UNIVERSITY OF KOTA

NATIONAL EDUCATION POLICY-2020

SYLLABUS

SEMESTER SCHEME

(w.e.f. 2023-24)

B.Sc. (Botany)

Semester- I & II

MBS Marg, Near Kabir Circle, KOTA (Rajasthan)-324 005

UNIT IV

Bryophyta : General characteristics, classification , economic importance and alternation of generation in Bryophyta. Structure, reproduction and economic importance of *Riccia, Marchantia*, *Anthoceros -Sphagnum* and *Funaria.*

UNIT V

Plant diseases ; General Symptoms and Causes of Plant diseases, special study of   -Green ear disease of Bjara ,White rust of Crucifer , Black or Stem rust of wheat, Smut disease, Citrus canker, Tobacco mosaic disease, Little leaf of brinjal. General account of Lichens.

Lab Course/Practical exercises:-

Staining of different types of Bacteria and fungi(*Phytophthora Albugo, Saccharomyces, Penicillium,.Puccinia, Ustilago ,Agaricus, Colletotrichum and Alternaria*)in laboratory .Microscopic preparation and detailed study of the following algal material: *Nostoc, Oscillatoria, Volvox, Coleochaete, ,Vaucheria, Chara, Ectocarpus* and *Polysiphonia* (mentioned in syllabus and locally available).

Study of some locally available plant diseases caused by Bacteria, fungi, Viruses and Mycoplasma. Citrus canker, Green ear disease of Bajra ,Tobacoo Mosaic Virus (TMV) and Little leaf of Brinjal.

 Study of External morphology,anatomy and reproduction of *Riccia, Marchantia, Anthoceros, Sphagnum* and funaria in Laboratory and microscopic preparations also.   Study of Lichens.

Books Recommended :

 1. Vashistha, B.R. 1989, Algae, S. Chand and Co. Delhi.

 2. Vashistha, B.R. 1989, Fungi, S. Chand and Co. Delhi.

 3. Pandey S.N. & other. 1995, A Text Book of Botany Vol. I, Vikas Publications Dehli.

 4. Pandey S.N. & other1995, A Text Book of Botany Vol. II, Vikas Publications Dehli.

 5. Alexopoulos and mims 1979 wiley Eastern, N.Delhi 6. Dubey H.C. 2017 fungi: Scientific Pubhlishers, Jodhpur

Hyperlinks e-Books : -

https://books.google.co.in/books?id=ZTNlDwAAQBAJ&printsec=frontcover&dq=algae+book+of+s+chand+publication&hl=en&newbks=1&newbks_redir=1&sa=X&ved=2ahUKEwjd--yB4qaBAxWkSmwGHVmoCKoQ6AF6BAgJEAI

https://books.google.co.in/books?id=r0h1DwAAQBAJ&printsec=frontcover&dq=algae+book+of+s+chand+publication&hl=en&newbks=1&newbks_redir=1&sa=X&ved=2ahUKEwjd--yB4qaBAxWkSmwGHVmoCKoQ6AF6BAgIEAI

Paleobotany : Aims and Objectives of Paleobotany**. F**ossilization and types of fossils, Techniques of fossil study, Geological time scale and significance of Paleobotany. Brief account *of Rhynia, Lepidodendron, Calamites, Cladoxylon ,Williamsonia and Glossopteris.*

BOT 2: Lab Course/Practical's

 Morphology and Reproductive parts of the *Lycopodium, Selaginella, Equisetum*, and *Marsilea*. Microscopic study by Slide   preparations. Morphology , anatomy and reproductive parts of Gymnosperm :Cycas , Pinus and Ephedra.

Specimens/photographs/Slides (microscopic examination)of fossil   plants-*Rhynia, Lepidodendron ,Calamites, Cladoxylon* and *Williamsonia* and *Glossopteris*.

Course Outcome :

1. After the completion of the course, the students will be able to learn about the instruments, techniques, lab etiquettes and will perform practical exercises in laboratory.
2.   Contents of this course will develop understanding about the classification and diversity of microbes (viruses, Bacteria, Bacteriophage), Algae , Fungi and   their economic importance.
3. Understand the detailed microscopic structure and reproduction of bacteria, algae, fungi and lichens.
4   Develop skills for identifying microbes and using them for Industrial, Agriculture and Environment purposes.
5   Develop conceptual skill of identifying microbes, Plant diseases, Pathogens, Symptoms   and students will learn host –pathogen relationship and disease management.

6. Develop critical understanding on morphology, anatomy and reproduction of Bryophytes.

7.   Student will know about the distribution and economic importance of Pteridophytes and Gymnosperms of the Surrounding.

8.   Student will know about the Fossils and Geological time scale.

Books recommended:

1.Bhatnagar. S. P and Moitra, A. 1996.Gymnosperm New Age International pvt. Ltd. New Delhi.

2. Parihar, N. S. 1996.Biology and Morphology of Ptridoohytes, Central Book Depot, Allahbad.

3.Singh, M 1978,Embryology of Gymnosperm, Encyclopaedia of Plant Anatomy. X. Gebruder Bortraeger, Berlin..

4.Sporne,K. K. 1991.Themorohology of ptridophytes, B. I. publishing. Pvt. Ltd. Mumbai.

5. Stewart, W. N. And Rathwell, G. W. 1983.Paleobotany and the evolution of plants. Cambridge University press.

6.Sunderrajan, S. 2007 .Introduction to pteridophyta, New Age International Publishers, New Delhi.

B.Sc. – Botany
Exam.-2023

UNIVERSITY OF KOTA
MBS Marg, Swami Vivekanand Nagar,
Kota - 324 005, Rajasthan, India
Website: uok.ac.in

Hartmann, H.T. and Kestier, D.E., 1976. Plant Propagation : Principles and Practices. 3rd edition. Prentice-Hall of India Pvt. Ltd. New Delhi.

King, J. 1997. Reaching for the Sun : How Plants Work, Cambridge University Press, Cambridge, U.K.

Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummins Publishing Company Inc., Menla Park, California, USA.

Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.

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

Thomas, P. 2000. Trees. Their Natural History, Cambridge University Press Cambridge.

PRACTICAL MARKING SCHEME :-

There shall be a practical examination of five hours duration and distribution of marks shall be as follows :

		STUDENT'S	
		REGULAR	EX
1.	A double stained section of plant part (vegetative) of Gymnosperms.	10	12
2.	T.S./L.S. of Reproductive part (Gymnosperms)	5	7
3.	A double stained section of plant part (Angiosperms)	10	13
4.	(A) Description of flowering twig in semitechnical language assigning its family. Give suitable diagrams	10	13
	(B) Description of reproductive parts of of a flower assigning its family. Draw floral diagram.	5	5
5.	Germination of seed / Seed viability	5	5
6.	Spots-Five (3 Marks each)	15	15
7.	Viva voce	5	5
8.	Practical record	10	-
	Total	**75**	**75**

SUGGESTED PRACTICAL EXERCISES :-

Gymnosperms

Cycas.

i. Habit, armour of leaf bases on the stem (if specimen is not available show photograph), very young leaf (circinate venation) and old foliage leaves, scale leaf, bulbils, male cone (specimen); microsporophyll, megasporophyll, mature seed.

ii. Study through permanent slides - normal root (T.S.), stem (T.S.) (if sections are not available show photographs), ovule (L.S.).

iii. Study through hand sections or dissections - coralloid root (T.S.), rachis (T.S.), leaflet (T.S.), microsporophyll (T.S.), pollen grains (W.M.)

Pinus

i. Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cone, 1st year, 2nd year and 3rd year female cones, winged seeds.

ii. Study through permanent slides - root (T.S.), female cone (L.S.), ovule (L.S.), embryo (W.M.) showing polycotyledonous condition.

iii. Study through hand sections or dissections - young stem (T.S.), old stem (wood) (T.L.S. and R.L.S.), needle (T.S.), male cone (L.S.), male cone (T.S.), pollen grains (W.M.)

