.

CO6: Know the solvent extraction method, its types and factors affecting the solvent extraction.

CO7: Make out the nutritional value of food, food processing, food preservation and adulteration.

Syllabus **OEC – 4 : Analytical Chemistry (Code: 004CHE051).**	**Total Hrs: 42**
Unit-I VOLUMETRIC AND GRAVIMETRIC ANALYSIS	**14 hrs**
Titrimetric analysis: Principle, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparation and dilution of reagents/solutions using $N_1V_1 = N_2V_2$, preparation of ppm level solutions from source materials (salts). **Acid-base titrimetry**: Theory, titration curves for all types of acids – base titrations. **Redox titrimetry**: Theory, balancing redox equations, titration curves, theory of redox indicators and applications. **Precipitation titrimetry:** Theory, titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences. **Complexometric titrimetry:** Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators for EDTA titrations - theory of metal ion indicators. **(10 Lectures)**	

Gravimetric analysis: Steps involved in gravimetric analysis, requisites of precipitation, factors influencing precipitation, co-precipitation and post precipitation. Advantages of organic reagents over inorganic reagents. Determination of Barium and Iron gravimetrically. **(4 Lectures)**	
UNIT-II ANALYSIS OF SOIL, WATER AND FOOD PRODUCTS	**14 hrs**
Analysis of soil : Composition of soil, Concept of pH and pH measurement. Determination of pH of soil samples. Estimation o f Calcium a n d Magnesium by complexometric titration. **(3 Lectures)** **Analysis of water:** Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods (reverse osmosis, electro dialysis, ionic exchange). Determination of pH, hardness, TDS and alkalinity of a water sample. Determination of dissolved oxygen (DO) and COD of a water sample. **(6 Lectures)** **Analysis of food products:** Nutritional value of food, idea about food processing and food preservation and adulteration. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, edible oils etc. Analysis of preservatives and colouring matter **(5 Lectures)**	
UNIT-III SEPERATION METHODS	**14 hrs**
Chromatography: Definition, general introduction on principles of chromatography, classification, selection of stationary and mobile phases. Paper chromatography: principle and applications (separation of mixture of metal ions (Fe^{3+} and Al^{3+}). **Thin layer chromatography:** principle, advantages over other methods, methodology and applications (To compare paint samples by TLC method). **Gas chromatography and High Performance Liquid Chromatography:** Principles and applications. **(6 Lectures)** **Ion-exchange:** Column, ion-exchange chromatography. Resins, types with examples, mechanism of cation and anion exchange processes and applications of ion-exchange chromatography in softening of hard water, separation of lanthanides and industrial applications. (4 **Lectures**) **Solvent extraction** :- Types, batch, continuous, efficiency, selectivity, distribution co efficient, Nernst distribution law, derivation, factors affecting the partition, relationship between percent extraction and volume fraction . Solvent extraction of iron and copper. **(4 Lectures)**	

Recommended Books/References

1. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th edition, Saunders College Publishing, New York (2005).
2. . Instrumental methods of chemical Analysis, B.K. Sharma, Goel Publishing House, Meerut,
3. .Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D.Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, Pearson Education Pvt.Ltd.(2007).
4. Laboratory manual for Environmental Chemistry: Sunita Hooda and Sumanjeet Kaur by S. Chand & Company 1999.
5. Soils and soil fertility, Troch, F.R. And Thompson, L.M. Oxford Press.
6. Fundamentals of soil science, Foth, H.D. Wiley Books. .
7. Handbook of Agricultural Sciences, S.S. Singh, P. Gupta, A. K. Gupta, Kalyani Publication.
8. Introduction to soil laboratory manual - J. J. Harsett Stipes.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

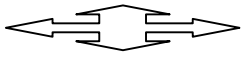
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

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'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SSL-394A/2022-23/1056 Date: 23 SEP 2022

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯ ಸಭೆಯ ಠರಾವುಗಳ ದಿನಾಂಕ: 06.09.2022
3. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂ. 01, ದಿನಾಂಕ: 17.09.2022
4. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 22-09-2022

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, **ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ** ನಿಖಾಯದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ (NEP)-2020 ರಂತೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗಾಗಿ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. www.kud.ac.in ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತಾ, ವಿದ್ಯಾರ್ಥಿಗಳು ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ / ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

Four - Year B.Sc. (Hons.) Program

SYLLABUS FOR III & IV SEMESTER

Course: ZOOLOGY

DISCIPLINE SPECIFIC CORE COURSE (DSCC) AND

OPEN ELECTIVE COURSE (OEC)

III-SEMESTER:

DSCC – 5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory) - V (Code: 033ZOO011)

DSCC – 6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) - VI (Code: 033ZOO012)

OEC- 3: Endocrinology (Code: 003ZOO051)

IV-SEMESTER:

DSCC – 7: Gene Technology, Immunology and Computational Biology (Theory) - VII (Code: 034ZOO011)

DSCC - 8: Gene Technology, Immunology and Computational Biology (Practical) - VIII (Code: 034ZOO012)

OEC- 4: Animal Behaviour (Code: 004ZOO051)

Effective from 2022-23

AS PER N E P - 2020

Karnatak University, Dharwad
Subject: Zoology

Semester	Type of Course	Course Code	Instruction hour / week (hrs)	Total hours of Syllabus / Semester	Duration of Exam (hrs)	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory) - V	033ZOO011	04	56	02	40	60	100	04
	DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) -VI	033ZOO012	04	52	03	25	25	50	02
	OEC- 3 Endocrinology	003ZOO051	03	42	02	40	60	100	03
IV	DSCC -7: Gene Technology, Immunology and Computational Biology (Theory) - VII	034ZOO011	04	56	02	40	60	100	04
	DSCC -8: Gene Technology, Immunology and Computational Biology (Practical) - VIII	034ZOO012	04	52	03	25	25	50	02
	OEC- 4: Animal Behaviour	004ZOO051	03	42	02	40	60	100	03
Details of the other semesters will be given later									

Programme Outcome (PO)

After the completion of 03/ 04 years Degree in Zoology, students will be able to:

PO 1: Students gain knowledge and skill in the fundamentals of animal sciences, understands the complex interactions among various living organisms

PO 2: Analyze complex interactions among the various animals of different phyla, their distribution and their relationship with the environment

PO 3: Apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms

PO 4: Understands the complex evolutionary processes and behaviour of animals

PO 5: Correlates the physiological processes of animals and relationship of organ systems

PO 6: Understanding of environmental conservation processes and its importance, pollution control and biodiversity and protection of endangered species

PO 7: Gain knowledge of agro based small scale industries like sericulture, fish farming, butterfly farming and vermicompost production

PO 8: Understands about various concepts of genetics and its importance in human health

PO 9: Apply the knowledge and understanding of Zoology to one's own life and work

PO 10: Develops empathy and love towards the animals

PO 11: Candidates find opportunities in government departments, environmental agencies, universities, colleges, biotechnological, pharmaceutical, environmental/ecological fields

PO 12: There are numerous career opportunities for candidates completing their B.Sc, M.Sc and Ph.D. in Zoology in public and private sectors

Programme Specific Outcomes (PSO)

PSO III:

PSO 1: Understanding of the processes of central dogma viz. transcription, translation etc. underlying survival and propagation of life at molecular level

PSO 2: Understanding how genes are ultimately expressed as proteins, which are responsible for the structure and function of all the organisms

PSO 3: Learn how four sequences (3 letter codons) generate the transcripts of life and determine the phenotypes of organisms

PSO 4: Understand the basics of various instruments like microscopes and bioinstruments used in biological studies and their applications

PSO 5: They are able to understand the use of biological instrumentation and proper laboratory techniques

PSO 6: The students will be acquiring basic experimental skills in various techniques in the fields of molecular biology

PSO 7: To learn various techniques used in biology like histochemistry and immunotechniques

PSO IV:

PSO 1: To understand the principles of genetic engineering and its applications

PSO 2: To understand the basics of immunology and various mechanisms involved in immunity and their response

PSO 3: Acquired skills in diagnostic testing, haematology, staining procedures used in clinical and research laboratories, will provide them opportunity to work in diagnostic or research laboratory.

PSO 4: Acquired practical skills in biostatistics, bioinformatics can be used to pursue career as a scientist in drug development industry in India or abroad.

PSO 5: To know various type of biostatistical and bioinformatics techniques

PSO 6: Students gain skills in basics of computers, operating systems, overview of programming languages, internet services, sequencing techniques

PSO 7: Attained knowledge of data collection, tabulation and presentation of data and measures of central tendency, probability and Chi-square test.

PSO 8: Know the applications of internet and statistical bioinformatics in research

B.Sc. Semester – III

DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory) - V (Code: 033ZOO011)

Course Outcome (CO):

After completion of this course (Theory)-V, students will be able to:

CO1: Acquire better understanding and comprehensive knowledge regarding most of the essential aspects of molecular biology subject, which in turn will provide a fantastic opportunity to develop professional skill related to the field of molecular biology.

CO2: The course will mainly focus on the study of principal molecular events of cell incorporating DNA Replication, Transcription and Translation in prokaryotic as well as eukaryotic organisms.

CO3: Acquiring knowledge on instrumentation and techniques in biology.

Syllabus **DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory)-V (Code: 033ZOO011)**	**Total Hrs: 56**
Unit I:	**14 hrs**
Chapter 1: Process of Transcription • Fine structure of gene (Cistron, Recon, Muton) • RNA polymerases - types and functions • Transcription in prokaryotes and eukaryotes **Chapter 2: Process of Translation** • Genetic code and its salient features • Translation in prokaryotes and eukaryotes	**08** **06**
Unit-II :	**14 hrs**
Chapter 3: Regulation of gene expression-I • Regulation of gene expression in prokaryotes- lac operon (inducible) and trp operon(repressible) in *E. coli* • Regulation of gene expression in eukaryotes - Role of chromatin (euchromatin and heterochromatin) in gene expression • Post-transcriptional modifications: capping, splicing, polyadenylation • Concept of RNA editing (mRNA), gene silencing, and, RNAi. **Chapter 4: Regulation of gene expression-II** • Post-translational modifications: purpose, advantages, and significance; glycosylation, methylation, phosphorylation, and acetylation. • Intracellular protein degradation (lysosomal autophagy and ubiquitin proteosome pathway).	**09** **05**

Unit-III:	14 hrs
Chapter 5: Microscopy • Principles and applications of Light microscopy, Dark field microscopy, Phase contrastmicroscopy, Fluorescence microscopy, Confocal microscopy and Electron microscopy (SEM and TEM). • **Micrometry:** Principle and applications of micrometry **Chapter 6: Centrifugation and Chromatography** • Centrifugation: Principles, types, and applications(High speed and Ultracentrifugation) • Chromatography : Principle and applications of: TLC, HPLC and GC	**09** **05**
Unit IV:	**14 hrs**
Chapter 7: Biochemical Instrumentation • Colorimetry and Spectrophotometry: Beer-Lambert's law, Absorption spectrum, UV-VLSpectrophotometer. • pH meter, measurement of pH • Principle, applications and safety measures of Radio-tracer techniques - Autoradiography. **Chapter 8: Molecular Techniques** • Principle and applications of Agarose Gel- Electrophoresis, SDS-PAGE, DNA Sequencing (Sanger's Dideoxy method),PCR, DNA Fingerprinting, ELISA, Southern Blotting and Western Blotting.	**06** **08**

Recommended Books/References:

1. Principles & Techniques of Biochemistry And Molecular Biology Keith Wilson and John Walker 7th Edition Cambridge University Press (2010)
2. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
3. Alberts et al: Molecular Biology of the Cell: Garland (2002).
4. Cooper: The Cell: A Molecular Approach: ASM Press (2000).
5. Karp: Cell and Molecular Biology: Wiley (2002).
6. Watson et al. Molecular Biology of the Gene. Pearson (2004).
7. Lewin. Genes VIII. Pearson (2004).
8. Pierce B. Genetics. Freeman (2004).
9. Sambrooket *al.* Molecular Cloning Vols I, II, III. CSHL (2001).
10. Primrose. Molecular Biotechnology. Panima (2001).
11. Clark and Switzer. Experimental Biochemistry. Freeman (2000)
12. Principles of Genetics Robert H. Tamarin WC B/McGraw-Hill (1999)
13. Animal Microtechniques by Humason(1962)
14. De- Robertis- Cell and Molecular Biology.
15. Verma, P.S. and Agrawal, V.K. Molecular Biology
16. Bioinstrumentation by L. Veerakumari

B.Sc. Semester – III

DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) - VI (Code: 033ZOO012)

Course Outcomes (CO):

After completion of this Course (Practical) - VI**,** students will be able to:

CO 1: To understand the principle of qualitative and quantitative analysis of nucleic acids (DNA and RNA)

CO 2: Understand the basic principles and applications of bioinstruments and biotechniques

CO 3: Understand the basic principles of microscopy, working of different types of microscopes

CO 4: Understand the principle of measuring the concentrations of macromolecules in solutions by colorimeter and spectrophotometer

CO 5: Learn about some of the commonly used separation techniques like centrifugation, chromatography

CO 6: To know about measurement of cells types through micrometry and also to get knowledge about virtual labs

Syllabus

DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) - VI (Code: 033ZOO012)

List of the experiments for 52 hrs / Semester

1. To study the working principle of Simple, Compound, and Binocular microscopes
2. To study the working principle of various laboratory equipments: pH Meter, Electronic balance, Laminar air flow, Incubator, Centrifuge, Micropipettes, Chromatography apparatus, Colorimeter , Spectrophotometer, PCR, Electrophoresis.
3. To prepare fixatives, stains and buffers (Phosphate, Citrate, Tris-HCL buffer).
4. To learn the working of measurement of the absorbance of any sample by using Colorimeter and/ or Spectrophotometer
5. To study Blotting techniques (working principle, procedure and applications)
6. Estimation of RNA by Orcinol method.
7. Estimate of DNA by Diphenyl Amine (DPA) method
8. To identify different unknown amino acids using ascending paper chromatography.
9. Isolation of DNA extraction from blood or any tissue samples.
10. Micrometry study of different cell types
11. Demonstration of differential centrifugation to fractionate components in a given mixture.
12. To estimate amount of protein by Lowry's method
13. Visit to nearby University/Research Institutions for demonstration of molecular biology techniques, bioinstruments/ biotechniques for students (not mandatory)
14. Any other practical's related to this paper may be added based on the feasibility

Recommended Books/References:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell, 4th edition. New York: Garland Science (2002).
2. Daniel L. Hartl and Maryellen Ruvolo. Genetics: Analysis of Genes and Genomes, 8th Edition. Burlington,Mass.: Jones & Bartlett Learning (2012).
3. Gerald Karp. Cell and Molecular Biology: Concepts and Experiments, 5th Edition. Wiley Publication (2008).
4. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Freeman. Molecular CellBiology, 5th edition. W. H. & Company (2003).
5. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, RichardLosick.Molecular Biology of the Gene, 5th edition. Cold Spring Harbor Laboratory Press (2003).
6. Stryer, Lubert. Biochemistry, 2nd Edition. W. H. Freeman and Company, New York (1981).

General instructions:

Perform all the experiments as per the instructions in each question.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end Examination

1. Major Experiments	**08 Marks**
2. Minor Experiments	**05 Marks**
3. Identifications (A-D)	**08 Marks**
4. Viva	**02 Marks**
5. Journal	**02 Marks**
Total 25 Marks	

Note: Same Scheme may be used for IA (Formative Assessment) examination

B.Sc. Semester – III

OEC- 3: Endocrinology (Code: 003ZOO051)

Course Outcome (CO):

After completion of this course, Endocrinology, students will be able to:

CO 1: Differentiate among endocrine, paracrine and autocrine systems.

CO 2: Describe the different classes and chemical structures of hormones.

CO 3: Identify the glands, organs, tissues and cells that synthesize and secrete hormones, hormone precursors and associated compounds.

CO 4: Identify and discuss the integration of the endocrine system in general with focus on specific interactions.

CO 5: Explain the consequences of under- and overproduction of hormones.

Syllabus **OEC-3: Title- Endocrinology (Code: 003ZOO051)**	**Total Hrs: 42**
Unit-I:	**14 hrs**
Chapter 1: About Endocrine glands • Endocrine glands and classifications of hormones. • Characteristics and Transport of Hormones. **Chapter 2: Hypothalamus-Hyphophysis** • Hypothalamus as a neuroendocrine organ • Pituitary – Structure and functions • Chemical nature, mode of action, and functions. • Pituitary disorders **Chapter 3: Pineal gland** • Structure and functions of Pineal gland. • Hypo- and hyperactive states of the gland.	
Unit-II:	**14 hrs**
Chapter 4: Thyroid and parathyroid • Histological structure of the glands. • Chemical nature, mode of action, and functions of the hormones. • Hypo-and hyperactive states of the glands. **Chapter 5: Adrenal cortex and medulla** • Histological structure of the gland. Chemical nature, and functions • Hypo- and hyperactive states of the gland. **Chapter 6.** Prostaglandins	

Unit-III:	14 hrs
Chapter 7: Pancreas • Pancreatic islets - histological structure. Chemical nature, and function. Hormonalcontrol of blood sugar. • Hyperinsulinism and diabetes mellitus. **Chapter 8: Gastro-intestinal hormones** • Functions and regulation of secretion of the hormones. **Chapter 9: Different types of Rhythms** • Ultradian, circadian, infradian. Different zeitgebers and their relation with circadianclock • Neural basis of biological clock and role of suprachiasmatic nuclei. Sleep-wakefulness cycle. Time keeping genes. Jet-lag and shift work.	

Recommended Books/References:

1. William's Text Book of Endocrinology Larsen et al.: An Imprint of Elsevier.
2. Endocrinology, Mac E. Hadley, Pearson Education.
3. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
4. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
5. Concise Medical Physiology by S.K. Chaudhuri, New Central Book Agency.
6. Endocrinology. Vols.I, II and III by L.O. DeGroot. W.B. Saunders Co.
7. The Physiology of Reproduction, Vols.I & II, by E. Knobil and J.D. Neil. Raven Press.
8. Guyton and Hall. Textbook of Medical Physiology. 13th Edition.
9. Histology: A Text and Atlas. Sixth Edition. Ross & Pawlina. Lippincott Williams & Wilkins.
10. Vertebrate Endocrinology by David O. Norris.

Details of Formative Assessment (IA) for DSCC/OEC (Theory):40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

(60 marks for Semester end Examination with 2 Hrs duration)

Part-A

1. Question number 1-06 carries 2 Marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – IV

DSCC- 7: Gene Technology, Immunology and Computational Biology (Theory) - VII (Code: 034ZOO011)

Course Outcome (CO):

After completion of this course (Theory)-VII, students will be able to:

CO1: Acquaint knowledge on versatile tools and techniques employed in genetic engineering and recombinant DNA technology.

CO2: An understanding on application of genetic engineering techniques in basic and applied experimental biology.

CO3: To acquire a fundamental working knowledge of the basic principles of immunology.

CO4: To understand how these principles, apply to the process of immune function.

CO5: Use, and interpret results of, the principal methods of statistical inference and design; helpsto communicate the results of statistical analyses accurately and effectively; helps in usage of appropriate tool of statistical software.

Syllabus **DSCC- 7: Gene Technology, Immunology and Computational Biology (Theory) - VII (Code: 034ZOO011)**	**Total Hrs: 56**
Unit-I:	**14 hrs**
Chapter 1: Principles of Gene Manipulation • Recombinant DNA Technology: Introduction, steps involved. • Restriction enzymes and Ligases and Nucleic acid modifying enzyme. • Gene cloning vector: Concept of Plasmids-pBR322, Lamda phage vectors, Cosmids • Gene transfer techniques (Direct and indirect). • Screening and selection of recombinant colonies/cells **Chapter 2: Applications of Genetic Engineering** • Transgenic animals (Transgenic Cow, Transgenic Fish); Transgenic plants (cry protein); Gene silencing (Knock out and Knock in mouse). • Production of Human Recombinant insulin and • Hybridoma technology: Synthesis and applications of Monoclonal antibodies • Gene Therapy (SCID) • Biosensors and its applications	**07** **07**
Unit-II:	**14 hrs**
Chapter 3: Introduction to the Immune System • Defence against diseases: Introduction, First and second line of defence, Types of immunity: Innate and acquired immunity; Antigen presenting cells (APC's), Role of Band T-lymphocytes (Humoral immunity and Cell mediated immunity), primary and secondary immune response. • Functional aspects of organs of the Immune system - Thymus and bone marrow spleen, Lymph Node, Small intestine and Liver (Peyer's patchesand Von Kupffer cells).	**07**

Chapter 4: Antigens and Antibodies • Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). • B and T cell epitopes. • Structure of IgG and functions of different classes of immunoglobulins. • Major histocompatibility complex - Structure of MHC I & II.	**07**
Unit-III:	**14 hrs**
Chapter 5: Clinical Immunology • Immunity against diseases of viral, bacterial and protozoan infections. • Vaccines: Types and Uses - Immunization schedule for children. • Transplantation immunology: Transplantation of organ- Types, graft rejection and Immuno-suppressors. **Chapter 6: Bioinformatics** • Databases: Sequence and structural • Sequence analysis (Homology): Pairwise and Multiple Sequence alignment- BLAST, CLUSTALW, Sequence alignment- FASTA. • Scope and applications of Bioinformatics.	**07** **07**
Unit-IV:	**14 hrs**
Chapter 7: Biostatistics I • Measures of central tendency: Mean, Median, Mode. • Data summarizing: Frequency distribution, Graphical presentation - Bar diagram, Pie diagram, Histogram. **Chapter 8: Biostatistics II** • Measures of dispersion: Range, Standard Deviation, Variance. • Correlation and Regression. • Tests of significance: F-test, ANOVA, t-test and Chi square test.	**07** **07**

Recommended Books/References:

1. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl& Jones. Genetics: Principles &Analsysis of Genes & Genomes. Jones & Bartlett (1998).
3. Sambrook *et al* .Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. An Introduction to Genetic Engineering by Desmond S. T. Nicholl
6. Principles of Genetics by D. Peter Snustad and Michael J. Simmons
7. Fundamental Immunology by William E. Paul
8. A Textbook of Immunology by Dr. P Madhavee Latha
9. Basic Bioinformatics by S. Ignacimuthu
10. Kuby Immunology by Punt, W. H. Freeman
11. Introduction to Bioinformatics (2003) by T.K. Attwood & D.J. Parry
12. Statistical Methods by G. W. Snecdeor and W. G. Cochran, Willey Blackwell.
13. Introductory Biological Statistics by John E. Havel, Raymond E. Hampton and Scott J. Meiners.
14. Sambrooket *al.* Molecular Cloning Vols I, II, III. CSHL (2001).
15. Clark andSwitzer. Experimental Biochemistry. Freeman (2000)
16. Animal Microtechniques by Humason(1962)
17. De- Robertis- Cell and Molecular Biology.
18. Verma, P.S. and Agrawal, V.K. Molecular Biology
19. Bioinstrumentation by L. Veerakumari

B.Sc. Semester – IV

DSCC-8: Gene Technology, Immunology and Computational Biology (Practical) – VIII (Code: 034ZOO012)

Course Outcomes (CO)

After completion of this course (Practical)-VIII, students will be able to:

CO 1: Understand the principles of genetic engineering with hands on experiments in detection of diseases

CO 2: Get introduced to DNA testing and utility of genetic engineering in forensic sciences.

CO 3: Understand the basics of immunology and its applications in clinical research.

CO 4: Study on immune system and its components

CO 5: Apply knowledge and awareness of the basic principles and concepts of biology, computers science and mathematics existing software's effectively to extract information from large data bases to use this in computer modeling

CO 6: Use bioinformatics tools to find out evolutionary/ phylogenetic relationship of organisms using gene /protein sequences

CO 7: Understand and can apply biostatistics and bioinformatics tools in research.

Syllabus

DSCC-8: Gene Technology, Immunology and Computational Biology (Practical) - VIII (Code: 034ZOO012)

List of the Experiments for 52 hrs / Semesters

1. Calculate the mean, median, mode and standard deviation (Measurement of pre and post clitellar lengths (with suitable examples).
2. Measure the height and weight of all students in the class and apply statisticalmeasures.
3. Determination of ABO Blood group and Rh factor.
4. To study of lymphoid organs: Thymus, Bone marrow, Spleen, Tonsil, Lymph node (Slides /Charts/ Video)
5. Preparation of blood smears to study various blood cells like RBC, WBC, Platelets, Lymphocytes & Monocytes
6. Separation of different blood cells like RBC, WBC, Platelets, Lymphocytes & Monocytes
7. To study Restriction enzyme digestion using teaching kits (Demonstration only).
8. To detect genetic mutations by Polymerase Chain Reaction (PCR) usingteaching kits (Demonstration only).
9. Demonstration of agarose gel electrophoresis for detection of DNA.
10. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detectionof proteins.
11. To calculate molecular weight of unknown DNA and protein fragments fromgel pictures. (https://youtube/mCiCiO0cfbg)
12. To learn nucleotide sequence database.
13. To learn sequence alignment: Pairwise alignment (Protein/ DNA).
14. To learn about basics of computer applications in biology
15. Visit to nearby University/Research Institutions for demonstration of genetic engineering / Immunology/Bioinformatic techniques for students
16. Any other practical's related to this paper may be added based on the feasibility

Recommended Books/References:

1. Primrose &Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl& Jones. Genetics: Principles &Analsysis of Genes & Genomes. Jones & Bartlett (1998).
3. Sambrook *et al* .Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. An Introduction to Genetic Engineering by Desmond S. T. Nicholl
6. Principles of Genetics by D. Peter Snustad and Michael J. Simmons
7. Fundamental Immunology by William E. Paul
8. A Textbook of Immunology by Dr. P Madhavee Latha
9. Basic Bioinformatics by S. Ignacimuthu
10. Kuby Immunology by Punt, W. H. Freeman
11. Introduction to Bioinformatics (2003) by T.K. Attwood & D.J. Parry
12. Statistical Methods by G. W. Snecdeor and W. G. Cochran, Willey Blackwell.
13. Introductory Biological Statistics by John E. Havel, Raymond E. Hampton and Scott J. Meiners.

General instructions:

Perform all the experiments as per the instructions in each question.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end Examination

1. Major Experiments	**08 Marks**
2. Minor Experiments	**05 Marks**
3. Identifications (A-D)	**08 Marks**
4. Viva	**02 Marks**
5. Journal	**02 Marks**
	Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

B.Sc. Semester – IV

OEC – 4: Animal Behaviour (004ZOO051)

Course Outcomes (CO)

After completion of this course, Animal Behaviour students will be able to:

CO 1: Understand types of animal behaviour and their importance to the organisms

CO 2: Explain about behaviour, migration and communication in animals

CO 3: Understand about ecological aspects of behaviour and social behaviour

CO 4: Understand animal behaviour and response of animals to different instincts

CO 5: Understand the proximate controls of behavior including the role of pheromones

CO 6: Learn about reproductive behaviour and parental care in animals

Syllabus **OEC-4: Animal Behaviour (Code: 004ZOO051)**	**Total Hrs: 42**
Unit-I:	**14 hrs**
Chapter 1: Introduction to Animal Behaviour • Brief contributions of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen. • Proximate and ultimate causes of behaviour. **Chapter 2: Patterns of Behaviour** • Stereotyped Behaviors - Orientation and Reflex. • Individual Behavioural patterns: Instinct and Learned Behaviour • Associative learning, classical and operant conditioning, Habituation, Imprinting.	
Unit-II:	**14 hrs**
Chapter 3: Social Behaviour: • Social organization in termites and honey bees. • Social behaviour: Altruism. • Conflict behaviour. **Chapter 4: Sexual Behaviour** • Sexual dimorphism, Mate choice in peacock. • Intra-sexual selection (male rivalry in red deer). • Kinship theory: Relatedness & inclusive fitness. • Parental care in fishes (Nest Building & cost benefit)	
Unit-III:	**14 hrs**
Chapter 5: Chronobiology • Brief historical developments in chronobiology. • Adaptive significance of biological clocks. • Biological Rhythms **Chapter 6: Communications in animals** • Bioluminescence in deep sea fishes and insects • Territoriality in Monkeys and Dogs • Role of pheromones in animal communication- Insects and Vertebrates, • Communication in Honey bees (Waggle Dance)	

Recommended Books/References:

1. Drickameré Vessey: Animal Behaviour, Concepts, Processes and Methods (Wadsworth)
2. Grier: Bilogy of Animal Behaviour (Mosby College)
3. Immelmann: Introduction to Ethology (Plenum Press)
4. Lorenz: The Foundation of Ethology (Springer-Verlag)
5. Manning: An Introduction to Animal Behaviour (Addison - Wesley)
6. McFarland: Animal Behaviour, Psychology, Ethology and Evolution (Pitman)
7. Price & Stoker: Animal behaviour in laboratory and field (Freeman)
8. Wood-Gush: Elements of Ethology (Chapman and Hall)
9. Animal Behaviour by Alock (2013)
11. Introduction to Animal Behaviour by Manning A. & M.S.Dawkins (2012)
12. Ecology by Charles J. Krebs (2009)
13. Elements of Ecology by Clarke (2015).

Details of Formative Assessment (IA) for DSCC /OEC (Theory):40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for Semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 Marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

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No. KU/Aca(S&T)/JS/MGJ(Gen)/2023-24/59 Date: 04/09/2023

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಪದವಿಗಳಿಗೆ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 104 ಯುಎನ್ಇ 2023, ದಿ: 20.07.2023.
2. ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 2 ರಿಂದ 7, ದಿ: 31.08.2023.
3. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 04/09/2023

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music) /BVA / BTTM / BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS) / BBA & BA ILRD ಸ್ನಾತಕ ಪದವಿಗಳ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020ರ ಮುಂದುವರೆದ ಭಾಗವಾಗಿ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಕೋರ್ಸಿನ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

4/9/23
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂರ್ತಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. in Botany

Syllabus With Effect From 2023-24

DISCIPLINE SPECIFIC CORE COURSE (DSCC)

FOR SEM V &VI,

SKILL ENHANCEMENT COURSE (SEC) FOR SEM V SEM

AS PER NEP - 2020

KARNATAK UNIVERITY, DHARWAD

04 – Year B.Sc. (Hons.) Program

SYLLABUS

Subject: Botany

[Effective from 2023-2024]

DISCIPLINE SPECIFIC CORE COURSE (DSCC-9 to 12), FOR SEM - V.

AS PER NEP- 2020

BOTANY AND ANOTHER SUBJECT AS DOUBLE MAJORS IN THIRD YEAR (V SEM) NEP 2020

Sem.	Type of Course	Theory/ Practical	Course Code	CourseTitle	Instructionhour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	**035 BOT 011**	Plant Morphology and Taxonomy	04hrs	56	02 hrs	40	60	100	04
	DSCC-10	Practical	**035 BOT 012**	Plant Morphology and Taxonomy	04 hrs	52	03 hrs	25	25	50	02
	DSCC-11	Theory	**035 BOT 013**	Genetics and Plant Breeding	04hrs	56	02 hrs	40	60	100	04
	DSCC-12	Practical	**035 BOT 014**	Genetics and Plant Breeding	04 hrs	52	03 hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	SEC-3	Practical	**035 BOT 061**		04hrs	52	03 hrs	25	25	50	02
	Total										**26**

B.SC.: SEMESTER – V
SUBJECT: BOTANY

THE COURSE BOTANY IN V SEMESTER HAS TWO PAPERS (THEORY PAPER- 033 BOT 011 FOR 04 CREDITS AND PRACTICAL PAPER- 033 BOT 012 FOR 02 CREDITS) FOR 06 CREDITS: BOTH THE PAPERS ARE COMPULSORY, DETAILS OF THE COURSES ARE AS

TITLE OF THE COURSE:
PLANT MORPHOLOGY AND TAXONOMY (THEORY)
COURSE CODE: 035 BOT 011
THEORY: DISCIPLINE SPECIFIC CORE COURSE (DSCC-9)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**PLANT MORPHOLOGY AND TAXONOMY (THEORY)**		
Course Code:	**035 BOT 011**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

COURSE OUTCOMES (COS):

After the successful completion of the course, the student will be able to:

CO1. Understanding the main features in Angiosperm evolution

CO2. Ability to identify, classify and describe a plant in scientific terms, thereby, Identification of plants using dichotomous keys. Skill development in identification and classification of flowering plants.

CO3. Interpret the rules of ICN in botanical nomenclature.

CO4. Classify Plant Systematic and recognize the importance of herbarium and Virtual Herbarium, Evaluate the Important herbaria and botanical gardens.

CO5. Recognition of locally available angiosperm families and plants and economically important plants. Appreciation of human activities in conservation of useful plants from the past to the present.

CONTENTS	**56 Hrs**
Unit 1:	**16 hrs**
Morphology of Root, Stem and Leaf. Their modifications for various functions. Inflorescence – types. Structure and variations of flower. Fruits–types. Floral diagram and floral formula. **Introduction to Taxonomy**: History, objectives, scope and relevance of Taxonomy **Systems of classification**: Artificial, Natural and Phylogenetic; brief account of Linnaeus',Bentham& Hooker's, Engler and Prantl's system and APG IV System (2016).-Merits anddemerits of classification. **Taxonomic literatures:** Floras, Monograph. Revisions, Journals. **Herbaria and Botanical gardens:** Important herbaria and botanical gardens of the worldand India. Technique of Herbarium Preparation and roles botanical gardens. **Virtual herbarium;** E-flora; Documentation.	
Unit 2:	**12 hrs**
Taxonomic Hierarchy: Concept of taxa (family, genus, species); Categories and taxonomichierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. Problems with species concepts. Rank less system of phylogenetic systematics **Botanical Nomenclature:** Principles and rules (ICN); Latest code –brief account, Brief account of Ranks of taxa, Type concept (Typification), Rule of priority, Author citation., valid publication, rejection of names, principle of priority and its limitations; Names of hybrids/cultivated species.	
Unit 3:	**18 hrs**
Plant identification: Taxonomic dichotomous keys; intended (yolked) and bracketed keys.(brief account only). **Plant descriptions**: Common Terminologies used for description of vegetative andreproductive parts of the following families. **Study of the diagnostic features of Angiosperm families:** Annonaceae, Brassicaceae, Malvaceae, Rutaceae, Anacardiaceae, Fabaceae (with sub Families), Myrtaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Arecaceae and Poaceae.	