Ephedra

i. Habit and structure of whole male and female cones.

ii. Permanent slides - female cone (L.S.).

iii. Hand sections/dissections - node (T.S.), internode (T.S.), male cone (T.S. and L.S.), pollen grains.

Ginkgo, Taxus & *Gnetum* - Study of morphology and anatomy of vegetative and reproductive parts.

Angiosperms

(A) The following species are suitable for study. This list is only indicative. Teachers may select plants available in their locality.

1. *Ranunculaceae* : *Ranunculus, Delphinium*

2. *Brassicaceae* : *Brassica, Iberis*

   Papaveraceae : Argemone / Papaver.

3. *Malvaceae* : *Hibiscus, Abutilon*

4. *Rutaceae* : *Murraya, Citrus*

5. *Fabaceae* : *Faboideae : Lathyrus, Cajanus, Melilotus, Trigonella*
   Caesalpinioideae : Cassia, Caesalpinia
   Mimosoideae : Acacia, Prosopis, Mimosa

6. *Apiaceae* : *Coriandrum, Foeniculum, Anethum*

7. *Asteraceae* : *Helianthus, Ageratum, Sonchus, Tridax*

8. *Acanthaceae* : *Adhatoda, Peristrophe*

9. *Apocynaceae* : *Vinca, Thevetia, Nerium*

10. *Asclepiadaceae* : *Calotropis*

11. *Solanaceae* : *Solanum, Withania, Datura*

12. *Euphorbiaceae* : *Euphorbia, Phyllanthus, Ricinus*

13. *Lamiaceae* : *Ocimum, Salvia*

14. *Amaranthaceae :* *Amaranthus, Achyranthus*

15. *Liliaceae* : *Asphodelus, Asparagus*

16. *Poaceae* : *Avena, Triticum, Hordeum.*

(B)

1. Study of any commonly occurring dicotyledonous plant (for example *Solanum nigrum* or *Kalanchoe*) to understand the body plan and modular type of growth.

2. Life forms exhibited by flowering plants (by a visit to a forest or a garden).

3. L.S. shoot tip to study the cytohistological zonation and origin of leaf primordia.

4. Monopodial and sympodial types of branching in stems (especially rhizomes)

5. Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood. Microscopic study of wood in T.S., T.L.S. and R.L.S.

6. Internal structure of leaf. Structure and development of stomata (using epidermal peels of leaf)

7. Anatomy of the root. Primary and secondary structure.

8. Examination of a wide range of flowers available in the locality and methods of their pollination.

9. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using in vitro pollen germination.

10. Structure of ovule and embryo sac development (using serial sections).

11. Nuclear and cellular endosperm. Embryo development in monocots and dicots (using slides/dissections)

12. Simple experiments to show vegetative, propagation. (leaf cuttings in Bryophyllum, Sansevieria, Begonia; stem cuttings in rose, salix, money plant, sugarcane and Bougainvillea).

13. Germination of non-dormant and dormant seeds.

14. Viability of seeds.

बी.एस.सी. पार्ट द्वितीय
वनस्पति विज्ञान

सैद्धान्तिक परीक्षा योजना

संख्या	प्रश्न पत्र	अवधि	अधिकतम अंक	न्यूनतम अंक
I	बीजीय पौधों की विविधता एवं वर्गिकी अनावृत बीजी	3 घंटे	50	
II	बीजीय पौधों की विविधता एवं वर्गिकी – आवृतबीजी	3 घंटे	50	54
III	पुष्पीय पौधों की संरचना जनन एवं परिवर्धन	3 घंटे	50	
	प्रायोगिक परीक्षा	5 घंटे (एक दिवस)	75	27

Botany Practical

Time: 5 Hrs.   Maximum Marks: 75   Minimum Marks: 27

Physiology:

1. To study the permeability of plasma membrane using different concentration of organic solvents.
2. To study the effect of temperature on permeability of plasma membrane.
3. To study of effect of toxic substances on permeability of plasma membrane.
4. To demonstrate the phenomenon of the osmosis by the use of potato osmometer.
5. To study the phenomenon of plasmolysis and deplasmolysis using Tradescantia / Rhoeo discolor leaves and different concentrations of sugar.
6. To study the protoplasmic streaming (In Hydrilla / vallisnaria)
7. To demonstrate the rate of transpiration by use of potometers (Ganong's/Farmers)
8. To study the relative rate of transpiration from the leaf surfaces of the different plants using cobalt chloride paper.
9. To demonstrate that oxygen is evolved during the photosynthesis by inverted funnel method.
10. To demonstrate that light is necessary for photosynthesis.
11. To demonstrate the effect of different wavelengths of light during the photosynthesis.
12. To demonstrate the carbon-dioxide, light, water and chlorophyll are essential for photosynthesis by moll's experiment.
13. To compare the rate of photosynthesis under different condition by using wilmott's bubbler.
14. comparison of the rate of respiration (R.Q.) of various plant parts or substrates with the help of Ganong's respirometer.
15. Separation of chlorophyll pigments by the paper chromatography.

Biochemistry:

1. To study the activity of catalase, peroxidase dehydrogenase enzymes in plant tissues.
2. Phytochemical test for starch, sugars, protein, fats, tannins, Anthocyanin.

Biotechnology :

1. Introduction of the instruments/techniques laminar air flow/ sterile bench and autoclave
2. Preparation of M.S and P.D.A. culture media, slant preparation.
3. Demonstration of inoculation techniques, aseptic transfer of explants and microbial transfer technique
4. Demonstration of the technique of micropropagation by using different explants e.g., axillary buds, shoot meristem

Ecology:

1. To determine minimum size of quadrat for phytosociological studies of herbaceous plants.
2. To determine frequency of the herbaceous species by quadrat method.
3. To determine density and abundance of the herbaceous flora by quadrat method.
4. Soil analysis/Field test
   - (a) Soil Texture
   - (b) Soil moisture
5. To determine water holding capacity of soil of grass land or wood land
6. To determine the pH of given soil samples.
7. To demonstrate the presence of carbonate and chloride in different water samples/soil samples.

Ecological adaptations:

8. Morphological & Anatomical adaptations in some hydrophytes & xerophytes: (Specimens/slides/section cutting) Hydrilla, Typha, Eichhornia, opuntia, Euphorbia, Capparis, Casurin, Nerium, Calotropis
9. Ecological instruments and their working

Economic Botany:

1. Microchemical tests for – Lignin, Cellulose, Cutin, Suberin, Starch, Sugar, Protein and Oil in plant tissues.
2. Microscopic examination of starch grains of wheat, maize Rice and Potato.

Utilization of plants
   - (a) Food plants – Wheat, Maize, Rice, Potato, Sugarcane
   - (b) Fibres – Cotton, Jute
   - (c) Vegetable oils – Ground nut, mustard and coconut
   - (d) A general account of the fire wood, timber yielding plants and Bamboos
   - (e) Spices and condiments – Clove, Black pepper, Cinnamon, Cardamom.
   - (f) Medicinal Plants – Rauwolfia, Withania, Cinchona, Papaver, Ocimum, Datura, Ephedra, Taxus, Aloe, Azadirachta
   - (g) Beverages – Tea, Coffee
   - (h) Rubber – Ficus elastica, Hevea
   - Viva-Voce

SCHEME OF EXAMINATION
RULES & REGULATIONS
AND
SYLLABUS
(Effective from Academic Session 2023-2024)

B.Sc. Chemistry
First Semester Examination, December 2023
Second Semester Examination, June 2024

under

Choice Based Credit System
(CBCS)

Faculty of Science

UNIVERSITY OF KOTA
MBS Marg, KOTA (Rajasthan)-324 005
INDIA

use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.