Unit 4:	10 hrs
Biometrics, Numerical Taxonomy; Phenetics and Cladistics: Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences). **Origin and evolution of angiosperms;** Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram). **Plant Taxonomic Evidences:** from palynology embryology, cytology, phytochemistry and molecular data. Field inventory.	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Test-I (Objective type)	10
Test-II (Objective type)	10
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines are compulsory	

TITLE OF THE COURSE: PLANT MORPHOLOGY AND TAXONOMY (PRACTICAL)
COURSE CODE: 035 BOT 012
PRACTICAL: DISCIPLINE SPECIFIC CORE COURSE (DSCC-10)

Program Name	**B.Sc. in BOTANY**		Semester	**V**
Course Title	**PLANT MORPHOLOGY AND TAXONOMY (PRACTICAL)**			
Course Code:	**035 BOT 012**		No. of Credits	**02**
Contact hours	**52 Hours**		Duration of Exam	**3 hours**
Formative Assessment Marks		**25**	Summative Assessment Marks	**25**

LIST OF EXPERIMENTS TO BE CONDUCTED

1. Study of root, stem and leaf structure and modifications. Study of inflorescence types. Study of flower and its parts, Study of fruits. Floral diagram and floral formula. 04 hrs

2. Study of families mentioned in theory with at least two examples for each family and make suitable diagrams, describe them in technical terms (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification) and identify up to species using the flora.
24 hrs

3. Identification of species using the flora 06 hrs

4. Identify plants/plant products of economic importance belonging to the families mentioned in the syllabus; with binomial, family and morphology of useful parts. Cotton, Mango, Red gram, Green gram, Horse gram, Black gram, Bengal gram, Indigo, Brinjal, Tomato, Chilly, Tamarind, Asfoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Coir, Arecanut, Rice, Wheat, Ragi, Sugarcane *Annona muricata Catharanthus roseus*, *Rauvolfia serpentina, Justicia adhatoda*, *Vitex negundo* and *Leucas aspera*
18 hrs

5. Submission of any 5 economic plant products.

Submission: Tour report and Herbarium (Preparation of 10 properly identified herbarium specimens; mounting of a properly dried and pressed specimen of any common plants fromyour locality with herbarium label).

Pedagogy: Teaching and learning, conducting experiments, field visits.

Formative Assessment for Practical	
Assessment Occasion/ type	**Marks**
Test-I	05
Test-II	05
Field visit(Tour report and Herbarium)	10
Submission (any 5 economic plant products)	05
Total	**25 Marks**
Formative Assessment as per guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)
Total: 60 MarksNote: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

1. Identify, classify and describe the specimen A & B taxonomically	6 Marks
2. Identify the given specimen C with the help of Key using Flora	4 Marks
3. Write the floral diagram and floral formal of the given specimen D	2 Marks
4. Identification of Specimen/slides E, F and G	6 Marks
5. Viva Voce	2 Marks
6. Submission (Practical Record/Journal)	5 Marks

Total 25 marks

GENERAL INSTRUCTIONS:

Q1. Give specimen from Dicotyledons (A) and Monocotyledons (B)
Q2. Give specimen from family they studied (C)
Q3. Give specimen from family they studied (D)
Q4. Specimen /Slides/ materials from Root/Stem/ Leaf/ Inflorescence (E), Flower/Fruit (F) and Economicimportance (G)
Q5. Viva
Q6. Submission (Practical Record/Journal)

Note: Same Scheme may be used for IA (Formative Assessment) examination

REFERENCES	
1	Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company.
2	Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons –Chichester
3	Cotton, C.M. 1996. Ethnobotany – Principles and Applications. Wiley and Sons
4	Datta S C, *Systematic Botany*, 4th Ed, Wiley Estern Ltd., New Delhi, 1988.
5	Eames A. J. - *Morphology of Angiosperms* - Mc Graw Hill, New York.
6	Hall, B.G. (2011). *Phylogenetic Trees Made Easy: A How-To Manual*. Sinauer Associates, Inc.USA
7	Heywood - *Plant taxonomy* - Edward Arnold London.
8	Jeffrey C .J. and A. Churchil - *An introduction to taxonomy* – London.

9	Jeffrey, C. (1982). An Introduction to *Plant Taxonomy.* Cambridge University Press, Cambridge
10	Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., Donogue, M.J., 2002. *PlantSystematics: A Phylogenetic approach,* 2nd edition. Sinauer Associates, Inc., USA.
11	Lawrence - *Taxonomy of Vascular Plants* - Oxford & I B H, New Delhi.
12	Manilal, K.S. and M.S. Muktesh Kumar 1998. *A Handbook on Taxonomy Training*. DST, NewDelhi.
13	Manilal, K.S. and A.K. Pandey, 1996. *Taxonomy and Plant Conservation*. C.B.S. Publishers &Distributors, New Delhi.
14	Manilal, K.S. 2003. *Van Rheede'sHortusMalabaricus. English Edition*, with AnnotationsandModern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum.
15	Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi.
16	Pandey, S. N, and S.P. Misra (2008)-*Taxonomy of Angiosperms*- Ane Books India, New Delhi.
17	Radford A B, W C Dickison, J M Massey & C R Bell, *Vascular Plant Systematics*, 1974,Harper& Row Publishers, New York.
18	Singh G.2012. *Plant systematics: Theory and Practice.* Oxford and IBH, Pvt. Ltd., New Delhi.
19	Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut.
20	Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford &I B H New Delhi.
21	Any local/state/regional flora published by BSI or any other agency.

TITLE OF THE COURSE: GENETICS AND PLANT BREEDING (THEORY)
COURSE CODE: 035 BOT 013
THEORY: DISCIPLINE SPECIFIC CORE COURSE (DSCC-11)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**GENETICS AND PLANT BREEDING (THEORY)**		
Course Code:	**035 BOT 013**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:
CO1.Understanding the basics of genetics and plant breeding
CO2.Abilitytoidentify, calculate and describe crossing over, allelic generations and frequencies ofrecombination.
CO3.Interprettheresults of mating and pollinations.
CO4.ClassifyPlantpollination methods
CO5.Recognitiono f modes of inheritance of traits/ phenotypes and Phenotype-genotype correlation.

CONTENTS	**56 Hours**
Unit 1:	**16 hrs**
Mendelian genetics and its extension Mendelism: History; Principles of inheritance;Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive andDominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance. Extrachromosomal Inheritance Chloroplast mutation: Variegation in Four o'clock plant;Mitochondrial mutations in yeast.	
Unit 2:	**16 hrs**
Linkage, crossing over and chromosome mapping. Linkage and crossing over-Cytological basis of crossing over; Recombination frequency,two factor and three factor crosses; Interference and coincidence; Numerical based on genemapping; Sex Linkage. Variation in chromosome number and structure: Gene mutations Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical(Base analogs, deaminating, alkylating and intercalating agents); Role of Transposons in mutation. DNA repair mechanisms. Fine structure of gene (Population and Evolutionary Genetics, Allele frequencies,Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.	
Unit 3:	**12 hrs**
Plant Breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. Methods of crop improvement Introduction: Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self-pollination, cross pollination and vegetativePropagation in plants; Hybridization: For self, cross and vegetative propagation in plants – Procedure, advantagesand limitations.	
Unit 4:	**12 hrs**
Quantitative inheritance Concept, mechanism, examples of inheritance of Kernel colour in wheat, Monogenic vs polygenic inheritance Inbreeding depression and heterosis. History, genetic basis of inbreeding depression and heterosis; Applications. Crop improvement and breeding Role of mutations; Polyploidy; Distant hybridization androle of biotechnology in crop improvement..	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
Test-I (Objective type)	10
Test-II (Objective type)	10
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines are compulsory	

TITLE OF THE COURSE: GENETICS AND PLANT BREEDING (PRACTICAL)
COURSE CODE: 035 BOT 014
PRACTICAL: DISCIPLINE SPECIFIC CORE COURSE (DSCC-12)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**GENETICS AND PLANT BREEDING (PRACTICAL)**		
Course Code:	**035 BOT 014**	No. of Credits	**02**
Contact hours	**52 Hours**	Duration of Exam	**3 hours**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**

Practical: Plant breeding: **26 hrs**

1. Reproductive of biology, self and cross pollinated plants; Vegetative reproduction
2. Hybridization: Emasculation, bagging, pollination and production of hybrids and pollen fertility
3. Origin, distribution and centres of diversity of crop plants: Wheat, Sorghum, Rice, Chilly, Sugarcane, Cotton, Potato, coffee, Sunflower and groundnut

Practical: Genetics **26 hrs**

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.
   Pedigree analysis for dominant and recessive autosomal and sex-linked traits.
3. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1 and 9:3:4).
4. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
5. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.

Pedagogy: Teaching and learning and conducting experiments.

Formative Assessment for Practical	
Assessment	**Marks**
Test-I	10 Marks
Test-II	10 Marks
Plant breeding station visit report	05 Marks
Total	**25 Marks**
Formative Assessment as per guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions: 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

1. Test the percentage of pollen viability of the given material by hanging drop technique **A** 5 Marks
2. Calculate the recombinant frequency and state the order of gene from the given data **B** 4 Marks
3. Solve the genetic problem **C** 4 Marks
4. Identification of Specimen/slides/ Photographs **D** and **E** 4 Marks
5. Viva Voce 3 Marks
6. Submission (Journal / Record) 5 Marks

Total 25 marks

GENERAL INSTRUCTIONS:

Q1 Material Cassia// Hibiscus/ etc (A)
Q2. Mapping using one point / two point test cross data (B)
Q3. Problems on gene interaction (C)
Q4. Down's, Klinefelter's and Turner's syndromes, Translocation Ring, Laggards and Inversion Bridge (D and E)
Q5. Viva Voce
Q6. Submission (Journal/ Record)

Note: Same Scheme may be used for IA (Formative Assessment) examination

REFERENCES

1	Acquaah, G. (2007). Principles of Plant Genetics &Breeding.NewJearsey, U.S.: Blackwell Publishing.
2	Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.
3	Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford – IBH.
4	Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi,Delhi: John Wiley & sons
5	Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th
	edition. New York, NY: W.H. Freeman and Co.
6	Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco,California: Benjamin Cummings
7	Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992).Biology of Plants. New York, NY: W.H. Freeman and Co.
8	Welsh, J. R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
9	Poehlman, J.M. (1987). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., Westport, Connecticut
10	Chopra, V.L. (2000). Plant Breeding: Theory and Practice 2nd Ed. Oxford & IBH, New Delhi.

B.SC. – V SEMESTER
SUBJECT: BOTANY
SKILL ENHANCEMENT COURSE (SEC-3)
CODE: 035 BOT 061

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**NURSERY AND GARDENING (PRACTICAL)**		
Course Code:	**035 BOT 061**	No. of Credits	**02**
Contact hours	**52 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**

Title of the Paper:
Nursery and Gardening
Code: 035 BOT 061

Course outcomes (COs):

After the completion of this course the learner will be able to:

CO1. Know tools and techniques of nursery
CO2. Techniques of vegetative propagation
CO3. Methods to break seed dormancy
CO4. Components of manures and fertilizers

NURSERY AND GARDENING

(Credits: 2)

1. Tools used in nursery and gardening techniques
2. Vegetative propagation techniques: Natural propagation methods
3. Vegetative propagation techniques: artificial propagation methods: cuttings, grafting, air layering and ground layering
4. Seed structure and types
5. Methods used to break seed dormancy
6. Types of manures: inorganic and organic
7. Common pests and diseases in nursery plants
8. Visit to commercial nursery

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

1.	Perform vegetative propagation method in specimen **A**	5 Marks
2.	Identify and describe the specimen/tools/photographs of specimen **B, C, D, E**, and **E**	10 Marks
3.	Viva voce	4 Marks
4.	Journal	3 Marks
5.	Field visit report	3 Marks
		Total 25 marks

GENERAL INSTRUCTIONS:

Q1 Vegetative propagation techniques from practical 3
Q2. One from practical 1, practical 2, practical 6 and two from practical 7 (one from pest and one from disease)
Q3. Viva Voce
Q4. Journal
Q5. Field visit report

References

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and
6. Cooperation, National Seed Corporation Ltd., New Delhi.
7. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San
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9. Hartmann and Kester. 2017, Plant Propagation: Principles and Practices. (9^{th} Ed.), Pearson Education, Inc., New York.

KARNATAK UNIVERITY, DHARWAD

B.Sc. Programme

SYLLABUS

Subject: Botany

[Effective from 2023-2024]

DISCIPLINE SPECIFIC CORE COURSE (DSCC)
FOR SEM - VI.

AS PER NEP- 2020

BOTANY AND ANOTHER SUBJECT AS DOUBLE MAJORS IN THIRD YEAR (VI SEM) NEP 2020

Sem.	Type of Course	Theory/ Practical	Course Code	CourseTitle	Instructionhour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
VI	DSCC-13	Theory	**036 BOT 011**	Cell Biology	04hrs	56	02 hrs	40	60	100	04
	DSCC-14	Practical	**036 BOT 012**	Cell Biology	04 hrs	52	03 hrs	25	25	50	02
	DSCC-15	Theory	**036 BOT 013**	Plant Physiology and Biochemistry	04hrs	56	02 hrs	40	60	100	04
	DSCC-16	Practical	**036 BOT 014**	Plant Physiology and Biochemistry	04 hrs	52	03 hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	Internship-1		**036 BOT 091**					50	0	50	02
	Total										**26**

B.SC.: SEMESTER – VI
Subject: Botany
Theory: Discipline Specific Core Course (DSCC)

THE COURSE BOTANY IN V SEMESTER HAS TWO PAPERS (THEORY PAPER- 033 BOT 011 FOR 04 CREDITS AND PRACTICAL PAPER- 033 BOT 012 FOR 02 CREDITS) FOR 06 CREDITS: BOTH THE PAPERS ARE COMPULSORY, DETAILS OF THE COURSES ARE AS

Title of the Course
CELL BIOLOGY (THEORY)

Course Code: 036 BOT 011

Program Name	**B.Sc. in BOTANY**	Semester	**VI**
Course Title	**CELL BIOLOGY (THEORY)**		
Course Code:	**036 BOT 011**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

COURSE OUTCOMES (COs):

After the successful completion of the course, the student will be able to:

CO1. Understanding of Cell metabolism, chemical composition, physiochemical and functionalorganization of organelle

CO2. Contemporary approaches in modern cell and molecular biology.

CO3.To study the organization of cell, cell organelles and biomolecules (i.e protein, carbohydrate, lipidand nucleic acid)

CO4.To gain knowledge on the activities in which the diverse macro molecules and microscopic structuresinhabiting the cellular world of life are engaged.

CO5.To understand the various metabolic processes such as respiration, photosynthesis etc. which areimportant for life.

CONTENTS	**56 Hrs**
Unit 1:	**18 hrs**
Cell wall, distribution, chemical composition, functions and variations in prokaryotic and eukaryoticcells (primary and secondary wall), Glycocalyx, Cell-cell interactions/ Junctions, pit connections chromosome, its morphology, types and ultra structure (nucleosome model). Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role ofprotein kinases; Structure and replication of DNA.	
Unit 2:	**12 hrs**
Programmed Cell Death; Biology and elementary knowledge of development and causes of cancer. Structure and functions of cell membrane, active and passive transport, proton pumps associated (Na-K, Ca+ calmodulin etc.and their distribution), phagocytosis, pinocytosis, exocytosis.	
Unit 3:	**14 hrs**
Structural organization, function, marker enzymes of the cell organelles, biogenesis of mitochondria and chloroplasts, brief account of transport in mitochondria and chloroplasts (Tim/Tom; Tic/Toc) and semi autonomous nature of mitochondria and chloroplast. Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclear membrane, Nucleolus, rRNA processing.	
Unit 4:	**12 hrs**
Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes.	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Attendance	10
Test (Objective type)	10
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines are compulsory	

Title of the Course
CELL BIOLOGY (PRACTICAL)

Course Code: 036 BOT 012

Course Title	**CELL BIOLOGY (PRACTICAL)**		Practical Credits	**02**
Course Code	**036 BOT 012**		Contact Hours	**52 Hours**
Formative Assessment	**25Marks**	Summative Assessment		**25 Marks**
PRACTICAL CONTENT				
1. Study of plant cell structure with the help of epidermal peel mount of Onion/ Rhoeo/ Crinum. 2. Study of cell and its organelles with the help of electron micrographs. 3. Measurement of length and breadth of plant cell using micrometry. 4. Study different stages of mitosis and meiosis (Onion/ Rhoeo/ Crinum) 5. Isolation of cell organelle – Chloroplast.				

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

4. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

CELL BIOLOGY

Time =03 hrs Marks =25

1. Preparation of squash/ smear of material A, identify, Sketch and label the any two stages with reasons. 06marks
2. Find out cell length and breadth of the given material using micrometry 05marks
3. Identify the slides C & D 04 marks
4. Viva-voce 05 marks
5. Submission (Journal/ Record + 5 slides) 05 marks

Total 25 marks

GENERAL INSTRUCTIONS:

Q1. Give specimen from Onion/ Rhoeo/ Crinum plant (A)
Q2. Give specimen from Onion/ Rhoeo leaf (B)
Q3. Give slide from mitosis (C) meiosis (D)
Q4. Viva-voce
Q5. Submission (Journal/ Record + 5 slides)

Note: Same Scheme may be used for IA (Formative Assessment) examination

REFERENCES	
1	Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington, D.C.:ASM Press & Sunderland, Sinauer Associates, MA
2	Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons.
3	De Robertis, E. D. P. and De Robertis R. E. 2009. Cell and Molecular Biology, 8th edition. LippincottWilliams and Wilkins, Philadelphia.
4	Becker W. M., Kleinsmith L.J. and Bertni G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San fransisco.
5	Reven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H.Freeman andCompany
6	Alberts, B., Bray, D., Hopkin, K., Johnson, A. D., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2013).Essential cell biology (4th ed.). Garland Publishing.
7	Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
8	Verma, P. S. (2004). Cell Biology,Genetics, Molecular Biology: Evoloution and Ecology. India: S. Chand Limited.

Title of the Course:
PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)
Course Code: 036 BOT 013

Program Name	**BSc/ BOTANY**	Semester	**VI**
Course Title	**PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)**		
Course Code:	**036 BOT 013**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

COURSE OUTCOMES (COs):

After the successful completion of the course, the student will be able to:

CO1. Importance of water and the mechanism of transport.
CO2.To understand biosynthesis and breakdown of biomolecules.
CO3. Role of plant hormones in plant development and about secondary metabolites.
CO4. Preliminary understanding of the basic functions and metabolism in a plant body.
CO5. To understand the importance of nutrients in plant metabolism and crop yield.

CONTENTS	**56 Hrs**
UNIT 1	**16Hrs**
Plant water relations: Importance of Water as a solvent, Diffusion, osmosis, imbibition, osmotic pressure, osmotic potential, turgor pressure, wall pressure, water potential and its components. Mechanism of water absorption, Factors affecting water absorption. **Transpiration.** Types and process. Mechanism of guard cell movement. K+ ion mechanism. Antitranspirants. **Mechanism of ascent of sap:** Vital and physical force theories. **Phloem Transport:** Transport of organic solutes. Path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis. **Mineral nutrition:** A brief account on Micro and macro nutrients**.**	
UNIT 2	**12Hrs**
Enzymes - classification, kinetics and mechanism of action. **Proteins and amino acids**: classification, structure - primary, secondary, tertiary and quaternary**.** **Vitamins** - classification, distribution, structure, production, function. **Lipids:** classification, structure, function and biosynthesis of fatty acids. **Secondary plant products**: structure, biosynthesis and distribution of terpenes, phenolics and nitrogen containing compounds.	
UNIT 3	**14Hrs**
Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration. **Respiration**: aerobic and anaerobic respiration, Glyoxylate, Oxidative Pentose Phosphate Pathway. **Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation.	

UNIT 4	**14Hrs**
Definition and classification of plant growth regulators- Hormones. Site of synthesis, biosynthesis pathway and metabolism and influence on plant growth development of individual group of hormone- Auxins, Gibberlins, cytokinins, ABA, ethylene. Synthetic growth regulators- classification, their effect on plant growth and development. Practical utility in agriculture and horticulture**.** **Sensory Photobiology**: Biological clocks, photoperiodism, function & structure of phytochromes, phototropin & cryptochromes. Senescence, Ageing & Cell Death (PCD and Autophagosis).Plant Movements.	

Assessment	**Marks**
Attendance	10 Marks
Test	10 Marks
Seminar	10 Marks
Assignment	10 Marks
Total	40 Marks
Formative Assessment as per guidelines are compulsory	

Title of the Course:
PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (PRACTICAL)
Course Code: 036 BOT 014

Course Title	**PLANT PHYSIOLOGY AND BIOCHEMISTRY (PRACTICAL)**	Practical Credits	**2**
Course Code	**036 BOT 014**	Contact Hours	**52 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

PRACTICAL CONTENT

1. Experiment to demonstrate the phenomenon of osmosis by physical and physiological method.
2. To determine the osmotic pressure of the cell sap by plasmolytic method.
3. To demonstrate root pressure / transpiration pull in plants.
4. To compare the rate of transpiration from the two surfaces of leaf by using Garrreau's potometer.
5. Experiment to measure the transpiration by using Ganong's photometer.
6. To demonstrate that oxygen is liberated in the process of photosynthesis.
7. Separation of photosynthetic pigments by paper chromatography and measure their Rf values.
8. Experiment to demonstrate the fermentation.
9. To isolate and identify the amino acids from a mixture using paper chromatography.
10. Study of plant movements.
11. Qualitative test for Starch, Protein, Sugars and Lipids.
12. Estimation of TAN (Titratbale acid Number) from *Bryophyllum* leaves/*Aloe vera*.

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

11. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5if necessary)

T

otal: 60 MarksNote: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

Time =03 hrs **Marks =25**

1. Conduct Major Experiment A 06 marks
2. Comment on minor Experiments B & C 06 marks
3. Micro Chemical test D 03 marks
4. Viva-voce 05 marks
5. Practical Record 05 marks

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Practical	
Assessment	**Marks**
Attendance	10 Marks
Test	10 Marks
Project report / Industrial visit	05 Marks
Total	**25 Marks**
Formative Assessment as per guidelines are compulsory	

References

1. Fundamentals of Biochemistry 2nd Ed, John Wiley and Sons Inc. Wilson, K. and Walker, J. 1994
2. JainV K, 2008. Fundamentals of Plant Physiology.S Chand andCo.
3. Kochhar P L, Krishnamoorthy H N. Plant Physiology. Atmaram and sons, Delhi.
4. Kumar and Purohit. Plant Physiology: Fundementals and Applications.Agrobotanical Publishers.
5. Malik CP, 2002. Plant Physiology. Kalyani publishers.
6. Mukherjii S, Ghosh AK, 2005. Plant Physiology. New Central Book Agency, Culcutta.
7. Noggle GR, Fritz GJ, Introductory Plant Physiology.Prentice Hall of India.
8. Pandey SN, Sinha BK, 2006. Plant physiology.Vikas Publishing House, NewDelhi.
9. Salisbury F B, Ross C W, 1992. Plant Physiology. CBS publishers and Distributers, NewDelhi.
10. Sinha A K, 2004. Modern Plant Physilogy. Narosa publishing House, NewDelhi.
11. Srivastava H S, 2004. Plant physiology and Biochemistry. Rasthogi publications.
12. Verma V, 2007.Text Book of Plant Physiology. Ane Books Pvt. Ltd

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

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'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/JS/MGJ(Gen)/2023-24/59 Date: 04/09/2023

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಪದವಿಗಳಿಗೆ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 104 ಯುಎನ್ಇ 2023, ದಿ: 20.07.2023.
2. ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 2 ರಿಂದ 7, ದಿ: 31.08.2023.
3. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 04/09/2023

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music) /BVA / BTTM / BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS) / BBA & BA ILRD ಸ್ನಾತಕ ಪದವಿಗಳ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020ರ ಮುಂದುವರೆದ ಭಾಗವಾಗಿ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಕೋರ್ಸಿನ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

4/9/23
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂರ್ತಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. in Chemistry

Syllabus With Effect From 2023-24

DISCIPLINE SPECIFIC CORE COURSE (DSCC)

FOR SEM V &VI,

SKILL ENHANCEMENT COURSE (SEC) FOR SEM V SEM

AS PER NEP - 2020

Karnatak University, Dharwad

B.Sc.in Chemistry

Effective from 2023-24

Sem.	Type of Course	Theory/Practical	Course Code	CourseTitle	Instruction hour/week	Total hours / sem	Duration Of Exam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	**035 CHE 011**	Chemistry (Theory) -IX	04hrs	56	02hrs	40	60	100	04
	DSCC-10	Practical	**035 CHE 012**	Chemistry (Practical) - X	04hrs	56	03hrs	25	25	50	02
	DSCC-11	Theory	**035 CHE 013**	Chemistry (Theory) -XI	04hrs	56	02hrs	40	60	100	04
	DSCC-12	Practical	**035 CHE 014**	Chemistry (Practical) - XII	04hrs	56	03hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	SEC-3	Practical	**035 CHE 061**	**Employability skills in Chemistry**	04hrs	56	03hrs	25	25	50	02
	Total										**26**
VI	DSCC-13	Theory	**036 CHE 011**	Chemistry (Theory) -XIII	04hrs	56	02hrs	40	60	100	04
	DSCC-14	Practical	**036 CHE 012**	Chemistry (Practical) - XIV	04hrs	56	03hrs	25	25	50	02
	DSCC-15	Theory	**036 CHE 013**	Chemistry (Theory) -XV	04hrs	56	02hrs	40	60	100	04
	DSCC-16	Practical	**036 CHE 014**	Chemistry (Practical) - XVI	04hrs	56	03hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	Internship-1	--	**036 CHE 091**	**Chemistry Internship**				50	0	50	02
	Total										**26**

Karnatak University, Dharwad
B.Sc. Chemistry

Programme Specific Outcomes (PSO):

On completion of the 03 years Degree in Chemistry students will be able to:

- Demonstrate, solve and understand the major concepts in all the disciplines of chemistry.
- Provide students with broad and balanced knowledge and understanding of key chemical concepts.
- Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.
- To apply standard methodology to the solutions of problems in chemistry.
- Provide students with knowledge and skill towards employment or higher education in chemistry or multi-disciplinary areas involving chemistry.
- Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.
- Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.
- Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.
- To prepare students effectively for professional employment or doctoral degrees in chemical sciences.
- To cater to the demands of chemical industries of well-trained graduates.
- To build confidence in the candidate to be able to work on his own in industry and institution of higher education.
- To develop an independent and responsible work ethics.

B.Sc. Semester–V

Discipline Specific Course (DSC) -9

Course Title: Chemistry (Theory) IX

Course Code : 035CHE011

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No.of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-9	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO1: Explain theory of coordination compounds, IUPAC system of nomenclature, calculation of EAN, Isomerism in coordination compounds and Valence bond theory

CO2: Understand Metal carbonyls: Types, nomenclature, preparation, and properties. 18 electron rule, Structure of mononuclear and binuclear carbonyls using VBT, Preparation and structure of methyl lithium, Zeiss salt and ferrocene and industrial applications of organometallic compounds.

CO3: Study aromaticity of 5-membered and six member rings containing one hetero atom, synthesis of pyrrole, furan, pyridine, mechanism of electrophilic substitution reactions of furan, pyrrole and pyridine. Indole, quinoline and isoquinoline.

CO4: Describe constitution of hygrine, coniine and nicotine. Classification and biological significance, source and structure of Vitamin A, Vit-B1, B2, B6, K1 and C and functions and diseases by the deficiency of hormones.

CO5: Explain the ionization of electrolyte, migration and transport number of ions and its determinations. Enable to explain the conductivity of ions, variation with dilution, differentiating specific, equivalent and molar conductivity. Describe the application of conductivity measurement for concentration, dissociation of weak electrolyte.

CO6: Explain the degree of dissociation for strong and weak electrolytes and their conductivity with concentrated and dilute solution.

CO7: Explain the laws of absorption and photochemistry. Quantum yield significance. Explain the photosensitization and photophysical processes.

CO8: Aware about the importance of energy sources, alternative energy from various sources. Explain about the working principle and applications of different batteries and fuel cells.

CO9: Understand Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and Inorganic polymers, thermoplastic and thermosetting polymers.

CO10: Understand about molecular weight in simple and polymer molecules. Explain about the various

methods applied to determine molecular weight of polymers.

Unit	Title: Chemistry (Theory) IX	56 hrs/ Sem
Unit I	**Coordination chemistry-I** Classification of ligands. Werner's theory of coordination compounds with reference to Cobalt ammine complexes. Methods of detection of complex formation. IUPAC system of nomenclature. Sidgwick's theory and calculation of EAN in different complexes. Isomerism in coordination compounds (ionisation, hydrate, linkage, coordination, coordination-position, geometrical and optical) with respect to coordination number 4 and 6. Valence bond theory, inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu with coordination number 4 and 6. Limitations of VBT. Chelates and their applications. (**8 hrs**) **Organometallic compounds** Definition and classification with appropriate examples. Concept of hapticity of organic ligands with examples. Metal carbonyls: Types, nomenclature, preparation, and properties. 18-electron rule. Structure of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π-acceptor behavior of carbon monoxide. Preparation and structure of methyl lithium, Zeiss salt and ferrocene. Industrial applications of organometallic compounds. **(6 hrs)**	14 hrs
Unit II	**Heterocyclic Compounds** Classification and Nomenclature, Aromaticity of 5-membered and six member rings containing one hetero atom, synthesis of pyrrole, furan (Paal-Knorr synthesis), pyridine (Hantzsch synthesis), Mechanism of Electrophilic substitution reactions of furan, pyrrole and pyridine, (Formylation, Nitration, Bromination, Friedel Craft's reaction). Indole (Fischer's synthesis) quinoline (Skraup's synthesis) aminoquinoline(Bischler-Napieraskisynthesis). **(5 hrs)** **Alkaloids:** Classification, extraction, general properties, Hoffman's exhaustive methylation. Constitution and synthesis of Hygrine, Coniine and Nicotine. **(4 hrs)** **Vitamins** Classification and biological significance, sources and structure of Vitamin A, Vit-B1 (thiamine), Vit-B2 (riboflavin), Vit-B6 (pyridoxine), tocopherol (Vit-E), Vit-K1 (phylloquinone), Vit-C (ascorbic acid). Synthesis of Vitamin C from D-glucose. **Hormones:** Definition, classification with examples and functions. Diseases caused due to deficiency of hormones. Synthesis of Adrenaline. **(5 hrs)**	14 hrs

Unit III	**Electrochemistry-I** Arrhenius theory of electrolytic dissociation and its limitations. Migration of ions - Transport number, Determination of transport number by Hittorf's and Moving boundary methods. Problems on transport number. Kohlrausch's law and its applications. **Conductivity:** Conductance of an electrolyte, specific conductance, equivalent conductance and molar conductance. Conductivity cell, cell constant and its importance. Applications of conductivity measurementsin various acid base titrations. Advantages of conductometric titration. Determination of solubility and solubility product of sparingly soluble salts. Determination of dissociation constant of weak acid. **Theory of strong electrolytes**: Degree of dissociation, Ostwald's dilution law and its limitations. Debye–Huckel theory of strong electrolytes, relaxation effect, electrophoretic effect, Debye–Huckel-Onsager equation and its significance (no derivation). **(8 hrs)** **Photochemistry** Absorbance, transmittance, Beer-Lambert's law and its limitations, Calculation of molar extinction coefficient. Laws of photochemistry - Grotthus-Draper law, Stark – Einstein's law of photochemical equivalence, differences between photochemical and thermal reactions. Quantum yield - definition, reasons for high and low quantum yields with examples. Determination of quantum yield by thermo-couple method and using chemical actinometer. Photosensitization with examples. Photophysical process - definition, fluorescence, phosphorescence, inter system crossing. Chemiluminescence and bioluminescence with examples, Difference between photophysical and photochemical process. **(6 hrs)**	14 hrs
Unit IV	**Solutions:** Introduction-liquid-liquid mixtures (miscible, immiscible and partially miscible), Raoult's law-definition, equation. Duhem – Margules equation and its applications, Principle of distillation of binary miscible liquids-Konowaloff's rule, derivation. Distillation of binary miscible liquids-type-I, II and III solutions.Azeotropes-definition, minimum and maximum boiling point azeotropes. Immiscible liquids-definition, Steam distillationPartially miscible liquids-definition, conjugate solutions, CST, types I (phenol-water system), II (triethylamine-water system) and III (nicotine-water system). Solutions of solid in liquids, solid solutions (qualitative treatment). **(5 hrs)**	14 hrs

	Phase Equilibria Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapor and solid-vaporequilibria, phase diagram for one component systems (H_2O and S), with applications. Phase diagrams for two component systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points. **(5 hrs)** **Polymers:** Introduction, definition, degree of polymerization and classification.Mechanism of addition and condensation polymerization: Molecular weight of polymers: Number average molecular weight and weight average molecular weight, Determination of molecular weight by Viscometry, and Osmotic pressure method. **(4 hrs)**	

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/Assignment/Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–V

Discipline Specific Course(DSC)-10

Course Title: Chemistry (Practical) X

Course Code:035CHE012

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No.of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-10	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Understand the qualitative analysis of inorganic mixtures containing two anions and two cations containing carbonates and bicarbonate, two halides, borate, phosphate, ferrous/ ferric salts & less common element (Mo, Ce or Li).

CO2: Perform the various steps involved in Gravimetric Analysis of metal ions.

1. Semi micro qualitative analysis of inorganic mixtures containing two anions and two cations

a) Mixture containing carbonate and bicarbonate

b) Mixture containing two halides

c) Mixture containing borate

d) Mixture containing phosphate

e) Mixture containing ferrous /ferric salt

f) Mixture containing less common element (Mo, Ce or Li)

2. Gravimetric Analysis:

1. Determination of barium as $BaSO_4$.
2. Determination of iron as Fe_2O_3
3. Determination of aluminum as Al_2O_3
4. Determination of aluminum (III) using oxine .
5. Separation of Fe (II) and Ni (II) from the solution. Determination of Fe (II) gravimetrically and Ni (II) volumetrically.
6. Separation of Fe (II) and Ni (II) from the solution. Determination of Ni (II) gravimetrically and Fe (II) volumetrically.

Examination

In a batch of ten students in the practical examination, five students may be given Semi micro qualitative analysis and other five students may be given gravimetric estimation. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

For Semi micro qualitative analysis:

Preliminary test and presentation - 03 marks

Anions (group test + C.T. + ionic reactions) (1+1+1) x 2 = 6 marks.

Cations(group test + C.T. + ionic reactions) (1+2+1) x 2 = 8 marks.

Journal - 3 marks, Viva-voce - 5marks, **Total = 25 marks.**

Gravimetric Determination:

Accuracy-12marks, Technique and Presentation-2marks Calculation and reactions 3 marks, Journal-3 marks, Viva-Voce-5 marks, Total=25 marks.

Deduction of Marks for accuracy:

±6mg -12 marks, ± 8mg-10 marks, ±10mg -8 marks, ±12mg-06 marks, ±14mg-04 marks, ±16mg-02marks, above ±16 mg -zero marks.