Behaviour of Real Gases:

Deviations from ideal gas behaviour, compressibility factor and its variation with pressure for different gases. Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietrici); virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

Paper-1.4: CHE..........P
Chemistry Practical-I

Contact Hours / Week   : 4 Hours / Week   Maximum Marks   : 50 Marks
Duration of Examination : 6 Hours   Semester Assessment   : 50 Marks

Distribution of Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1: Inorganic Chemistry	10
2.	Exercise No. 2: Organic Chemistry	10
3.	Exercise No. 3: Physical Chemistry	10
4.	Practical Record	10
5.	Viva-voce	10
	Total Marks	**50**

Introduction to Laboratory Safety and Working:
- Safe working in chemical laboratories.
- Experiments and recording of results.
- Good laboratories practices (GLPs).
- Standard operating procedures (SOPs).
- Hazards in chemical laboratories.
- Introduction of working with lab ware.
- Proper uses of solvents and reagents.

Inorganic Chemistry:

Qualitative Semimicro Analysis:

Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:
- Anions: CO_3^{2-}, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_2^-, NO_3^-, SO_4^{2-}, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-},
- Cations: NH_4^+, Ag^+, Hg^+, Pb^{2+}, Hg^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, $Sn^{2+/4+}$, $As^{3+/5+}$, $Sb^{3+/5+}$, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Co^{2+}, Zn^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}.

Mixtures should preferably contain one interfering anion or insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) or combination of anions *e.g.* CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^- and Br^-, Cl^- and I^-, Br^- and I^-, NO_3^- and Br^-, NO_3^- and I^-.

Organic Chemistry:

Determination of Melting Points and Boiling Points:
- Determination of melting points:
  - Naphthalene 80-82°C, Benzoic acid 121.5-122°C, Urea 132.5-133°C, Succinic Acid 184.5-185°C, Cinnamic acid 132.5-133°C, Salicylic acid 157.5-158°C, Acetanilide 113.5-114°C, *m*-Dinitrobenzene 90°C, *p*-Dichlorobenzene 52°C, Aspirin 135°C.
- Determination of boiling points:
  - Ethanol 78°C, Cyclohexane 81.4°C, Toluene 110.6°C, Benzene 80°C
- Determination of mixed melting points:
  - Urea-Cinnamic acid mixture of various compositions (1:4,1:1,4:1)

Purification of Organic Compounds:
- Distillation:
  - Simple distillation of ethanol-water using water condenser
  - Distillation of nitrobenzene and aniline using air condenser
  - Steam Distillation:
- Sublimation (Simple and vacuum)
  - Camphor, Naphthalene, phthalic acid and Succinic acid.
- Crystallization
  - Concept of induction of crystallization.
  - Phthalic acid from hot water (using fluted filter paper and stemless funnel).
  - Acetanilide from boiling water.
  - Naphthalene from Ethanol.
  - Benzoic acid from water.
- Decolorization and crystallization using charcoal
  - Decolorization of brown sugar (sucrose) with animal charcoal using gravity filtration.
  - Crystallization and decolorization of impure naphthalene (100g of naphthalene mixed with 0.3g. of Congo Red using l.0g decolorizing carbon) from ethanol.

Stereochemical Study of Organic Compounds via Models
- R and S configuration of optical isomers.
- E and Z configuration of geometrical isomers.
- Conformational analysis of cyclohexanes and substituted cyclohexanes.

Qualitative Analysis:
Detection of extra elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, ester, carbohydrates, amine, amide, nitro, anilide, glucose, fructose, *etc.*) in simple organic compounds.

Physical Chemistry:

Solution Preparation and Standardization:
- Preparation of solutions in terms of molarity, molality, formality, normality, w/w, w/v, v/v, percent, mole ratio, partial pressure and presentation of concentration in g/L, percent, ppt, ppm, ppb.
- Standardization of solutions.

Surface Tension:
- Determination of the surface tension of a liquid or a dilute solution by (i) drop number (ii) drop weight method.
- Study of the variation of surface tension of a detergent solution with concentration.

Viscosity:
- Determination of co-efficient of viscosity of an unknown aqueous solution
- Determination of the relative and absolute viscosity of a liquid or dilute solution.
- Study of the variation of viscosity of an aqueous solution with concentration of solute.

Suggested Books for Theory Papers:

Inorganic Chemistry:
- *Basic Inorganic Chemistry: F. A. Cotton and G. Wilkinson, Wiley Eastern*
- *Chemistry of the Elements, N.N. Greenwood and A. Earnshaw*
- *Shriver & Atkins' Inorganic Chemistry*
- *Concise Inorganic Chemistry: J. D. Lee, ELBS*
- *Theoretical Inorganic Chemistry, ACS Publications. M.C. Day and J. Selbin*
- *Advanced Inorganic Chemistry, Vol I & II. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan*
- *Principles of Inorganic Chemistry: B. R. Puri and L. R. Sharma*
- *Fundamentals of Inorganic Chemistry, Vol. I, Das, CBS Publications, 2nd Ed.*
- *Bioinorganic Chemistry-Bertini*
- *Biological Inorganic Chemistry-An Introduction-Robert R. Crichton*
- *The Organometallic Chemistry of Transition Metals, 4e-Robert H Crabtree*
- *Organometallic Chemistry, Mehrotra and Singh. New Age International Publishers, 2ndEdn.*
- *Basic Organometallic Chemistry, 2ndEdn., Gupta B. D. and Elias A. J., University Press.*

Organic Chemistry:
- *Organic Chemistry, Claydon, Nick Greeves and Stuart Warren, Oxford University Press*
- *Organic Chemistry, Graham Solomons, John Wiley & Sons, Inc.*
- *Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.*
- *Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.*
- *Organic Chemistry (Volume 1), I.L. Finar, Dorling Kindersley (India) Pvt. Ltd.*
- *Organic Chemistry (Volume 2): Stereochemistry and the Chemistry of Natural Products, I.L. Finar, Dorling Kindersley (India) Pvt. Ltd.*
- *Organic Chemistry, Vol. I, II & III. Jag Mohan, R. Chand & Company*
- *Organic Chemistry, (Vol. I, II & III. S. M. Mukherji, S. P. Singh and R. P. Kapoor*
- *Stereochemistry of Carbon Compounds, Ernest L. Eliel, Tata McGraw Hill.*
- *Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.*
- *Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.*
- *A Textbook of Organic Chemistry: P S Kalsi, New Age International*
- *A Text Book of Organic Chemistry: B. S. Bahl and Arun Bahl*
- *A Text Book of Organic Chemistry: P. L. Soni & H.M. Chawla*
- *A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal*
- *Organic Synthesis: Jagadamba Singh and L.D.S. Yadav*
- *Principles of Organic Synthesis-Norman & Coxon*
- *Heterocyclic Chemistry at a Glance 2e by Joule & Mills Blackwell*
- *Heterocyclic Chemistry by RK Bansal*
- *Heterocyclic Chemistry Volume I and II by RR Gupta*
- *Fundamentals of Biochemistry 5e Voet & Voet*
- *Lehninger Principles of Biochemistry 4e Nelson & Cox*
- *Harper's Illustrated Biochemistry. XXVIII edition. Murray, Granner, Mayes and Rodwell. Lange Medical Books/ McGraw-Hill.*
- *Elementary Organic Spectroscopy, 5th Edition, Y R Sharma, S. Chand & Company.*
- *Organic Spectroscopy and Applications, Jag Mohan, Narosa Publishers*

(equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects (no derivation).

Catalysis:

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Paper-2.4: CHE.........P
Chemistry Practical-II

Contact Hours / Week : 4 Hours / Week   Maximum Marks : 50 Marks
Duration of Examination : 6 Hours   Semester Assessment : 50 Marks

Distribution of Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1: Inorganic Chemistry	10
2.	Exercise No. 2: Organic Chemistry	10
3.	Exercise No. 3: Physical Chemistry	10
4.	Practical Record	10
5.	Viva-voce	10
	Total Marks	**50**

Inorganic Chemistry:

Qualitative Semimicro Analysis:

Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:

- Anions: CO_3^{2-}, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_2^-, NO_3^-, SO_4^{2-}, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-},
- Cations: NH_4^+, Ag^+, Hg^+, Pb^{2+}, Hg^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, $Sn^{2+/4+}$, $As^{3+/5+}$, $Sb^{3+/5+}$, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Co^{2+}, Zn^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}.