Books recommended:

1. Vogel's Qualitative and quantitative Inorganic Analysis, G. Svehla, 7th Ed, Longman (2001).
2. Advanced Practical Chemistry, Pragathi, Publications, Jagadamba Singh,
3. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut

B.Sc. Semester–V

Discipline Specific Course(DSC)-11

Course Title: Chemistry (Theory) XI

Course Code:035CHE013

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No.of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-11	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course, students will be able to:

CO1: Understand the types, theory,technique and applications of separation techniques like solvent extraction and chromatography,dyes and colors used in day-to-day life.

CO2: Know color and constitution, classification, synthesis and applications of different types of dyes.

CO3: Define spectroscopy and different regions of electromagnetic spectrum.Basics of UV/visible spectroscopy. Different kind of transitions that can take place within molecule

CO4: Explain the origin of IR spectrum.Describe different types of vibrational modes of simple molecules.Explain the principles of different types of IR instruments.Outline different applications of UV, IR.

CO5: Importance Air pollution and Water Pollution, techniques for measuring water pollution, effluent treatment plant, water purification methods, sludge disposal, disposal of nuclear wastes and Water quality parameters for waste water, industrial water and domestic water. Understand about types of soil, physical, chemical and biological properties of soil, soil organisms, micro and macronutrients

CO6: Know about Chemical explosives and Rocket propellants.

Unit	**Title: Chemistry (Theory) XI**	**56 hrs/ sem**
Unit I	**Solvent extraction**: Types, theory and mechanism. Extraction by ion-association and Chelation. Synergistic extraction, techniques and applications. Determination of Uranium using oxine. **(3hrs)** **Chromatography**: Classification, techniques and development of chromatograms. **Paper chromatography**: Theory, R_f value, factors affecting R_f value and its	14 hrs

	calculations, techniques and applications. Separation of Pb^{2+}, Ag^{+} and Hg_2^{2+} and calculation of R_f value. **Column chromatography**: Theory, techniques and applications. Separation of methylene blue and malachite green. **Thin-layer chromatography**: Superiority of TLC, theory methodologyand applications **Ion exchange chromatography**: Properties and types of ion exchangers. Action of cation and anion exchange resins, techniques and applications. Separation of amino acids from its mixture. **Gas Chromatography and High-Performance Liquid Chromatography:** Principles and applications. **(11hrs)**	
Unit II	**Ultraviolet Spectroscopy:** Types of electronic transitions, chromophores and auxochromes, bathochromic shift and hypochromic shift, intensity of absorption, Woodward-Fieser rules for calculating λ_{max}Conjugateddienes such as alicyclic, homoannular and heteroannulardienes. Applications of UV spectroscopy. **(5 hrs)** **Infrared Spectroscopy:** Introduction to infrared spectroscopy, intensity of absorption band, position of absorptions, C-H, >C=O, O-Hand N-H absorption bands with explanation for variation in stretching frequencies. Identification of H- bonding in alcohols, phenols and carboxylic acids using IR spectroscopy. **(5 hrs)** **Dyes:** Theory, color and constitution, classification, mordant and wet dyes, synthesis and applications of congo red, malachite green, phenolphthalein, eosin and indigo. Dyes used in food and their safety, organic pigments with examples. **(4 hrs)**	14 hrs
Unit III	**Molecular Spectroscopy:** Interaction of electromagnetic radiation with matter, electromagnetic spectrum. **Rotational Spectroscopy:** Rotation of molecules, diatomic: rigid rotator, selection rule: derivation for expression of energy and bond length (HCl), problems on bond length, polyatomic molecules: linear, symmetric top, asymmetric top molecules (qualitative approach).	14 hrs

	Vibrational Spectroscopy: Vibrating diatomic molecules - energy of diatomic molecules, force constant, vibrational spectra: harmonically vibrating diatomic molecules (HCl) and anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies, and problems on force constants. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. **Raman spectra:** Classical theory, Rotational Raman spectroscopy (Linear and symmetric top molecules for S and R branch), Vibrational Raman spectroscopy; vibration - rotational Raman spectra (Rotational fine structures), complementary of Raman and IR. **Electronic Spectroscopy:** Diatomic molecules: Born- Oppenheimer approximation, vibrational course structure of electronic transition and intensity, Franck – Condon principle, pre-dissociation, 'g' and 'u' transitions and their applications in organic molecules.	
Unit IV	**Environmental Chemistry** **Air pollution:** Review of major regions of atmosphere. Chemical and photochemical reactions in the atmosphere. Sources, effects and control measures of air pollutants (CO, CO_2, NO_x, SO_x and H_2S). Methods of determination of CO, NO_x and SO_x. **Water Pollution:** Water pollutants and their sources. Techniques for measuring water pollution. Effluent treatment plant (primary, secondary and tertiary treatment).Water purification methods (reverse osmosis, electrodialysis and ion- exchange) Sludge disposal. Industrial waste management. Disposal of nuclear wastes. Water quality parameters. **(7 hrs)** **Soil chemistry**: Types of soil, physical, chemical and biological properties of soil, soil organisms, nitrogen and sulphur transformation. A brief account of micro- and macronutrients (sources and importance) Determination of pH, alkalinity, total organic matter, Ca (II) and Mg (II) ions in soil samples. **(4 hrs)** **Chemical explosives**: Preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to Rocket propellants. **(3 hrs)**	14 hrs

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/Assignment/Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–V

Discipline Specific Course (DSC) -12

Course Title: Chemistry (Practical) XII

Course Code:035CHE014

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-12	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Understand to apply the knowledge of conductivity, emf and absorbance to performing the experiments.

CO2: Acquire skills for handling analytical instruments like potentiometer, conductometer, pH meter & colorimeter.

Expt. No,	Title: PHYSICAL CHEMISTRY EXPERIMENTS	56 hrs/ Sem
1	Determination of concentration of HCl using standard NaOH solution by conductometric titration.	
2.	Determination of concentration of CH_3COOH using standard NaOH solution by conductometric titration.	
3	Determination of concentration of HCl using standard NaOH solution by potentiometric titration.	
4	Determination of concentration of FAS using standard $KMnO_4$ solution by potentiometric titration.	
5	Verification of Beer- Lambert law by colorimetric method and calculation of molar extinction coefficient of $Cu^{2+.}$	
6	Determination of critical solution temperature of two partially miscible liquids (water and phenol).	
7	Determination of equivalent conductance of strong electrolyte (NaCl) and equivalent conductance at infinite dilution (λ_∞).	
8	Determination of dissociation constant (K_a) of weak acid by potentiometrically.	
9	Determination of second order rate constant for the hydrolysis of ethyl acetate by NaOH conductometrically.	
10	Determination of dissociation constant of acetic acid by conductometrically.	
11	Verification of Beer- Lambert law by colorimetric method and determination of unknown concentration of ferric (Fe^{3+}) ions.	
12	Preparation of standard acidic buffer solutions using 0.1M acetic acid & 0.1M sodium acetate using Henderson-Hasselbatch and determination of mole ratio of buffer solutions of unknown pH	

NOTE: Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. During practical examination chart is not allowed, wherever necessary simple procedure may be given.

Distribution of Marks:

Accuracy-10 marks, Technique and Presentation-2, Calculation and graph-5 marks, Journal-3 marks, Viva-Voce-5 marks, Total = 25 marks.

Deduction of Marks for accuracy:

Error up to 5% - 10 marks, 6 - 10% 08 marks, 11-15% 06 marks, 16-20% - 04 marks, above 20% zero (0) marks

Recommended Books/References

1. Vogel's Qualitative Inorganic Analysis, G.Svehla, 7th Ed, Longman (2001).
2. Advanced Practical Chemistry, Jagadamba Singh, R.K.P. Singh, Jaya Singh, L.D.S.Yadav, I.R. Siddiqui, Pragati prakashan, 7th edition, 2017.
3. College Practical Chemistry: V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati. University Press-2011.
4. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.
5. Comprehensive Practical Organic Chemistry: V K Ahluwalia, and Renu Aggarwal, University Press-2000.
6. Findlay's practical physical chemistry -revised by levitt, Longman's, London,(1968).
7. Experiments in Physical chemistry - Shoemaker and Garland, McGraw Hill International edn (1996).

B.Sc. Semester–V

Skill Enhancement Course: SEC-3

Course Title: Employability skills in chemistry

Course Code: 035CHE061

Type of Course	Theory /Practical	Credits	Instruction hour/week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	TotalMarks
SEC-3	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**25**	**25**	**50**

Employability skills in chemistry will have Paper A, B and C. Students will choose experiments either from Paper A or B or C but not mixture of all. Principal of the college can also suggest the selection of Paper based on availability of Chemicals, instruments etc.

Paper A: Separation techniques and pharmaceutical analysis

1. Separation of amino acids by paper chromatography and measuring R_f values.
2. Compare the aspirin prepared in the laboratory with the ingredients of an aspirin tablet by thin layer chromatography.
3. Separation of Co^{2+} and Ni^{2+} by paper chromatography and measuring R_f values.
4. Separation of Ni(II) and Fe(II) by complexation with DMG, extracting the Ni(II)-DMG complex in chloroform and determine its concentration by colorimetry.
5. Separation of amino acids from organic acids by ion exchange chromatography,
6. Separation of Mg (II) and Fe (II) by ion exchange chromatogrphy.
7. Determination of aspirin present in tablets conductometrically /titrimetrically
8. Determination cholesterol colorimetrically.
9. Determination of amino acids colorimetrically using ninhydrin.
10. Determination of Glucose /Sucrose colorimetrically using Fehling's Solution.
11. Preparation of magnesium bisilicate (Antacid)

Paper B: Industrial Chemistry

1. Safety practices in the Chemistry laboratory.
2. Determination of calcium in CAN fertilizer.
3. Determination of water of crystallization and Fe (II) in Mohr's salt by titrating with standard $KMnO_4$.
4. Preparation of phenol formaldehyde Resin.
5. Preparation of urea formaldehyde resin.
6. Nitration of salicylic acid by green method (Using calcium nitrate and acetic acid).
7. Preparation of aspirin from salicylic acid.
8. Analysis of Cement. (Moisture, Silica and Calcium (II))
9. Analysis of food adulterants in Tea Powder, Coffee Powder, turmeric powder, Chili Powder, oil / fat, milk, etc.
10. IR peak analysis for functional groups using recoded IR Spectra
11. Preparation and characterization of biodiesel from vegetable oil/waste cooking oil.

Paper C: Soil, Water and Food Analysis (With effect from 2024-25 and onwards)

1. Qualitative detection of nitrate, phosphate, Fe (II) and Ca (II) in soil samples.
2. Determination of pH of different types of soil samples.
3. Determination of total alkalinity of soil samples.
4. Determination of total organic matter in the given soil samples.
5. Determination of Ca (II) ions from soil samples.
6. Determination of TDS in water samples.
7. Determination of chloride and sulfate of water samples by precipitation titration ($AgNO_3$ and K_2CrO_4).
8. Determination of pH, acidity and alkalinity of polluted water samples.
9. Qualitative analysis of carbohydrates, proteins and lipids (minimum to samples).
10. Determination of proteins colorimetrically using biuret reagent.

Examination

Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of marks

1. **Preparation experiment:** Reaction – 03 marks, Calculation of theoretical Yield- 02 mark, Observed yield-12 marks, Journal- 03 marks, Viva- voce – 05 marks, **Total= 25 marks**

   Deduction of Marks for accuracy:

   Less than 10% yield- 5 marks, 11-15%- 4 marks, 16-20%-3 marks, 21-25%- 2 marks, above 25%- zero marks

2. **Analysis experiments: a)** In the Analysis food adulteration, Identification of adulterants in each sample carries 4 marks. Four different samples may be given, 4 x 4 = 16 marks,

   b) In the analysis cement, moisture content - 04 marks, Silica content - 6 marks and Calcium content – 6 marks = 16 marks

   c) In the analysis of IR spectra, the spectra of 4 different compounds may be given. The analysis of each carries 4 marks, 4 x 4 = 16 marks

   Systematic presentation = 1 mark, Journal-3 marks, Viva-Voce-5 marks, Total = 25 marks.

3. **Determination experiments:**

   Accuracy-10 marks, Technique and Presentation-2, Calculation and reaction/graph-5 marks, Journal-3 marks, Viva-Voce-5 marks, Total = 25 marks.

   Deduction of marks for accuracy:

   Error up to 5% - 10 marks, 6 - 10% 08 marks, 11-15% 06 marks, 16-20% 04 marks, above 20% zero (0) marks

4. **Chromatographic / Ion-exchange Techniques**

   Distribution of Marks:

a. Preparation of paper chromatography / Column for ion-exchange method: 8 marks
b. Spotting : 03 marks, Identification of Spots: 03 marks, R_f Calculation: 03 marks
c. Separation by ion-exchange and determination: 09 marks

   Journal – 03 marks, Viva-Voce-5 marks

   Marks for Accuracy: Error up to 10% -17 marks, 11-15%- 14 marks, 16-20%- 10 marks, 21-25% - 07 marks, 26 – 30 % - 05 marks and above 30% nil.

References

1. Vogel's Qualitative Inorganic Analysis, G.Svehla, 7th Ed, Longman (2001).
2. Advanced Practical Chemistry, Jagadamba Singh, R.K.P. Singh, Jaya Singh, L.D.S. Yadav, I.R. Siddiqui, Pragati prakashan, 7th edition, 2017.
3. College Practical Chemistry: V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati. University Press-2011.
4. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.
5. Comprehensive Practical Organic Chemistry: V K Ahluwalia, and Renu Aggarwal, University Press-2000.
6. Findlay's practical physical chemistry -revised by Levitt, Longman's, London,(1968)
7. Experiments in Physical chemistry - Shoemaker and Garland, McGraw Hill International Edn (1996)

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
3. Douglas, B. E., Mc Daniel, D. H .& Alexander,
4. J. J.Concepts and Models in Inorganic Chemistry, John Wiley& Sons.
5. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
6. Shriver, D.F.& Atkins,P.W. Inorganic Chemistry,Oxford University Press.
7. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt.Ltd.
8. Rodgers, G. E. Inorganic & Solid-State Chemistry, Cengage Learning India Ltd., 2008.
9. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
10. Mahan, B.H. University Chemistry3rd Ed. Narosa (1998).
11. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).
2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.
3. McMurry, J. E. Fundamentals of Organic Chemistry,7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P.A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Morrison, R.T.&Boyd,R.N.OrganicChemistry,Pearson,2010.
7. Bahl,A.&Bahl,B.S.AdvancedOrganicChemistry,S.Chand,2010.
8. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).
11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.
12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.
14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
15. Organic Chemistry- Mehta and Mehta, 2005.

Physical Chemistry

1. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
2. Fundamental of electrochemistry by Vladimir S. Bagotsky · 2005
3. An introduction to electrochemistry by Samuel Glasstooe 2011
4. Photochemistry by Gurdeep Raj, 5th edition -2008
5. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, 1987.
6. The Elements of Physical Chemistry (3rd edition) - Peter Atkins, Oxford Univ. Press, 2000
7. Essentials of Physical Chemistry by Bahl and Bahl, Revised edition-2009
8. Polymer Science. V. R. Gowariker, Viswanathan jayadev Sreedhar 2nd edition-2015
9. Text Book of Polymer Science - Bilmeyer, Jr. F.W. John Wiley & Sons, 1984

B.Sc. in Chemistry

VI Semester

With effect from 2023-24

B.Sc. Semester–VI

Discipline Specific Course (DSC)-13

Course Title: Chemistry (Theory) XIII

Course Code:036CHE011

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-13	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):At the end of the course students will be able to:

CO1: Understand Crystal field theory, crystal field splitting, calculation and comparison of CFSE in octahedral, tetragonal, tetrahedral and square planar complexes.

CO2: Study the Stability of metal complexes (thermodynamic and kinetic), stepwise and overall stability constant and their relationship. Factors affecting the stability of metal complexes.

CO3: Learn the structure and constitution of Carbohydrates, Ring Size determination and properties, Structures of disaccharides and polysaccharides and biological importance.

CO4: Study the classification of amino acids, stereochemistry of amino acids. Zwitter ion and explanation to isoelectric point, Synthesis of amino acids and diptides, biological importance, primary, secondary structure of proteins (α-helical, β-sheet), classification, isoprene rule, special isoprene rule constitution and synthesis of citral and α-terpinol.

CO5: Describe the Role of metal ions in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions. Na/K pump and Structure of hemoglobin, myoglobin and chlorophyll.

CO6: Know the Solvent properties and typical reactions in liquid ammonia and liquid Sulphur dioxide.

CO7: Distinguish between reversible and irreversible cells. Concept of EMF and its measurement.

CO8: Describing the electrode potential, types, applications for pH and EMF determinations.

CO9: Explaining free energy change for ideal solution, theory of distillation process for separating liquid mixtures.

CO10: Distinguish between miscible and immiscible liquids. Explain the critical solution

temperature, liquid-solid solution, solid solutions.

CO11: Learn to develop and demonstrate knowledge pertaining to the background and development of Green Chemistry, Learn about green chemistry and its necessity, choice of solvents, atom economy, and sustainable raw materials, about the examples of green reactions and future trends in green reaction.

Unit	Title: Chemistry (Theory) XIII	56 hrs/ Sem
UnitI	**Coordination Chemistry-II** Crystal field theory, crystal field splitting, calculation and comparison of CFSE in octahedral and tetrahedral complexes, crystal field effects in weak and strong field ligands. Pairing energies. Factors affecting the magnitude of crystal field splitting. Spectrochemical series. Tetragonal distortion of octahedral geometry, John Teller distortion. Crystal field splitting in square planar complexes. Explanation of color and magnetic moments of complexes. Determination of magnetic susceptibility by Gouy's method. Stability of metal complexes (thermodynamic and kinetic), stepwise and overall stability constant and their relationship. Factors affecting the stability of metal complexes. **(8 hrs)** **Bioinorganic Chemistry** Role of metal ions in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions. Na/K pump. Structures of hemoglobin and chlorophyll, and the role of Fe(II) and Mg(II) metal ions in these pigments. Role of Ca^{2+} in blood clotting. **(3 hrs)** **Non-aqueous solvents** Solvent properties and typical reactions studied in liquid ammonia and liquid sulphur dioxide. **(3 hrs)**	14 hrs
UnitII	**Carbohydrates:** Definition, classification, osazone formation and its mechanism, epimers and epimerization, interconversion of fructose and glucose, Kiliani synthesis and Ruff degradation, ring structure of D-glucose, mutarotation, and determination of ring size of D-glucose by Haworth -Hirst method, conformational analysis of monosaccharides (example: Glucose). Disaccharides: structure of sucrose and lactose (mention hydrolysis product, glycoside linkage and reducing properties). Polysaccharides: partial structure of starch and cellulose. Photosynthesis of carbohydrates. **(8 hrs)**	14 hrs

	Amino Acids, Peptides and Terpenes: Classification of amino acids, stereochemistry of amino acids, Zwitter ion and explanation to isoelectric point, synthesis of amino acids from Gabriel phthalimide synthesis, Strecker's synthesis, ninhydrin reaction. **Peptides:** Definition, synthesis of dipeptides by N-protecting (t-butoxycarbonyl and phthaloyl) & C-activating groups. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. **Terpenes:** Classification, isoprene rule, constitution and synthesis of Citral and ∝-terpinol **(6 hrs)**	
UnitIII	**Electrochemistry-II** **Electro Motive Force(EMF)** Electrochemical cells, Reversible and irreversible cells, EMF of a cell and its measurement by potentiometer, standard cell (Weston standard cell), types of electrodes, reference electrode- calomel electrode, sign conventions, Nernst equation, electrochemical series and its applications, salt bridge and its applications. Determination of pH of solution by hydrogen electrode, quinhydrone electrode and glass electrode methods, concentration cell with and without transference, liquid junction potential. Numerical problems. Applications of EMF measurements- i) Determination of solubility and solubility product of sparingly soluble salts. ii) Potentiometric titrations- acid–base and redox titrations, iii) Determination of redox potential **(7hs)** **Energy sources:** Non-conventional energy sources. Solar energy, thermal energy, wind energy, geothermal energy, photovoltaic cells, biofuels and their applications. **Batteries & Fuel cells-** Primary and secondary batteries – Construction and Applications of Pb-acid battery, Li-Battery, Lithium-polymer cell, and nickel-cadmium cell. **Fuel cells**-hydrogen-oxygen and Hydrocarbon–Oxygen fuel cells and their applications. **(4hrs)** **Micelle:** Emulsions, micro emulsions or micellar emulsions, and its stability, properties of micro emulsions: electro kinetic effects. Colloidal electrolytes or association colloids, types of colloidal electrolytes. Micelles: surface-active agents or surfactants. **(3 hrs)**	14 hrs

UnitIV	**Green Chemistry** Basics of Green Chemistry. Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry. Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following: Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products , Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. Prevention/ minimization of hazardous/ toxic products reducing toxicity. risk = (function) hazard × exposure; waste or pollution prevention hierarchy. Green solvent Supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solvent less processes, immobilized solvents and how to compare greenness of solvents. Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy. (**8hrs)** **Examples of Green Synthesis/ Reactions** Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis) Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; Microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction. Ultrasound assisted reactions: Sono chemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine). (**6hrs)**	14 hrs

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–VI

Discipline Specific Course(DSC)-14

Course Title: Chemistry (Practical) XIV

Course Code:036CHE012

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-14	**Practical**	**02**	**04**	**56 hrs.**	**3 hrs.**	**25**	**25**	**50**

ORGANIC CHEMISTRY EXPERIMENTS

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Qualitative analysis of solid – solid organic mixtures, Identification, nature and separation of mixture. Analysis of any one separated compound through preliminary tests, element test, physical constant, functional Group test and preparation of suitable derivative and its physical constant, distillation of Liquid-Liquid mixtures containing low boiling and high boiling liquids and their analysis.

Expt. No.	ORGANIC CHEMISTRY EXPERIMENTS	56hrs/ Sem
1	**Qualitative analysis of solid – solid organic binary mixtures and liquid-liquid binary mixture (by distillation)** Identification, nature and separation of mixture. Analysis of any one of the separated compound or a fresh compound through preliminary tests, element test, physical constant, functional group test and preparation of suitable derivative and its physical constant. **Acids:** Salicylic, Cinnamic andPhthalic. **Phenol:** β–naphthol. **Base:** m-nitroaniline and p-nitroaniline. **Neutral:** Naphthalene, Acetanilide, Benzamide. **Low Boiling:** Ethyl acetate, acetone **High Boiling:** Phenol, aniline, acetophenone, toluene	
	NOTE: In a batch of ten students, not more than two students should get the same mixture in the practical examination. Preparation of derivative is not needed at the time of examination. Viva questions may be asked on any of the experiments	

	prescribed in the practical syllabus. During practical examination chart is not allowed. **Distribution of marks:** Nature and Separation: (5 marks), Preliminary test and Elemental analysis test: (4marks), Physical Constant:(3 marks), Functional Group test (5 marks), Journal: (3marks), Viva-voce: (5marks). **Total 25marks**	

Recommended Books/References

1. Vogel's Qualitative Inorganic Analysis, G. Svehla, 7th Ed, Longman (2001).
2. Advanced Practical Chemistry, Jagadamba Singh, R.K.P. Singh, Jaya Singh, L.D.S. Yadav, I.R. Siddiqui, Pragatiprakashan, 7th edition, 2017.
3. College Practical Chemistry: V K Ahluwalia, SunithaDhingra and AdarshGulati. University Press-2011.
4. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.
5. Comprehensive Practical Organic Chemistry: V K Ahluwalia, and RenuAggarwal, University Press-2000.

B.Sc. Semester–VI

Discipline Specific Course (DSC) -15

Course Title: Chemistry (Theory) XV

Course Code:036CHE013

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No.of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-15	**Theory**	**04**	**04**	**56 hrs.**	**2 hrs.**	**40**	**60**	**100**

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Understand manufacture, applications and hazards in handling of chemicals and preparation, properties and uses of useful chemicals and complexes

CO2: Know nuclear particles, nuclear instability, nuclear fission and fusion, nuclear reactors, nuclear reactions and applications of radioisotopes

CO3: Learn about requirement of an ideal drug and classification, Synthesis and therapeutic uses of different chemotherapeutic agents.

CO4: Understand basic principles of PMR, molecular structure signals, interpretation of PMR structure of simple organic molecules, principle, instrumentation, definitions of parent peak and base peak.

CO5: Explain the spectral distribution of block body radiation, Plank's radiation law, Photoelectric effect, Compton effect.

CO6: Describing Schrödinger's wave equation, wave functions, Eigen function and Eigen values, normalization and orthogonality

CO7: Interpretation of equations of motion, elementary wave motion and operators.

CO8: Derive expression of Solutions of Schrödinger equations of a free particle, particle in a box.

CO9: Explain the dimensions, degeneracy, reflection and penetration of a particle in a one dimensional box of semi-infinite barrier, a particle in a box of finite walls.

CO10: Understand instrumental technique, methodology and applications of Flame Emission Spectroscopy, Atomic Absorption Spectroscopy**,** Thermal methods of analysis Electrogravimetry. Nephelometry and Turbidimetry

Unit	Title: Chemistry (Theory) XV	56.hrs/ Sem
Unit I	**Inorganic chemicals** Manufacture, applications and hazards in handling of hydrochloric acid, caustic soda and bleaching powder. Preparation, properties and uses of TiO_2, V_2O_5, $PbCrO_4$, $KMnO_4$, $(NH_4)_2MoO_4$ and complexes of platinum. **(7hrs)** **Nuclear chemistry** Nuclear particles (positron, neutrino, mesons, pions, and quarks), nuclear instability, nuclear fission and fusion, nuclear reactors, Different types of nuclear reactors, nuclear reactions (α, n), (n, α), (α, p), (p, α), (p, n) and (n, p). Applications of radioisotopes in tracer technique, neutron activation analysis and carbon dating (numerical problems). **(7hrs)**	14 hrs
Unit II	**Drugs** Definition and classification, requirement of an ideal drug, synthesis and therapeutic use of a) Analgesic and antipyretic: Paracetamol, Analgin, ibuprofen and diclofenac sodium, b) Antibacterial: Sulphadiazineand sulphathiazole, c) Antimalarial: Chloroquine, d) Antibiotic:Chloramphenicol, e) Tranquilizers: mysoline and pentothal sodium, f) Local anesthetics: novacaine, g) Antihistamines: Chlorpheniraminemaleate, cetirizine, HCl. **(5 hrs)** **Basics of ^{1}H NMR Spectroscopy** Introduction to magnetic properties of nuclei, concept of nuclear spin: Spin of protons and neutrons, nuclear quantum number for various nuclei (depending upon mass and charge of nuclei, I = 0, ½, 1, 3/2), nuclear angular momentum and magnetic momentum, interaction of magnetic nuclei with applied magnetic field, Larmor precession, nuclear energy levels in applied magnetic fields, concept of resonance and expression for energy, concept of chemical shift, shielding and deshielding effect, typical chemical shift values for different class of compounds, anisotropic effects. Applications of NMR spectroscopy: Interpretation of spectrum of ethyl bromide, ethanol, acetone, 2-chloroethanol, acetaldehyde, ethyl acetate, propanamide, benzene, acetophenone and acetanilide**.** **(7 hrs)** **Mass Spectrometry** Principle, instrumentation, molecular ion peak and base peak, McLaffertyrearrangementwithrespectto2-hexanone, hexenoic acid and methyl hexanoate. **(2 hrs)**	14 hrs

Unit III	**Quantum Chemistry:** Black body radiation, Spectral distribution of black body radiation, Plank's theory, derivation of Planck's radiation law, photoelectric effect, Compton effect, wave nature of electron, derivation of Schrödinger's wave equation, wave function and its significance, Eigen function and Eigen values, normalization and orthogonality. Equation of motion for a particle, Newtonian, Lagrangian and Hamiltonian equations of motion, elementary wave motion. Operators, Eigen values and expectation values, commuting operators, linear operator and Hermitian operators. Solutions of Schrödinger equations of a free particle, particle in a box problem: in one and three dimensions, degeneracy, reflection and penetration of a particle in a one dimensional box of semi-infinite barrier, a particle in a box of finite walls.	14 hrs
Unit IV	**Flame Emission Spectroscopy (FES):** Principle, flames and flame temperature, instrumentation, interferences, applications, and limitations of FES. Determination of Na/K in soil / water samples. **Atomic Absorption Spectroscopy (AAS):** Principle, types of burners (premix and total consumption) and their comparison, instrumentation and applications, Determination of Mg in tap water. Comparison of AAS with FES. **Thermal methods of analysis:** Thermogrametric analysis (TGA), Theory, thermogravimetric curves for one, two and three decomposition steps, instrumentation, factors affecting thermograms. Applications of TGA. Differential thermal analysis (DTA): Theory and applications Differential scanning calorimetry (DSC): Theory and applications **Electrogravimetry:** Theory, instrumentation. Determination of copper. **Nephelometry and Turbidimetry:** Principle, instrumentation and applications.	14 hrs

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–VI

Discipline Specific Course (DSC)-16

Course Title: Chemistry (Practical) XVI

Course Code:036CHE014

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-16	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Learn the complex preparation skills

CO2: Understand the determination of contents of given organic compounds.

CO3: Understand to apply the knowledge of conductivity, EMF and absorbance to performing the experiments.

CO4: Acquire skills for handling analytical instruments like potentiometer, conductometer, pH meter & colorimeter.

DSCC -16: Chemistry (Practical) XVI (Code : 036CHE014)	
GENERAL CHEMISTRY EXPERIMENTS	52 rs
SET-I 1. Preparation of trans-potassium diaquadioxalatochromate (III) 2. Preparation of tris(thiourea) copper (I) sulphate monohydrate 3. Preparation of hexaamminecobalt(III) chloride 4. Determination of glycine present in the given solution volumetrically 5. Determination saponification value of oil/fat. 6. Determination of iodine number of an oil/fat. **SET-II** 1. Determination of concentrations of given acids in a mixture (HCl + CH_3COOH) using the standard NaOH by conductometric titration method. 2. Determination of solubility of sparingly soluble salt ($BaSO_4$/$PbSO_4$) conductometrically. 3. Determination of redox potentials of Fe^{3+}/Fe^{2+} using of $FeSO_4.7H_2O$ solution by potentiometric titration against the standard solution of $K_2Cr_2O_7$ 4. Determination of solubility and solubility product of sparingly soluble salts (AgCl) potentiometrically. 5. Determination of molecular weight of polymer by viscosity method. 6. Determination of the composition of Fe^{3+} - salicylic acid complex solution by Job's method.	

Examination

In a batch of ten students in the practical examination, five students may be given SET–I experiments and remaining 5 students may be given SET-II experiments. In SET-I experiments one preparation and one determination experiment may be given. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

SET-I

Preparation experiment: Reaction – 01 mark, Calculation of theoretical Yield- 01 mark, Observed yield-05 marks, = 07 marks

Determination Experiment: Accuracy – 06 marks, Technique and presentation- 02 marks, calculation- 02 marks = 10 marks,

Journal- 03 marks, Viva- voce – 05 marks, **Total= 25 marks**

Deduction of marks for accuracy:

Less than 10% yield- 5 marks, 11-15%- 4 marks, 16-20%-3 marks, 21-25%- 2 marks, above 25%- zero marks

±0.4 cc- 6 marks, ±0.6cc- 04 marks, ±0.8cc-02 marks, ±1cc-01 marks, above ±1cc- Zero marks

SET-II

NOTE: Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. During practical examination chart is not allowed, wherever necessary simple procedure may be given.

Distribution of Marks:

Accuracy-10 marks, Technique and Presentation-2, Calculation and graph-5 marks, Journal-3 marks, Viva-Voce-5 marks, Total=25 marks.

Deduction of Marks for accuracy:

Error up to 5% - 10 marks, 6 - 10% 08 marks, 11-15% 06 marks, 16-20% 04 marks, above 20% zero (0) marks

Recommended books

1. Findlay's practical physical chemistry -revised by Levitt, Longman's, London,(1968)

2. Experiments in Physical chemistry - Shoemaker and Garland, McGraw Hill International Edn. (1996)

B.Sc. Semester–VI

INTERNSHIP

Course Title: Chemistry Internship

Course Code:036 CHE 091

Type of Course	Theory /Practical	Credits	Instruction hour/week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
INTERNSHIP	**Practical**	**02**				**50**	**0**	**50**

Internship:

A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations for 2 credits. Internships involve working with local industry or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

Note:

1. One credit internship is equal to 30hrs on field experience.
2. Internship shall be Discipline Specific of 45-60 hours (2 credits) with duration 1-2 weeks.
3. Internship may be full-time/part-time (full-time during last 1-2 weeks before closure of the semester or weekly 4 hrs in the academic session for 13-14 weeks). College shall decide the suitable method for programme wise but not subject wise.
4. Internship mentor/supervisor shall avail work allotment during 6^{th} semester for a maximum of 20 hours.
5. The student should submit the final internship report (45-60 hours of Internship) to the mentor for completion of the internship.
6. Method of evaluation: Presentations/Report submission/Activity etc.

Wherever internship is not feasible, the students can to choose the Project Work

Project Work: Plant training in industries/short term work in the College/other Institution:

The project work may include in Educational Institutions/R&D organizations/data mining/review of current literature/theoretical methods/ computer applications.

Experimental work may involve studies on synthesis/measurements/study of properties/ characterization/applications/activities for reported/unreported research or any suitable combination thereof. In case of the students who would work outside the campus, the Supervising Staff member may visit him/her/them.

References:

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic ChemistryELBS,1991.
2. Cotton, F. A, Wilkinson, G.&Gaus, P.L. BasicInorganicChemistry,3rdEd., Wiley.
3. Douglas, B.E., Mc Daniel, D.H.&Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Huheey, J. E., Keiter, E.A., Keiter, R.L. &Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson EducationIndia, 2006.
5. Shriver, D.F.&Atkins,P.W.InorganicChemistry,OxfordUniversityPress.
6. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
7. Rodgers, G. E. Inorganic &Solid State Chemistry, Cengage Learning India Ltd., 2008.
8. G.L. Miessler& Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
9. Mahan, B.H. UniversityChemistry3rd Ed.Narosa(1998).
10. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).
2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.
3. McMurry, J.E. Fundamentals of Organic Chemistry,7th Ed. Cengage Learning India Edition,2013.
4. Sykes, P.A Guide book to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Morrison, R.T.&Boyd, R.N. Organic Chemistry, Pearson,2010.
7. Bahl, A.&Bahl, B.S. AdvancedOrganicChemistry, S. Chand,2010.
8. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley& Sons(2014).
9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).
11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.
12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.
14. Organic Chemistry - M. K. Jain, Nagin& Co., 1987.
15. Organic Chemistry- Mehta and Mehta, 2005.
16. William Kemp, NMR Chemistry A Multinuclear Introduction.
17. Clyden, Greeves, Warrens, and Wothers, Oraganic Chemistry, 1st Edition.
18. Robert M. Silverstain, Francis X Webster, David J Kiemel and David L Bryce, 18th edition.