Mixtures should preferably contain one interfering anion or insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) or combination of anions *e.g.* CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^- and Br^-, Cl^- and I^-, Br^- and I^-, NO_3^- and Br^-, NO_3^- and I^-.

Organic Chemistry:

Qualitative Analysis:

Systematic qualitative analysis of an organic compounds through monofunctional group analysis (carboxylic, phenolic, aldehydic, ketonic, amide, nitro, amines, *etc.*), determination of melting point and preparation of suitable derivatives.

Paper Chromatography-Ascending and Circular:

Separation of a mixture of organic compounds and reporting of the R_f values:

- Separation of a mixture of phenyl alanine and glycine, alanine and aspartic acid, leucine and glutamic acid, or other combination of amino acids. Spray reagent-Ninhydrin.
- Separation of a mixture of D,L-alanine, glycine and L-leucine using n-butanol: acetic acid:water (4:1:5). Spray reagent-Ninhydrin.
- Separation of monosaccharides-a mixture of D-galactose and D-fructose using n-butanol:acetone:water (4:5:1). Spray reagent- Aniline hydrogen phthalate.

Physical Chemistry:

Chemical Kinetics:

Study the kinetics of the following reactions.

- Initial rate method: Iodide-persulphate reaction
- Integrated rate method:
  - Acid hydrolysis of methyl acetate and/or ethyl acetate with hydrochloric acid.
  - Saponification of ethyl acetate.
  - Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate and/or ethyl acetate

Volumetric Analysis:

- Determination of acetic acid in commercial vinegar using NaOH
- Determination of alkali content in antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permanganometry.

Suggested Books for Theory Papers:

Inorganic Chemistry:

- *Basic Inorganic Chemistry: F. A. Cotton and G. Wilkinson, Wiley Eastern*
- *Chemistry of the Elements, N.N. Greenwood and A. Earnshaw*
- *Shriver & Atkins' Inorganic Chemistry*
- *Concise Inorganic Chemistry: J. D. Lee, ELBS*
- *Theoretical Inorganic Chemistry, ACS Publications. M.C. Day and J. Selbin*
- *Advanced Inorganic Chemistry, Vol I & II. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan*
- *Principles of Inorganic Chemistry: B. R. Puri and L. R. Sharma*
- *Fundamentals of Inorganic Chemistry, Vol. I, Das, CBS Publications, 2nd Ed.*
- *Bioinorganic Chemistry-Bertini*
- *Biological Inorganic Chemistry-An Introduction-Robert R. Crichton*
- *The Organometallic Chemistry of Transition Metals, 4e-Robert H Crabtree*
- *Organometallic Chemistry, Mehrotra and Singh. New Age International Publishers, 2ndEdn.*
- *Basic Organometallic Chemistry, 2ndEdn., Gupta B. D. and Elias A. J., University Press.*

Organic Chemistry:

- *Organic Chemistry, Claydon, Nick Greeves and Stuart Warren, Oxford University Press*
- *Organic Chemistry, Graham Solomons, John Wiley & Sons, Inc.*
- *Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.*
- *Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.*
- *Organic Chemistry (Volume 1), I.L. Finar, Dorling Kindersley (India) Pvt. Ltd.*
- *Organic Chemistry (Volume 2): Stereochemistry and the Chemistry of Natural Products, I.L. Finar, Dorling Kindersley (India) Pvt. Ltd.*
- *Organic Chemistry, Vol. I, II & III. Jag Mohan, R. Chand & Company*
- *Organic Chemistry, (Vol. I, II & III. S. M. Mukherji, S. P. Singh and R. P. Kapoor*
- *Stereochemistry of Carbon Compounds, Ernest L. Eliel, Tata McGraw Hill.*
- *Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.*
- *Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.*
- *A Textbook of Organic Chemistry: P S Kalsi, New Age International*
- *A Text Book of Organic Chemistry: B. S. Bahl and Arun Bahl*
- *A Text Book of Organic Chemistry: P. L. Soni & H.M. Chawla*
- *A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal*
- *Organic Synthesis: Jagadamba Singh and L.D.S. Yadav*
- *Principles of Organic Synthesis-Norman & Coxon*
- *Heterocyclic Chemistry at a Glance 2e by Joule & Mills Blackwell*
- *Heterocyclic Chemistry by RK Bansal*
- *Heterocyclic Chemistry Volume I and II by RR Gupta*
- *Fundamentals of Biochemistry 5e Voet & Voet*

SCHEME OF EXAMINATION

AND

SYLLABUS

(for Academic Session 2023-2024)

B.Sc. (Part-II) Chemistry

**This syllabus is for the B.Sc. Course
running under Annual Scheme
in the affiliated Colleges of the University**

Bachelor of Science (B.Sc.)
Chemistry

Faculty of Science

UNIVERSITY OF KOTA

MBS Marg, KOTA (Rajasthan)-324 005

INDIA

electrodes, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolyte and Galvanic Cells: Reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, over-potential and hydrogen over-voltage. Concentration cell with and without transport, liquid-junction potential, application of concentration cells, valency of ions.

Solubility product and activity coefficient, determination of solubility product of a sparingly soluble salt. Definition of pH and pKa. Determination of pH using hydrogen electrode by potentiometric titrations. Buffers: mechanism of buffer action, Henderson-Hazel equation, hydrolysis of salts.

Books Suggested:
1. *Principles of Physical Chemistry: B. R. Puri Sharma and M. S. Pathania*
2. *A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand*
3. *A Text Book of Physical Chemistry: Kundu and Jain*

Paper-IV (CH-204): Chemistry Practical

Laboratory Course: 4 Hrs. /Week   Duration of Practical Examination: 5 Hrs.
Max. Marks: 75 Marks   Min. Pass Marks: 27 Marks

Distribution of Marks:
- Inorganic Chemistry Experiments   -   20
- Organic Chemistry Experiments   -   20
- Physical Chemistry Experiments   -   20
- Practical Record (for regular students only)   -   05
- Viva-voce (for regular students)   -   10
- Viva-voce (for non-collegiate students)   -   15

Inorganic Chemistry:
Section-A
Calibration of fractional weights, pipettes and burettes. Preparation of standard solution. Dilution-0.1M to 0.001M solutions.
Section-B
Quantitative Analysis:
Volumetric analysis
- Determination of acetic acid in commercial vinegar using NaOH
- Determination of alkali content in antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permanganato-metry.
- Estimation of hardness of water by EDTA.
- Estimation of ferrous and ferric by dichromate method.
- Estimation of copper using thiosulphate.

Gravimetric analysis

Analysis of Cu as CuSCN and Ni as Nickel dimethylglyoxime.

Organic Chemistry

Laboratory techniques:

A Thin Layer Chromatography: Determination of Rf values and identification of organic compounds.

- Separation of green leaf pigments (spinach leaves may be used)
- Preparation and separation of 2,4-Dinitrophenyl hydrazones of acetone, 2-butanone, hexan-2 and 3-one using toluene and light petroleum (40:60)
- Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5)

B Paper Chromatography-Ascending and Circular: Determination of values and Identification of organic compounds.

- Separation of a mixture of phenyl alanine and glycine. Alanine and aspartic acid. leucine and glutamic acid. Spray reagent-Ninhydrin.
- Separation of a mixture of D,L-alanine, glycine and L-leucine using n-butanol: acetic acid:water (4:1:5) Spray reagent-Ninhydrin.
- separation of mono saccharides-a mixture of D-galactose and D-fructose using n-butanol:acetone:water (4:5:1) spray reagent- Aniline hydrogen phthalate.

Qualitative Analysis:

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry:

Transition temperature:

- Determination of the transition temperature of the given substance by thermometric /dialometric method (e.g. $MnCl_2.4H_2O$ / $SrBr_2.2H_2O$)

Phase Equilibrium

- To study the effect of a solute (*e.g.* NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (*e.g.* phenol-water system)
- To construct the phase diagram of two component (*e.g.* diphenyl-benzophenone) system by cooling curve method.

Thermochemistry:

- To determine the solubilizes of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
- To determine the enthalpy of neutralization of a weak acid weak base verses strong acid and strong base and determine the enthalpy of ionization of the weak acid/weak base.
- To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using born Haber cycle.

Books Suggested:
1.   Practical Chemistry: Giri Bajpai and Pandey, S. Chand & Co. Ltd., New Delhi
2.   Practical Chemistry (Hindi Ed.): Suresh Ameta & P. B. Punjabi, Himanshu Publication

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SCHEME OF EXAMINATION

AND

SYLLABUS

(for Academic Session 2024-2025)

B.Sc. (Part-III) Chemistry

**This syllabus is for the B.Sc. Course
running under Annual Scheme
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Bachelor of Science (B.Sc.)
Chemistry

Faculty of Science

UNIVERSITY OF KOTA

MBS Marg, KOTA (Rajasthan)-324 005

INDIA

Unit-V Physical Properties and Molecular Structure:

Optical activity, polarization (Calusius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment- temperature method and refractivity method. dipole moment and structure of molecules. magnetic properties-paramagnetism, diamagnetism and ferromagnetism.

Solutions, Dilute Solutions and Colligative Properties:

Ideal and non-ideal solutions and their properties, methods of expressing concentrations of solutions, activity and activity coefficient. Roult's and Henry's laws, Azeotropes-ethanol-water system. Nernst Distribution Law-Thermodynamic derivation, applications. Dilute solution, colligative properties, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal value and abnormal molar mass, degree of dissociation and association of solutes.

Books Suggested:
1. *Physical Chemistry, G.M. Barrow. International Student Edition, McGraw Hill.*
2. *Basic Programming with Application, V.K. Jain. Tata McGraw Hill.*
3. *Computers and Common Sense. R Hunt and Shelly, Prentice Hall.*
4. *University General Chemistry, C.N.R Rao, Mac Millan.*
5. *Physical Chemistry, RA. Alberty, Wiley Eastern Ltd.*
6. *The elements of Physical Chemistry, P.W. Atkins, Oxford.*
7. *Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.*
8. *Principles of Physical Chemistry: B. R. Puri Sharma and M. S. Pathania*
9. *A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand*
10. *A Text Book of Physical Chemistry: Kundu and Jain*

Paper-IV (CH-304): Chemistry Practical

Laboratory Course: 4 Hrs. /Week   Duration of Practical Examination: 5 Hrs.
Max. Marks: 75 Marks   Min. Pass Marks: 27 Marks

Distribution of Marks:
- Inorganic Chemistry Experiments - 20
- Organic Chemistry Experiments - 20
- Physical Chemistry Experiments - 20
- Practical Record (for regular students only) - 05
- Viva-voce (for regular students) - 10
- Viva-voce (for non-collegiate students) - 15

Inorganic Chemistry
Synthesis and Analysis
- Preparation of sodium trioxalatoferrate (III) $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permaganotometry.
- Preparation of Ni-DMG complex $[Ni(DMG)_2]$.
- Preparation of copper tetraammine complex $[Cu(NH_3)_3]SO_4$.
- Preparation of cis-and trans-bisoxalatodiaquachromate (III) ion.

Instrumentation

- Colorimetry   - Job's method and Mole-ratio method.
- Adulteration   - Food stuff.
- Effluent analysis   - water analysis.
- Solvent Extraction   - Separation and estimation of Mg(II) and Fe(II)
- Ion Exchange Method - Separation and estimation of Mg(II) and Zn(II)

Volumetric Analysis

- Iodometric & Iodimetric titrations.

Organic Chemistry

Section-A

Laboratory Techniques:

(i) Steam Distillation:

- Naphthalene from its suspension in water.
- Clove oil from Clove
- Separation of o-and p-nitrophenols

(ii) Column Chromatography:

- Separation of fluorescein and methylene blue.
- Separation of leaf pigments from spinach leaves.
- Resolution of racemic mixture of (Z)-mandelic acid.

Qualitative Analysis:

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.

Section-B

Synthesis of Organic Compounds

- Acetylation: Salicylic acid, aniline, glucose and hydroquinone.
- Benzoylation: Aniline and phenol.
- Aliphatic Electrophilic Substitution: Preparation of Iodoform from ethanol and acetone.
- Aromatic Electrophilic Substitution:
  - o Nitration:
    Preparation of m-dinitrobenzene,
    Preparation of p-nitroacetanilide
  - o Halogenation:
    Preparation of p-bromoacetanilide
    Preparation of 2,4,6-tribromophenol.
- Diazotization/coupling: Preparation of methyl orange and methyl red.
- Oxidation: Preparation of benzoic acid from toluene.
- Reduction: Preparation of aniline from nitrobenzene and m-nitroaniline from m-dinitrobenzene.

Stereo-chemical study of Organic Compounds via Models

- R and S configuration of optical isomers.
- E and Z configuration of geometrical isomers.
- Conformational analysis of cyclohexanes and substituted cyc1ohexanes.

Section-C

Organic estimation: Amino group, phenolic group, carboxylic acid group and glucose.

Physical Chemistry

Electrochemistry

- To determine the strength of the given acid conductometrically using standard alkali solution.
- To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
- To study the saponification of ethyl acetate conductometrically.
- To determine the ionization constant of a weak acid conductometrically.
- To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4$ / $K_2Cr_2O_7$ as titrant calculate the redox potential of Fe^{2+}/Fe^{3+} system on the hydrogen scale.

Refractometry and Polarimetry

- To verify law of refraction of mixtures for ego of glycerol and water) using Abe's refractometer.
- To determine the specific rotation of a given optically active compound.

Molecular Weight Determination

- Determination of molecular weight of a non-volatile solute by Rast method / Beckmann freezing point method.
- Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.

Colorimetry

- To verify Beer-Lambert law $KMnO_4$ / $K_2Cr_2O_7$ and determined the concentration of the given solution of the substance.

Books Suggested (Laboratory Courses):
1. *Vogel's Qualitative Inorganic analysis, revised, SveWa, Orient Longman.*
2. *Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V.Rogers, P.W.G. Smith and A.R Tatchell, ELBS.*
3. *Vogel's Text Book of Quantitative Inorganic Analysis (revised), J. Bassentt. RC. Deney G.H. Jeffery and J. Mendham. ELBS.*
4. *Standard methods of chemical Analysis. W.W. Scott. The technical Press.*
5. *Handbook of Preparative Inorganic Chemistry. Vol I & II, Braver, Academic Press.*
6. *Inorganic Synthesis, McGraw Hill.*
7. *Experimental Organic Vol I & II, P.R Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.*
8. *Experiments in Physical Chemistry, RC. Das and B. Behra, Tata McGraw Hill.*
9. *Advanced Experimental Chemistry, Vol I Physical, J.N. Gurtu and R Kappor, S Chand & Co.*
10. *Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghose & Sons.*
11. *Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.*

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UNIVERSITY OF KOTA

SCHEME OF EXAMINATION AND

COURSES OF STUDY

**Faculty of Science Bachelor of Science (B.Sc.)
Mathematics-Course Code MAT9600P**

First Semester (July-December, 2023) Second Semester (January-June, 2024)

UNIVERSITY OF KOTA
MBS Marg, Near Kabir Circle, KOTA (Rajasthan)-324 005
INDIA

Edition: 2023

अनंत्स्पर्शी हों, संयुग्मी व्यास और आयताकार अतिपरवलय

Unit-V

Cone : Homogeneous equation in x, y, z, cone with a given vertex and given base, enveloping cone, condition for the general equation to represent a cone, tangent plane, reciprocal cone, angle between the two lines, in which a plane cuts a cone, three mutually perpendicular generators and right circular cone.

Cylinder : Right circular cylinder and enveloping cylinder.