Physical Chemistry

1. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
2. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania,1987.
3. The Elements of Physical Chemistry(3rd edition) - Peter Atkins, Oxford Univ. Press, 2000
4. Essentials of Physical Chemistry by Bahl and Bahl, Revised edition-2009
5. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpad Rai and Sons, Delhi, Jalandhar, 1995.
6. Spectroscopy by H. Kaur, APragati edition-9th edition 2014.
7. Molecular structure and spectroscopy by G. Aruldhas, 2nd edition-2014
8. Basic Physical chemistry - Walter J. Moore, Prentice Hall, 1972.

UG programme: 2023-24

GENERAL PATTERN OF THEORY QUESTION COURSE FOR DSCC/ OEC

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks
(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours Prescribed

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION

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ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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No. KU/Aca(S&T)/JS/MGJ(Gen)/2023-24/59 Date: 04/09/2023

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಪದವಿಗಳಿಗೆ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 104 ಯುಎನ್ಇ 2023, ದಿ: 20.07.2023.
2. ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 2 ರಿಂದ 7, ದಿ: 31.08.2023.
3. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 04/09/2023

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music) /BVA / BTTM / BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS) / BBA & BA ILRD ಸ್ನಾತಕ ಪದವಿಗಳ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020ರ ಮುಂದುವರೆದ ಭಾಗವಾಗಿ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಕೋರ್ಸಿನ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

4/9/23
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂರ್ತಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. in Zoology

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SYLLABUS

With Effect from 2023-24

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM V & VI,

SKILL ENHANCEMENT COURSE (SEC) FOR SEM V
INTERNSHIP COURSE FOR SEM VI

AS PER N E P - 2020

Karnatak University, Dharwad

B.Sc. in Zoology

Effective from 2023-24

Sem.	Type of Course	Theory/ Practical	Course Code	CourseTitle	Instruction hour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	**035 ZOO 011**	Non-Chordates and Economic Zoology	04hrs	56	02 hrs	40	60	100	04
	DSCC-10	Practical	**035 ZOO 012**	Non-Chordates and Economic Zoology	04 hrs	56	03 hrs	25	25	50	02
	DSCC-11	Theory	**035 ZOO 013**	Chordates and Comparative Anatomy	04hrs	56	02 hrs	40	60	100	04
	DSCC-12	Practical	**035 ZOO 014**	Chordates and Comparative Anatomy	04 hrs	56	03 hrs	25	25	50	02
	Other subject										04
	Other subject										02
	Other subject										04
	Other subject										02
	SEC-3	Practical	**035 ZOO 061**	The Bee Keeping	04hrs	56	03 hrs	25	25	50	02
	Total										**26**
VI	DSCC-13	Theory	**036 ZOO 011**	Evolutionary and Developmental Biology	04hrs	56	02 hrs	40	60	100	04
	DSCC-4	Practical	**036 ZOO 012**	Evolutionary and Developmental Biology	04 hrs	56	03 hrs	25	25	50	02
	DSCC-15	Theory	**036 ZOO 013**	Environmental Biology, Wildlife Management and Conservation	04hrs	56	02 hrs	40	60	100	04
	DSCC-16	Practical	**036 ZOO 014**	Environmental Biology, Wildlife Management and Conservation	04 hrs	56	03 hrs	25	25	50	02
	Other subject										04
	Other subject										02
	Other subject										04
	Other subject										02
	Internship-1	Practical	**036 ZOO 091**	Internship				50	0	50	02
	Total										**26**

B.Sc. in Zoology

V Semester

W. E. F. 2023-24

B.Sc. Semester – V

Discipline Specific Course (DSCC)-9

Course Title: Non-Chordates and Economic Zoology (Theory)
Course Code: 035 ZOO 011

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-9	**Theory**	**04**	**04**	**56 hrs**	**2hrs**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO1: Understand the evolutionary history and diversity of non-chordates

CO2: Study the external and internal characters of non-chordates

CO3: Expose type, structural and functional organization of non-chordates

CO4: Group the animals on the basis of their morphological characteristics.

CO 5: Understand the economic importance of non-chordates

Units	DSCC-9: Course Title: Non-Chordates and Economic Zoology –Theory (Code: 035 ZOO 011)	56.hrs/ sem
Unit- I	**Phylum Protozoa:** General characters and classification up to classes; Locomotory organelles and locomotion in Protozoa. Type study: Paramecium (Morphology and Reproduction) **Phylum Porifera:** General characters and classification upto classes; Canal System in poriferans. Type study: Sycon (Morphology and Reproduction) **Phylum Cnidaria:** General characters and classification upto classes; Polymorphism in Physalia. Type study: Obelia (Morphology and Reproduction) **Ctenophora:** Salient features	14
Unit- II	**Phylum Platyhelminthes:** General characters and classification upto classes; Parasitic adaptations (morphological and physiological). Type study: Taenia (Tape worm)- (Morphology and Reproduction) **Phylum Nemathelminthes:** General characters and classification upto classes; Transmission, pathogenicity and preventive measures of Ascarisasis. Type study: Ascaris (Round worm)- (Morphology and Reproduction) **Phylum Annelida** General characters and classification upto classes; Metamerism in Annelida and external morphology of Leech. Type study: Hirudinaria (Leech) - (Morphology and Reproduction)	14
Unit- III	**Phylum Arthropoda** General characters and classification upto classes; Metamorphosis in Insects and economic importance insects. Type study: Palaemon (Prawn) - (Morphology, Appendages, Nervous system and Reproduction). **Phylum Mollusca** General characters and classification upto classes; Torsion in gastropods, Pearl	14

	formation. Type study: Pila (morphology, shell, respiration, nervous system and Reproduction) **Phylum Echinodermata** General characters and classification upto classes; Water-vascular system in Asteroidea. Type study: Pentacerous (Morphology and Reproduction)	
Unit- IV	**Economic Zoology:** **Pests:** Life cycle and their control of following pests: Gundhi bug, Leaf hopper. **Vectors:** Prevention and control of Termites and Mosquitoes **Economic Zoology:** Economic importance of Lac Culture, Vermiculture and Sericulture.	14

References:

1. Barnes, R.S.K.; Calow,P.; Olive,P.J.W.; Golding,D.W.; Spicer, J.I.(2002) The Invertebrates: Synthesis,BlackwellPublishing.

2. Hickman,C.; Roberts,L.S.; Keen,S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.

3. Holland, P.(2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.

4. Kardong, K.V.(2006) Vertebrates: Comparative Anatomy, Function, Evolution (4thedition), McGraw-Hill.

5. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.

6. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia

7. Bushbaum, R.(1964)Animals without Back bones.University of Chicago Press

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSCC)-10

Course Title: Non-Chordates and Economic Zoology (Practical)
Course Code: 035 ZOO 012

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-10	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Understand basics of classification of non-chordates.

CO 2: Learn and understand the internal systems of non-chordates.

CO 3: Develop the skills to identify different classes and species of animals.

CO 4: Know uniqueness of a particular animal and economic importance of non-chordates.

CO 5: Enhancement of basic laboratory skill like keen observation and drawing.

CO 6: Study the useful and harmful non-chordates

Expt. No.	**DSCC-10:** **Course Title: Non-Chordates and Economic Zoology –Practical (Code: 035 ZOO 012)**	56.hrs/ sem
1	Preparation and observation of protozoan culture. **Protozoa**: Systematics of *Amoeba*, *Euglena*, *Noctiluca*, *Paramecium* and *Vorticella* (Permanent slides/ Charts).	4
2	**Porifera:** Systematics of *Sycon, Euplectella, Hyalonema, Spongilla* and *Euspongia* T.S of *Sycon*, Spicules and Gemmules (Specimens/ Permanent slides/ Charts)	4
3	**Cnidaria:** Systematics of *Aurelia* and *Metridium* (Specimens). Slides/Charts of *Hydra*, *Obelia* - polyp and medusa, and *Ephyra* larva, T.S. of *Metridium* passing through mesenteries. **Study of Corals**- *Astraea, Fungia, Meandrina, Corallium, Gorgonia, Millepora* and *Pennatula.*	4
4	**Helminthes:** Systematics of *Planaria*, *Fasciola hepatica* and *Taenia solium*, Ascaris- Male and female (Specimens/Charts). Slides/Charts of T.S. of *Planaria*, T.S. of male and female Ascaris.	4
5	**Annelida:** Systematics of *Nereis, Heteronereis, Sabella, Aphrodite* (Specimens/Charts). Slide/Chart of T.S. of earthworm through typhlosole.	4
6	**Arthropoda**: Systematics of *Panaeus, Palaemon, Astracus,* Scorpion, Spider, *Limulus, Peripatus, Millipede, Centipede,* Praying mantis, Termite Queen, Moth, Butterfly, Dung beetle /Rhinocerous beetle (Any six specimens). Slide/Chart of Larvae- Nauplius, Zoea, Mysis.	6

7	**Mollusca:** Systematics of *Chiton, Mytilus, Aplysia, Pila, Octopus, Sepia* (Specimens) and Glochidium larva (Slide/Chart). **Shell Pattern-** *Unio, Ostrea, Cypria, Murex, Nautilus, Patella, Dentalium,* Cuttle bone	4
8	**Echinodermata**: Systematics of Sea star, Brittle star, Sea Urchin, Sea Cucumber, Sea lilly (Specimens/Charts). Slides/Charts of Bipinnaria larva, Echinopluteusl arva and Pedicellaria.	4
9	**Harmful Non-chordates:** Soil Nematodes, Agricultural, Veterinary and Human pests (Ticks, Mites and Bugs).	4
10	**Beneficial Non-chordates:** **Sericulture:** Life cycle of *Bombyx mori*, Types of silk **Vermiculture**: Earthworm species used in Vermiculture and Vermicomposting,Vermi products	6
11	**Virtual Dissection/Cultured specimens:** Earthworm –Nervous system, Leech-Digestive system	6
12	**Virtual Dissection/Cultured specimens:** Prawn-Nervous system. Cockroach-Salivary apparatus and Digestive system.	6
13	Any other practical's related to this paper may be added based on the feasibility	

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**08**
2. Minor Experiments	**05**
3.Identifications (A-D)	**08**
4. Viva	**02**
5. Journal	**02**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. Semester – V

Discipline Specific Course (DSCC)-11

Course Title: Chordates and Comparative Anatomy (Theory)
Course Code: 035 ZOO 013

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-11	**Theory**	**04**	**04**	**56 hrs**	**2hrs**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course, students will be able to:

CO1: Understand the basic concept, diversity and classification of Chordates

CO2: Demonstrate comprehensive identification abilities of chordate diversity

CO3: Understand evolutionary relationship amongst all chordates

CO4: Understand the external morphology and sexual dimorphism in chordates.

CO5: Understand arrangement of endoskeleton of vertebrates.

CO6: Know the comparative anatomy of various systems, adaptations, physiological mechanisms of vertebrates.

Units	DSCC-11: Course Title: Chordates and Comparative Anatomy-Theory (Code:035 ZOO 013)	56.hrs/ sem
Unit-I	**Chordates:** Origin of Chordates; Basic characters of chordates and classification upto classes. **Protochordates:** General features and phylogeny of Protochordata, Classification of Protochordates: **Hemichordata:** Type Study: Balanoglossus- Habit and Habitat, Morphology, Coelom. Tornaria larva and its affinities. **Urochordata:** Type Study: *Herdmania*- Habit and Habitat, Morphology, Ascidian tadpole-structure and its retrogressive metamorphosis. **Cephalochordata:** Type Study: *Branchiostoma* (*Amphioxus*)-Habit and habitat, Morphology, Digestive system, Feeding mechanism, excretory and circulatory system. **Agnatha:** General characters of Agnatha and classification upto classes. Salient features of Cyclostomata and Ostracodermi with examples. Ammocoete larva and its significance.	14
Unit-II	**Vertebrates:** General characters and Classification of different classes of vertebrates (Pisces - Chondrichthyes and Osteichthyes, Amphibia, Reptilia, Aves, Mammalia) upto the orders with five characters for each order citing examples.	14
Unit-III	**Pisces:** Osmoregulation, migration and swim bladder in fishes. Types of caudal fins, scales in fishes. **Amphibia:** Origin of Amphibia, Parental care and Neoteny in Amphibia, **Reptilia:** Adaptive radiation in extinct reptiles with suitable examples. Temporal fossae in reptiles. Poisonous and non-poisonous snakes, biting mechanism in snakes, types of venom. **Aves:** Flightless birds and their distribution, Major types of beaks. Kinds of migration in birds. Flight adaptations in birds. **Mammals:** Distribution of Prototheria and Metatheria with examples. Dentition in mammals and evolution of molar tooth. Adaptive radiation in mammals.	14

Unit-IV	**Comparative Anatomy of Vertebrates:** **Integumentary System:** Structure of skin and its derivatives. **Skeletal System:** Comparative account of Axial (Skull) and Appendicular (girdles) Skeletal system in Amphibians (Frog), Reptiles (Calotes), Aves (Pigeon) and Mammals (Rabbit). Comparative account of **Digestive system** (digestive glands and alimentary canal), **Respiratory System** (gills, lungs, air sacs, swim bladder) **Circulatory System** (heart and aortic arches) and **Nervous system** (brain) in Pisces (Scoliodon), Amphibians (Frog), Reptiles (Calotes), Aves (Pigeon) and Mammals (Man). **Excretory System:** Succession of vertebrate kidney and Evolution of urino-genital ducts in vertebrates	14

References:

1. Colbert*et al*: Colbert's Evolution of the Vertebrates: A history of the back boned animals through time. (5th ed2002, Wiley–Liss).

2. Hildebrand:Analysis of Vertebrate Structure(4th ed1995,JohnWiley)

3. Kenneth V.Kardong (20015) Vertebrates:Comparative Anatomy, Function, Evolution Mc Graw Hill

4. Mc Farland *et al.,*:Vertebrate Life (1979,Macmillanpublishing)

5. Parker and Haswell: Text Book of Zoology, Vol. II(1978,ELBS)

6. Romer and Parsons:The Vertebrate Body (6th ed1986, CBS Publishing, Japan)

7.Young:The Life of Vertebrates (3rd ed 2006,ELBS/Oxford)

8. Weichert C.K. and William Presch(1970).Elements of Chordate Anatomy, Tata Mc Graw Hills

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSCC)-12

Course Title: Chordates and Comparative Anatomy (Practical)
Course Code: 035 ZOO 014

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-12	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Understand the external morphology of proto-chordates and chordates

CO 2: Study the cartilaginous, bony and ornamental fishes

CO 3: Understand the systematic position and classification of Chordates

CO 4: Study the comparative anatomy and internal systems of vertebrates

CO 5: Understand the beak and foot modifications in birds.

Expt. No.	DSCC-12: Course Title: Chordates and Comparative Anatomy –Practical (Code:035 ZOO 014)	56.hrs/ sem
1	**Protochordata**: Balanoglossus and T. S through proboscis Ascidian/*Herdmania* and *Amphioxus,* T.S. of *Amphioxus* through pharynx and intestine. **Cyclostomata:** *Petromyzon*, *Myxine.* Ammocoete larva	04
2	**Pisces**: Cartilaginous fishes – *Narcine, Trygon, Pristis, Myolobaties, Scolidion*.(Any four) Bony fishes– Zebrafish, Hippocampus, Muraena, Ostracion, Tetradon, Pleuronectus, Diodon, Echeneis. (Any six).	05
3	**Ornamental fishes:** Siamese, Koi, Oscar, Betta Sp., Neon tetra, Guppies, Goldfish, Angle fish, Rainbow fish, Mollies (Any four). **Accessory respiratory organs**– *Saccobranchus, Clarias* and *Anabas.*	04
4	**Amphibia**: *Rana*, *Bufo, Ambystoma, Axolotl larva, Necturus and Ichthyophis.*	04
5	**Reptilia**: Turtle, Tortoise, *Mabuya, Calotes,* Chameleon, *Varanus*. **Snakes**–Dryophis, Ratsnake, Brahmini, Cobra, Krait, Russell's viper and Hydrophis.	04
6	**Aves:** Beak and feet modifications in the following examples: Duck, Crow, Sparrow, Parrot, Kingfisher, Eagle or Hawk. **Mammalia**: Mongoose, Squirrel, Pangolin, Hedge Hog, Rat and Loris, Platypus, Echidna.	05
7	**Virtual Dissection/Cultured specimens:** Shark/Bony fish: Afferent and efferent branchial systems, glosso-pharyngeal and vagus nerves.	05
8	**Virtual Dissection/Cultured specimens:** Rat: Dissection (only demonstration)– Circulatory system (Arterial and Venous), Urinogenital system.	05
9	**Comparative account of skeletal system:** Skull, vertebrae, girdles and limb bones of Shark, Frog, Calotes, Pigeon and Rabbit	05
10	**Comparative account** of skin in Shark, Frog, Calotes, Pigeon and Man.	05
11	**Comparative account** of heart in Shark, Frog, Calotes, Pigeon and Man.	05

12	**Comparative account** of brain in Shark, Frog, Calotes, Pigeon and Man.	05
13	Any other practical's related to this paper may be added based on the feasibility	

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**08**
2. Minor Experiments	**05**
3.Identifications (A-D)	**08**
4. Viva	**02**
5. Journal	**02**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. Semester – V

Skill Enhancement Course: SEC-3

Course Title: The Bee Keeping (Practical)
Course Code: 035 ZOO 061

Type of Course	Theory / Practical	Credits	Instruction hour/ week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
SEC-3	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs):At the end of the course students will be able to:

CO 1: Explain what the prerequisite to get started in beekeeping

CO 2: Discuss the responsibilities of urban beekeepers.