शंकु: x, y, z में सजातीय समीकरण, एक दिए गए शीर्ष और दिए गए आधार के साथ शंकु, आवरण शंकु, एक शंकु का प्रतिनिधित्व करने के लिए सामान्य समीकरण की स्थिति, स्पर्शरेखा विमान, व्युत्क्रम शंकु, दो रेखाओं के बीच का कोण, जिसमें एक विमान काटता है एक शंकु, तीन परस्पर लंबवत जनरेटर और लंब वृतीय शंकु।

सिलेंडर: राईट सर्कुलर सिलेंडर और अन्वालोप सिलेंडर।

MAT102P- MATHEMATICS PRACTICAL-I

Duration 2 hrs.   **Min. Pass Marks 25**   **Max. Marks 50**

Note-Total number of experiments to be performed by the students during the session. Two experiments must be performed in the semester examination. Marks distribution will be as: Experiment I- 30, Practical record – 10, Viva Voce – 10.

1. Application of Gauss Theorem.
2. Application of Stokes Theorem
3. Problems related to Pedal Equations
4. Problem related to permutation group.
5. Applications of Lagrange's Theorem
6. Problem related to Normal Subgroups.
7. Problem related to Ellipse.
8. Problem related to Hyperbola.
9. Problem related to Cone.
10. Problem related to Cylinder.

1. गॉस प्रमेय का अनुप्रयोग.
2. स्टोक्स प्रमेय का अनुप्रयोग
3. पेडल समीकरण से संबंधित समस्याएं
4. क्रमपरिवर्तन समूह से संबंधित समस्या।
5. लैग्रेंज प्रमेय के अनुप्रयोग
6. सामान्य उपसमूहों से संबंधित समस्या।
7. दीर्घवृत से सम्बंधित समस्या.
8. हाइपरबोला से सम्बंधित समस्या.
9. शंकु से सम्बंधित समस्या.
10. सिलेंडर से जुड़ी समस्या.

MAT201- MATHEMATICS-II

Duration 3 hrs.   **Max. Marks:70**

Note: The question paper will contain three sections as under –

Section-A :   One compulsory question with 10 parts, having 2 parts from each unit. Total marks:20

Section-B :   10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit.   Total marks: 50

Lecture- Sixty Lectures including diagnostic and formative assessments during lecture hours.

Ellipsoid : Normal, six normals from a point, cone through six normals, conjugate diameters and their properties.

केंद्रीय शांकवज: मानक समीकरण, स्पर्शरेखा तल, स्पर्शरेखा की स्थिति, निदेशक क्षेत्र, ध्रुवीय तल, ध्रुवीय रेखाएं, दिए गए केंद्र के साथ अनुभाग, आवरण शंकु, अन्वालोप सिलेंडर।

दीर्घवृत्ताकार: सामान्य, एक बिंदु से छह सामान्य, छह सामान्य से शंकु, संयुग्म व्यास और उनके गुण।

MAT202 - MATHEMATICS PRACTICAL II

Duration 2 hrs.   **Min. Pass Marks 25**   **Max.Marks 50**

Note-Total number of experiments to be performed by the students during the session. Two experiments must be performed in the semester examination. Marks distribution will be as:
Experiment I- 30, Practical record – 10, Viva Voce – 10.

1. Application of fundamental theorem of Homomorphism
2. Problem related to Spheres.
3. Problem related to co axial system of spheres.
4. Problem related to Asymptotes.
5. Problem related to differentiations of composite functions.
6. Application of Euler's theorem.
7. Problem related to curve tracing.
8. Applications of Beta and Gamma function.
9. Problems related to Number Theory and its applications.

1. समरूपता के मौलिक प्रमेय का अनुप्रयोग
2. क्षेत्रों से संबंधित समस्या.
3. गोले की सह-अक्षीय प्रणाली से संबंधित समस्या।
4. अनंतस्पर्शी से सम्बंधित समस्या।
5. समग्र फलनों के विभेदन से संबंधित समस्या।
6. यूलर प्रमेय का अनुप्रयोग.
7. कर्व ट्रेसिंग से जुड़ी समस्या.
8. बीटा और गामा फंक्शन के अनुप्रयोग।
9. संख्या सिद्धांत और उसके अनुप्रयोगों से संबंधित समस्याएं।

SEMESTER I & II - Suggested Books

1. Shanti Narayan, A text book of Modern Abstract Algebra, S. Chand and Co. New Delhi.
2. A, R, Vasishtha, Modern Algebra, Krishna Prakashan Mandir, Meerut
3. Pundir and Pundir, Theory of numbers , Pragati Prakashan, Meerut.
4. J. N. Sharma & A. R. Vasishtha, Vector Calculus, Krishna Prakashan Mandir, Meerut.
5. S. L. Loney, the elements of coordinate Geometry, Macmillan and Company, London
6. R. J. T. Bell, Elementary Treatise on Coordinate Geometry of Three dimension Macmillan India Ltd., 1994.
7. M. Ray & S. S. Seth, Differential calculus, students, friends & Co. Agra
8. M. Ray & S. S. Seth, Integral calculus, students, friends & Co. Agra.
9. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.

Bachelor of Science- Mathematics Exam.- 2023

UNIVERSITY OF KOTA
MBS Marg, Swami Vivekanand Nagar,
Kota - 324 005, Rajasthan, India
Website: uok.ac.in

1

Partial differential equations of first order, Lagrange's solution. Charpit's general method of solution.

UNIT-V

Partial differential equations of second and higher orders. Classification of linear partial differential equations of second order. Homogeneous and non-homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients. Monge's method.

***Books recommended for reference* :-**

1. M. Ray, J.C. Chaturvedi & H.S. Sharma : A Text Book of Differential Equations, Students Friends & Company, Agra.
2. J.L. Bansal & H.S. Dhami : Differential Equations Vol. I & II, Jaipur Publishing House, Jaipur.

List of Practicals for B.A./B.Sc. (Pt.-II) Paper-II

Name of Practicals

1. Solution of differential equations using picard's method and comparision with exact solution.

2. Solution of differential equations using Euler's method and comparision with exact solution.

3. Formation of the ordinary differential equation.

4. Singular solution of differential equations.

5. Solution of differential equations using variation of parameters method.

6. Solution of partial differential equations using charpit's method.

7. Application of differential equations to solve LCR-circuits and harmonic motions.

8. Find convexity and concavity of the plane curves.

9. Find the singular points and their nature of the plane curves.

10. Formation of partial differential equations.

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks : (Science -20 / Arts- 14)

Unit - I

Principles of C Programming **:** Algorithms, Flowcharts, Constants, Variables, Data type, Declaration of storage class, assigning values of variables, symbolic constant. Operators and Expressions. Common I/O operators decision making, branching and loops : if, if-else, Nested if-else, WHILE, DO, for loop, while statement, switch-case statement.

Array : One dimensional, Two dimensional. Initialization of two dimensional arrays.

Unit - II

User defined function in C: function declaration, calling a function, Category of function, nesting of functions recursion, Pointers.

Operators : forward difference , backward difference, Shift E, Inverse shift E_{-1}, Differentiation D, Central -Difference , Mean difference , Central sum , Divided difference, Inter relation between various operators, Forward and backward difference table. Factorials notation.

Unit - III

Interpolation with equal and unequal intervals, Central difference interpolation, inverse interpolation.

Unit - IV

Numerical differentiation and Numerical –Integration: Trapezoidal rule, Weddle rule, Simpson's rules, Gauss quadrature formula.

Unit - V

Solution of equations : Bisection method, regula-falsi method and Newton- Raphson method.
Solution of ordinary differential equations : Picard's method and Euler's method.

Book Recommended :
E. BALAGURUSWAMY   PROGRAMMING IN ANSI C 2ed TATA Mc Graw - Hill
Pub. N. Delhi.

REFRENCES :

1. SAXENA H.C. -	FINITE DIFFERENCE AND NUMERICAL ANALSIS	S.CHAND AND COMPANY
2. E.BALAGURUSWAMY	PROGAMMING IN ANSI C 2nd	TATA McGraw-HILL PUB. DELHI

List of Practicals for B.A./B.Sc. (Pt.-III)

List of Practicals :

1. To find the sum of HARMONIC SERIES.

2. To solve the quadratic Equation.

3. Evaluation of Binomial Coefficients Using do and while loops

4. To print a grouped frequency table using switch case statements.

5. To find minimum cost of operation which consists two components using Break and continue statements.

6. To Calculate the average of numbers.
7. To show a matrix using array.
8. To sort a list and calculate its median using array , If - then - else .
9. To find the Area of curve using trapezoidal rule.
10. To copy one string into another string.
11. Writing a string using % format.
12. To form a grouped frequency table using array and for loop.
13. To calculate the standard deviation of given data using array , If and break statements.
14. to open a file and appending using pointers.

B.A./B.Sc Part – III Examination – 2023

गणित

योजना

प्रश्नपत्र	शीर्षक	कालांश	अवधि	पूर्णांक	
		प्रति सप्ताह		विज्ञान	कला
I	विश्लेषण (रैखिक बीजावली एवं सम्मिश्र विश्लेषण)	4	3 घण्टें	75	66
II	सांख्यिकी एवं रेखिक समस्याऐं	4	3 घण्टें	75	66
III	संख्यात्मक विश्लेषण एवं ह्र–प्रोग्रामिंग	3	3 घण्टें	50	46
	प्रायोगिक	2		25	22

Note : Common paper will be set for both faculties i.e., Arts and Science

प्रश्न पत्र –। विश्लेषण (रैखिक बीजावली एवं सम्मिश्र विश्लेषण)

समय – 3 घटे   अधिकतम अंकः विज्ञानः 75 ⁄कला : 66

नोट : इस प्रश्न पत्र में 03 खण्ड निम्न प्रकार होगें :

खण्ड अ : इस खण्ड में एक अनिवार्य प्रश्न जिसमें प्रत्येक इकाई से 02 लघु प्रश्न लेते हुए कुल 10 लघु प्रश्न होंगे।प्रत्येक लघु प्रश्न का उत्तर लगभग 20 शब्दों में हो।   कुल अंकः(10–विज्ञान) (5–कला)

UNIVERSITY OF KOTA

SCHEME OF EXAMINATION

AND

COURSES OF STUDY

Faculty of Science

Bachelor of Science (B.Sc.)
Physics-Course Code PHY9600P

First Semester (July-December, 2023)
Second Semester (January-June, 2024)

UNIVERSITY OF KOTA

MBS Marg, Near Kabir Circle, KOTA (Rajasthan)-324 005
INDIA

Edition: 2023

भौतिक नियम व निर्देश तन्त्र:जड़त्वीय एवं अ जड़त्वीय तंत्र, गैलेलियन रूपान्तरण व भौतिक नियमों की अनिश्चरता, अजड़त्वीय तन्त्र, आभासी बल, निश्चित कोणिक वेग से घूमता निर्देश तन्त्र एवं विस्थापन, वेग एवं त्वरण के रूपान्तरण, कोरियोलिस बल, पृथ्वी के सापेक्ष गति पृथ्वी के परिभ्रमण का गुरुत्वाकर्षणीय ;ह्द्ध त्वरण पर प्रभाव एवं इसका 1–डी एवं 2–डी में आवर्तकाल (फोको का लोलक) ।

इकाई – 2

द्रव्यमान केन्द्र की अवधारणा :कण तंत्र का द्रव्यमान केन्द्र, गति का समीकरण, रेखीय संवेग का संरक्षण, प्रयोगशाला तंत्र व द्रव्यमान तंत्र में प्रत्यास्थ व अप्रत्यास्थ टक्कर, परिवर्तनशील द्रव्यमान के किसी निकाय की गति। केन्द्रीय बल क्षेत्र में गति, कोणीय संवेग का संरक्षण, व्युत्क्रम गुरुत्वीय बल के प्रभाव में कण की गति का पथ। केप्लर के नियम।

द्रव्य पिण्ड गतिकी, दृढ़ वस्तु के लिए घूर्णन गति का समीकरण, जड़त्वीय गुणांक, श्र एवं ू समानान्तर नहीं होने की स्थिति, मुख्य अक्ष का ज्ञान एवं घूर्णन की गतिज उर्जा, चकण करते लट्टू की पुरूस्सरण गति, नियत चुम्बकीय क्षेत्र में प्रचकण पुरूस्सरण, लारमोर आवृत्ति।

इकाई – 3

पदार्थ के गुण : प्रत्यास्थता, हुक का नियम, प्रत्यास्थता स्थिरांक, प्रतिबल एवं विकृति पर प्रमेय, प्रत्यास्थता नियतांकों में सम्बन्ध, दण्डों के बंकन का सिद्धान्त तथा बेलन में ऐंठन, एक सिरे पर भारित केण्टीलीवर;पद्धजब दण्ड का भार नगण्य हो और;पप्द्धजब प्रति एकांक लम्बाई का द्रव्यमान हो। मध्य में भारित केण्टीलीवर। बंकन विधि से व सर्ल विधि से प्रत्यास्थ स्थिरांकों का प्रायोगिक निर्धारण, दृढ़ता प्रत्यास्थता गुणांक का स्थैतिक व गतिक विधि से प्रायोगिक निर्धारण, रबर के लिए पाइसां निष्पत्ति का प्रयोगिक निर्धारण।

इकाई – 4

दोलन : किसी स्वैच्छिक विभव कूप में दोलनों की गुणात्मक विवेचना, सरल आवर्त गति, समानीत द्रव्यमान, युग्मित दोलन, दो सरल आवर्त युग्मित दोलकों के गति का समीकरण एवं उर्जा स्थानान्तरण, सामान्य विधाएँ, दो रेखिकत युग्मित दोलकों के सामान्य निर्देशांक, अवमन्दित आवर्तीय दोलन, प्रक्षेप गैलवेनोमीटर का उदाहरण, प्रणोदित आवर्तीय दोलन, कला सम्बंध, शक्ति अवशोषण, अनुनाद, बैण्ड चौड़ाई व विशेषता गुणांक, स्वपरिपथ का उदाहरण।

इकाई – 5

तरंग :एक विमीय तरंग गति का सामान्य समीकरण एवं उसके हल, अनुदैर्घ्य व अनुप्रस्थ तरंगें, समतल प्रगामी तरंग व इसकी उर्जा फ्लक्स व तीव्रता, गैसों में दाब तरंगे।

एक विमीय एकल परमाणु एवं द्वि परमाणु जालक के लिए गति का समीकरण, ध्वनिक व प्रकाशिक विधाएं ।विक्षेपण सम्बंध, तरंग वेग व समूह वेग की अभिधारणा।

PHY102- Physics Practical-I

| Duration 6 hrs. | Min. Pass Marks 25 | Max. Marks 50 |

Note-Total number of experiments to be performed by the students during the session. Two experiments must be performed in the semester examination. Marks distribution will be as: Experiment I- 30, Practical record – 10, Viva Voce – 10.

1. Study of bending of a beam and determination of Young's modulus.
2. Modulus of rigidity by statical method and dynamical method.
3. Elastic constant by Searle's method.
4. Study of frequency of energy transfer as a function of coupling strength using coupled oscillator.
5. Determination of dispersive power of material of a prism using spectrometer.
6. Measurement of wavelength of monochromatic source of light by Newton's rings.
7. Measurement of wavelength of monochromatic source of light by plane transmission grating.
8. Measurement of wavelength of monochromatic source of light by biprism.
9. Study of specific rotation by polarimeter.
10. Determination of resolving power of a plane transmission grating.
11. Determination of resolving power of telescope.
12. Determination of the Poisson's ratio of rubber tube.
13. Any experiment, equivalent to the UG level.

PHY202 - PHYSICS PRACTICAL II

Duration 6 hrs.   Min. Pass Marks 25   Max.Marks 50

Note-Total number of experiments to be performed by the students during the session. Two experiments must be performed in the semester examination. Marks distribution will be as: Experiment I- 30, Practical record – 10, Viva Voce – 10.