CO 3: Identify where to purchase equipment and demonstrate how to assemble it.

CO 4: Name and identify major parts of the honeybee such as mouth parts, sting apparatus and mandibular parts.

CO5: Describe bee biology and anatomy from the perspective of managing bees.

CO 6: Describe the importance and usage of honey and bee wax.

Expt. No.	SEC-3: Course Title: The Bee Keeping-Practical (Code:035 ZOO 061)	56.hrs/ sem
1	Study of general characters and anatomy of honey bee	6
2	Systematic position and classification of honey bee	2
3	Study of life cycle of honey bee	4
4	Mounting of mouth parts/sting apparatus of honey bee	4
5	Study of castes in honey bees	4
6	Identification of honey bee species	4
7	Study of social organization in honey bees	4
8	Requirements of bee keeping: Hive, Protective gear, smoker, hive tool and other equipments (Charts)	4
9	Study of honey bee by-products and their uses (Charts)	4
10	Study of diseases of honeybees (Charts)	4
11	Study of pests of honeybees (Charts)	4
12	Field study/Project report on nearby Apiary/bee keeping unit and submit a report	12
13	Any other practical's related to this paper may be added based on the feasibility	

References:

1. Abrol , D. P. (1997) Bees and Beekeeping. Kalyani Publisher, New Delhi. 173
2.Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi.
3. Withhead, S. B. (2010) Honey bees and their management Axis books Publisher, Jodhpur.
4.Nagaraja, N. and Rajagopal, D. (2013) Honey bees: Diseases, Parasites, Pests, Predator and their management. M.J.P Publisher, Chennai.
5. Dharamsing and Singh, D. P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur.
6. Prost, P. J. Apiculture. Oxford and IBH, New Delhi.
7. Bisht D.S. Apiculture, ICAR Publication.
8. Bisht, D.S. Agricultural Development in India, Anmol Pub. Pvt. Ltd.
9. Singh S. Beekeeping in India, Indian council of Agricultural Research, New Delhi
10. Mehrotra, K.N. Bisht, D.S. Twenty-five years of apiculture research at IARI.

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**06**
2. Minor Experiments	**04**
3.Identifications (A-C)	06
4. Viva	**02**
5. Journal	**02**
6. Field visit report	**05**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. in Zoology

VI Semester

W. E. F: 2023-24

B.Sc. Semester – VI

Discipline Specific Course (DSCC)-13

Course Title: Evolutionary and Developmental Biology (Theory)
Course Code: 036 ZOO 011

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-13	**Theory**	**04**	**04**	**56 hrs**	**2hrs**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: Understand that by biological evolution we mean that many of the organisms that inhabit the earth today are different from those that inhabited it in the past.

CO 2: Understand that natural selection is one of several processes that can bring about evolution, although it can also promote stability rather than change.

CO 3: Understand how the single cell formed at fertilization forms an embryo and then a full adult organism.

CO 4: Integrate genetics, molecular biology, biochemistry, cell biology, anatomy and physiology during embryonic development.

CO 5: Understand a variety of interacting processes, which generate an organism's heterogeneous shapes, size, and structural features.

Units	**DSCC-13:** **Course Title: Evolutionary and Developmental Biology-Theory (Code:036ZOO 011)**	**56.hrs/ sem**
Unit- I	Origin of Life and theories**;** Historical review of evolutionary concept. **Theories of Evolution:** Lamarckism, Darwinism (Natural, Sexual and Artificial selection), Mutation Theory of Evolution (Hugo de Vries) and Neo- Darwinism (Synthetic theory of evolution, gene mutation, gene flow, genetic drift, Hardy-Weinberg equilibrium). Adaptive radiations: Patterns of evolution (Divergence, Convergence, Parallel, Co-evolution).	14
Unit- II	**Evidences of Evolution**: Relationship among organisms, Morphological and Anatomical evidences, Embryological evidences, Paleontological evidences, Bio-geographical evidences, Biochemical/Physiological evidences, Cytological evidences, Taxonomical evidences and Current evidences. **Geological Time Scale**/ Stratigraphic Scale. **Species Concept and Extinction**: Concept of species; Modes of speciation: Allopatric and Sympatric species; Mass extinction (Causes, Names of five major extinctions) **Origin and evolution** of Human and Horse.	14

Unit- III	**Introduction to Developmental Biology:** Scope and theories of development biology **Early Embryonic Development:** **Gametogenesis:** Spermatogenesis and oogenesis in mammals. **Fertilization:** external (amphibians), internal (mammals), monospermy and polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.	14
Unit- IV	**Embryonic membranes and early development of Chick:** Development, structure and functions of yolk sac, amnion, chorion and allantois, structure of hen's egg, cleavage, blastula, gastrulation, origin and structure of primitive streak, structure of 18, 24, 36 and 48 hrs chick embryos. **Placenta:** Classification of placenta (morphological and histological) with examples, and functions of placenta. **Modern trends in human reproduction**: In-vitro fertilization, sperm and egg banks, sexually transmitted diseases (AIDS, syphilis and gonorrhea).	14

References:

1. Ridley, M (2004) Evolution (3rd edition) Blackwell Publishing

2. Hall, B.K. and Hallgrimson, B(2008)Evolution(4th edition) Jones and Barlett Publishers

3. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.

4. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.

5. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.

6. Developmental Biology: T. Subramaniam, (Reprint), Narosa Publishing House Pvt. Ltd., New Delhi

7. Developmental biology: Werner A. Müller, Springer Science & Business Media. (2012).

8. Human Embryology and Developmental Biology E-Book: Bruce M. Carlson, Elsevier Health Sciences.

9. Developmental Biology: Michael J. F. Barresi, Scott F. Gilbert, Oxford University Press. (2019)

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSCC)-14

Course Title: Evolutionary and Developmental Biology (Practical)
Course Code: 036 ZOO 012

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-14	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Explain core features of evolutionary theory and their applications to biological systems.

CO 2: Explain how evolutionary patterns and processes can be inferred using sequence data, the biology of extant organisms, and fossils.

CO 3: Study the process by which organisms grow and develop.

CO 4: Understand the development of multicellular organisms from a single cell zygote.

CO 5: Learn interesting and unique post-embryonic development in other animals.

CO 6: Understand the concept of aging and the relevance of this knowledge in several medical applications.

Expt. No.	DSCC-14: Course Title: Evolutionary and Developmental Biology-Practical (Code:036 ZOO 012)	56.hrs/ sem
1	Study and verification of Hardy-Weinberg Law by chi-square analysis.	3
2	Graphical representation and interpretation of data of height/weight of a sample of 100 humans in relation to their age and sex	3
3	Study of connecting links and fossils (models/pictures); Connecting links/ Living fossils: Neopilina, Peripatus, Limulus, Latimeria, Sphenedon, Archeopteryx and Duck Billed Platypus	3
4	Study of homology and analogy from suitable examples.	3
5	Study of aquatic, arboreal and volant adaptations with suitable examples: Shark, Turtle, Chameleon, Loris, Exocoetus, Bat, Pigeon and Draco	4
6	Vestigial organs: Vermiform appendix, Wisdom teeth, Coccyx (tail bone), Tonsils, Body hairs, Nipples on males, Nictitating membranes of eye (Any three)	4
7	Types of eggs based on quantity and distribution of yolk: Sea urchin, Insect, Frog, Chick.	5
8	Study of development of chick embryo through incubated chick eggs upto 96hrs	6
9	Study of stages of development of Frog: Cleavage stages, Blastula, Gastrula, Neurula stages (whole mount) and various stages of tadpole	6
10	Study of permanent slides of Chick embryo -18 hrs, 24 hrs, 36 hrs, 48 hrs (whole mount and T.S of 18 hrs and 24 hrs chick embryo)	6
11	Evolution of Man and Horse (Charts and models)	6
12	Study of Mesozoic Reptiles (Charts or models);	7

	Study of adaptive radiations in feet of birds and mouth parts in insects with example	
13	Any other practical related to this paper may be added based on the feasibility	

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**08**
2. Minor Experiments	**05**
3.Identifications (A-D)	**08**
4. Viva	**02**
5. Journal	**02**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. Semester – VI

Discipline Specific Course (DSCC)-15

Course Title: Environmental Biology, Wildlife Management and Conservation (Theory)
Course Code: 036 ZOO 013

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-15	**Theory**	**04**	**04**	**56 hrs**	**2hrs**	**40**	**60**	**100**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Develop an understanding of how animals interact with each other and their natural environment.

CO 2: Get knowledge about all types of ecosystems, food chains, webs and energy models.

CO 3: Study various types of environmental pollutions

CO 4: Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues.

CO 5: Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management.

CO 6: Develop an ability to analyze, present and interpret wildlife conservation management information.

Units	**DSCC-15:** **Course Title: Environmental Biology, Wildlife Management and Conservation-Theory (Code:036 ZOO 013)**	**56.hrs/ sem**
Unit I	**Ecology:** Introduction to ecology, Definition, Ecosystem, Types of ecosystem, Food chain and Food web, Trophic levels. **Environment:** Definition, Types of environment, Terrestrial, Aquatic, Desert, Grassland and Aerial environment. **Marine habitat: Z**onation of the sea and ecological classification of marine biota, coastalecology, estuarine ecology and mangroves. **Freshwater habitat**: Lentic and Lotic systems. Ecological classification of fresh water animals **Terrestrial habitat**: A brief account of biomes Ecological adaptations to marine, freshwater and terrestrial habitats.	14
Unit II	**Environmental Pollution:** Definition, types of pollutants, air, soil, water and thermal pollution, ozone layer depletion, biomagnifications, bioaccumulation and bioremediation. Effects of pollution on plants and animals. **Toxicants –** Natural and synthetic toxicants and toxicity measurements. Global warming, Acid rain, Bio-accumulation, Bio-magnification, Eutrophication-Types and its impact.	14

Unit III	**Distribution of Wildlife in India:** The Himalayan ranges, The peninsular India sub-region, Deccan plateau, Western ghats, Eastern hill chain, Aravali ranges, Indian desert, Tropical rain forests, Wildlife in Andaman and Nicobar Islands. **Wild life problems:** Hunting, overharvesting, habitat destruction &degradation, over population, and possibilities of climatic changes.	14
Unit IV	**Wildlife Management and Conservation:** In-situ and ex-situ conservation methods; Wildlife sanctuaries, National parks, Biosphere reserves, Project Tiger, Project Elephant, Project Lion, Zoological Gardens, Habitat preservation and Captive breeding. Wildlife Protection Act, 1972, Causes and depletion of Wildlife, General strategies and issues, Concept of home range and territory, Animal census, Tracing movement and Remote sensing and GIS.	` 14

References:

1. Colinvaux,P.A.(1993) Ecology (2nd edition) Wiley, John and Sons,Inc.
2. Krebs,C.J.(2001) Ecology (6th edition) Benjamin Cummings.
3. Odum,E.P.,(2008)Fundamentals of Ecology. Indian Edition. Brooks/Cole. (3rd Edition) Blackwell Sci.
4. Kendeigh, FC.(1984) Ecology with Special Reference to Animal and Man. Prentice HallInc.
5. Caughley,G.,and Sinclair,A.R.E.(1994)Wildlife Ecology and Management. Blackwell Science.
6. Woodroffe,R.,Thirgood,S.and Rabinowitz,A.(2005) People and Wildlife, Conflict or Co-existence? Cambridge University.
7. Bookhout,T.A.(1996) Research and Management Techniques for Wildlife and habitats(5th edition) The Wildlife Society,Allen Press.
8. Sutherland,W.J.(2000)The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
9. Hunter M.L.,Gibbs, J.B.and Sterling, E.J.(2008) Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	10
Internal Assessment Test 2	10
Quiz/ Assignment/ Small Project	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSCC)-16

Course Title: Environmental Biology, Wildlife Management and Conservation (Practical)
Course Code: 036 ZOO 014

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-16	**Practical**	**02**	**04**	**56 hrs**	**3hrs**	**25**	**25**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Understand the basic concepts of environmental sciences, ecosystems, natural resources, population, environment and society

CO 2: Understand the basic concepts of toxicology, their impact on human health and remedial measures

CO 3: Provide understanding and knowledge on modern concepts in wildlife management and relevant conservation policies and legislation and their enforcement mechanism at Global and Local Level,

CO 4: Understand the scientific approach to wildlife management and planning.

CO 5: Develop scientific skills for resolving human wildlife conflict including capture, handling, care and management of wild animals.

Expt. No.	**DSCC-16:** **Course Title: Environmental Biology, Wildlife Management and Conservation-Practical (Code: 036 ZOO 014)**	56.hrs/ sem
1	Collection of water sample and analysis of physical parameters of water: Temperature, pH, Electrical Conductivity.	4
2	Estimation of chemical parameters of water: Dissolved Oxygen (O_2), Carbon Dioxide (CO_2), Hardness, Chloride, Alkalinity, Total dissolved solids (TDS).	6
3	Analysis of physical parameters of soil: pH, EC, Soil moisture, Soil temperature	2
4	Determination of organic matter in the soil sample	4
5	Study of tropical pond as an ecosystem: Study of flora and fauna and interaction between the various constituents using charts.	4
6	Analysis of air pollution: Air monitoring for particulate matter	4
7	Collection, preservation and estimation of zooplanktons	4
8	Study of threatened animals of India (charts/models/pictures): Tiger, Lion, one horned Rhinoceros, Golden langur, Lion tailed monkey, Musk deer, Kashmir stag, Great Indian horn bill and Indian rock python.	4
9	Location of Tiger reserves, National parks, Biosphere reserves, Wildlife sanctuaries of India on Map.	4

10	Demonstration of field equipments used in Wildlife census**:** Compass, Binoculars, Spotting scope, Range finders, Global Positioning System, Various types of cameras and lenses.	4
11	Identification wild animals**:** Wild animal's pugmarks, hoof marks scats, pellet groups, nest, antlers. Demonstration of field techniques for wild flora and fauna.	4
12	Visit to Zoo/ Sanctuaries/ National parks/ Biosphere reserves	12
13	Any other practical's related to this paper may be added based on the feasibility	

Scheme of Practical Examination (distribution of marks): 25 Marks for Semester end Examination

1. Perform all the experiments as per the instructions in each question

Semester end Examination for Practical	
Assessment	**Distribution of Marks**
1. Major Experiments	**08**
2. Minor Experiments	**05**
3.Identifications (A-D)	**08**
4. Viva	**02**
5. Journal	**02**
Total	**25 Marks**

Note: Same Scheme may be used for IA (Formative Assessment) examination for 25 marks

B.Sc. Semester – VI
INTERNSHIP

Course Title: Internship (Practical)
Course Code: 036 ZOO 091

Type of Course	Theory / Practical	Credits	Instruction hour/ week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
Internship	**Practical**	**02**	**04**	**56 hrs.**	**-**	**50**	**0**	**50**

Course Outcomes (COs): At the end of the course students will be able to:

CO 1: Explore career alternatives prior to graduation and Integrate theory and practice

CO 2: Assess interests and abilities in their field of study/ research.

CO 3: Develop work habits and attitudes necessary for job success

CO 4: Build a record of work experience

CO 5: Identify, write down, and carry out performance objectives related to the job assignment

Expt. No.	Internship: Course Title: Internship-Practical (Code: 036 ZOO 091)	56.hrs/ sem
1	Small Laboratory Research Projects related to Zoology **OR**	56
2	Field Study Report: Survey of animal biodiversity nearby villages/ ecosystem **OR**	
3	Survey of insect vectors/ animal diseases/human diseases/blood groups etc. **OR**	
4	Any other work related to this paper may be added based on the feasibility	

Formative Assessment for Practical	
Assessment	**Distribution of Marks**
Project / Survey work / Field Study Report submission	25
Internal marks based on the performance of work by mentor	10
Presentation of work	15
Total	**50 Marks**
Formative Assessment as per guidelines.	

Internship:

A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations for 2 credits. Internships involve working with local industry, local governments (such as panchayats, municipalities) or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

Note:

1. 1 credit internship is equal to 30hrs on field experience.
2. Internship shall be Discipline Specific of 45-60 hours (2 credits) with duration 1-2 weeks.
3. Internship may be full-time/part-time (full-time during last 1-2 weeks before closure of the semester or weekly 4 hrs in the academic session for 13-14 weeks).
4. College shall decide the suitable method for programme wise but not subject wise.
5. Internship mentor/supervisor shall avail work allotment during 6^{th} semester for a maximum of 20 hours.
6. The student should submit the final internship report (45-60 hours of Internship) to the mentor for completion of the internship.
7. Method of evaluation: Presentations/Report submission/Activity etc.

UG programme: 2023-24

GENERAL PATTERN OF THEORY QUESTION COURSE FOR DSCC/ OEC

(60 Marks for Semester End Examination with 2 Hrs duration)

Part-A

1. Question number 01- 06 carries 2 Marks each. Answer any 05 questions : 10 Marks

Part-B

2. Question number 07 - 11 carries 05 Marks each. Answer any 04 questions : 20 Marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 Marks
(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

(Note: Proportionate weightage shall be given to each unit based on number of hours prescribed)