1. Study of temperature variation of surface tension by Jaeger's method.
   To determine the polarizing angle for the glass prism surface and todetermine the refractive index of the material of prism using Brewster's law $\mu = \tan(i_p)$.
2. Low resistance by Carey-Foster' bridge.
3. Variation of magnetic field along the axis of circular coil and hence determine the radius of coil.
4. To study the variation of charge and current in RC circuit for different time constants (using DC source).
5. To study the behavior of RC circuit with varying resistance and capacitance using AC Mains as a power source and also determine the impedance and phase relations.
6. To study the rise and decay of current in LR circuit with a source of constant emf.
7. To study the voltage and current behavior of LR circuit with a AC power sourcealso determinepower factor,impedance and phase relation.
8. To study resonance in a series LCR circuit and determine Q of the circuit.
9. Conversion of Galvanometer into Ammeter/Voltmeter.
10. Any experiment, equivalent to the UG level.

B.Sc. (Physics) Part-I

Paper	Minimum Passing Marks	MaximumMarks
I- Mechanics	18	50
II- Electromagnetism	18	50
III- Optics	18	50
Physics Practicals	27	75
TOTAL		**225**

B.Sc. (Physics) Part-II

Paper	Minimum Passing Marks	MaximumMarks
I- Thermal and Statistical Physics	18	50
II- Electronics	18	50
III- Relativity and Mathematical Physics	18	50
Physics Practicals	27	75
TOTAL		**225**

B.Sc. (Physics) Part-III

Paper	Minimum Passing Marks	MaximumMarks
I- Solid State Physics	18	50
II- Nuclear Physics	18	50
III- Elementary Quantum Mechanics and Spectroscopy	18	50
Physics Practicals	27	75
TOTAL		**225**

rotation in space time, time like and space like vectors, length contraction, time dilation, worldline, mass-energy relation, energy-momentum relation.

Unit-III

Four vector formulation, energy-momentum four vectors, relativistic equation of motion, Orthogonality of four forces and four velocities, transformation of four wave vector, longitudinal and transverse Doppler's effect, Transformation between laboratory and center of mass systems, four momentum conservation, Kinematics of decay products of an unstable particle and reaction thresholds, pair production, inelastic collision of two particles, Compton effect. Electromagnetic field tensor, transformation of four potentials, four currents, electric and magnetic field between two inertial frames of reference, Lorentz force, equation of continuity, conservation of charge, tensor description of Maxwell's equations.

Unit-IV

The second order linear differential equation with variable coefficient and singular points, series solution method and its application in the Bessel's, Hermite's, Legendre's and Laguerre's differential equations, Basic properties like orthogonality, recurrence relations, graphical representation and generating function of Bessel, Hermite, Legendre Laguerre and Associated Legendre functions.

Unit-V

Technique of separation of variables and its application to following boundary value problems: (i) Laplace equation in three dimension Cartesian, Coordinate system-line charge between two earthed parallel plates, (ii) wave equation in spherical polar coordinates the vibration of circular membrane, (iii) Diffusion equation in two dimensional Cartesian coordinate system-heat conduction in thin rectangular plate, (iv) Laplace equation in spherical coordinate system-Electric Potential about a spherical surface.

PHYSICS PRACTICAL

Duration 5 hrs.   Min. Pass Marks 27   Max.Marks 75

Note-Total number of experiments to be performed by the students during the session should be 16 selecting any eight from each section.

Section –A

1. Study of dependence of velocity of wave propagation on line parameters using torsional wave apparatus.
2. Study of variation of refection coefficient with nature of termination using torsional wave apparatus.
3. Using platinum resistance thermometer to find the melting point of a given substance.
4. Using Michelson's interferometer: Find out the wavelength of a given monochromatic source (sodium light);Determine difference in wave length ofD1and D2 lines.
5. Determine the thermodynamic constant (r=Cp/Cv) using Clement's and Desormes methods.
6. Determine Thermal conductivity of a bad conductor by Lee's method.
7. Determination of Ballistic constant of Ballistic galvenometer.
8. Determination of high resistance by method of leakage.
9. Study the variation of total thermal radiation with temperature.

Section-B

1. Plot thermo emf versus temperature and find the neutral temperature.
2. Study of power supply using two diodes/ bridge rectifier using various filter circuits.
3. Study of half wave rectifier using L and pi section filters.

4. Characteristics of given transistor PNP/ NPN (common emitter, common base and common collector configurations).
5. Determination of band gap using a junction diode.
6. Determination of power factor of a given coil using CRO.
7. Study of single stage transistor audio amplifier(variation of gain with frequency)
8. Study of diode as integrator with different voltage wave forms.
9. Determination of e\m of electron by Thomson's method.
10. Determination of velocity of sound using CRO, microphone and speaker by standing wave method.
11. Determination of self inductance of a coil by Anderson's bridge method.
12. Determination of unknown capacity by De'sauty-bridge method and to determine dielectric constant of a liquid.

"Distribution of marks for Regular students"

1. *Experiments:-* Two experiments each of 22½ marks in which the distribution of marks is as follows.

    a.   Figure ans Formula   :   6 marks
    b.   Observation and calculation   :   12 marks
    c.   Result (with unit) and precaution   :   4½ marks
2. Record   :   15 marks
3. Viva-Voce   :   15 marks
    Total   **:**   **75 marks**

"Distribution of marks for Non-Collegiate students"

1. *Experiments :-* Two experiments each of 27½ marks in which the distribution of marks is as follows:

    a.   Figure and formula   :   8 marks
    b.   Observations and calculations   :   15 marks
    c.   Result (with unit) and precautions   :   4½ marks
2. Viva-Voce   :   20 marks
    Total   **:**   **75 marks**

बी.एससी. पार्ट –भौतिक विज्ञान– परीक्षा 2023

योजना

तीन प्रश्न पत्र   न्यूनतम उत्तीर्णांक 54 (सैद्धांन्तिक) अधिकतम अंक 150
    प्रश्न पत्र Ⅰ   समय 3 घण्टे   अधिकतम अंक 50
    प्रश्न पत्र Ⅱ   समय 3 घण्टे   अधिकतम अंक 50
    प्रश्न पत्र Ⅲ   समय 3 घण्टे   अधिकतम अंक 50
    प्रायोगिक समय 5 घण्टे   न्यूनतम उत्तीर्णांक 27 अंक   अधिकतम अंक 75

प्रश्न पत्र –ऊष्मीय एवं सांख्यिकीय भौतिकी

समय 3 घण्टे   पूर्णांक : 50

नोट : इस प्रश्न पत्र में 03 खण्ड निम्न प्रकार होंगें :

खण्ड अ :इस खण्ड में एक अनिवार्य प्रश्न जिसमें प्रत्येक इकाई से 02 लघु प्रश्न लेते हुए कुल 10 लघु प्रश्न होंगे।प्रत्येक लघु प्रश्न का उत्तर लगभग 20 शब्दों में हो।   कुल अंक:05

dimensional box, Eigenfunction and eigenvalues, discrete energy levels, generalisation to three dimensions and degenaracy of levels. Potential steps and rectangular potential barrier, calculation of reflection and transmission coefficient. Qualitative discussion of the application to alpha decay, Square well potential problem calculation of transmission coefficient and resonant scattering (Ramsaur–Townsent effect).

UNIT – IV

Bound state problems : Particle in one dimensional infinite potential well and finite depth potential well–energy eigen–values and eigenfunction, transcedental equation and its solution, Simple harmonic oscillator (one dimensional case) and qualitative discussion of its eigenfunctions, energy eigenvalues. Zero point energy, parity symmetric and antisymmetric wave function's with graphical representation. Schrodinger equation for a spherically symmetric potential, Schrodinger equation for a one electron atom in spherically coordinates, separation of variables, Orbital angular momentum and quantization spherical harmonics, energy levels of H–atom, Shapes of $n = 1$ and $n = 2$ wave functions, Average value of radius of H–atom

UNIT – V

Applications of Quantum Theory to Atomic Spectroscopy: Quantum features of spectra of one electron atoms, Frank–Hertz experiment and discrete energy states, Stern and Gerlach experiment, spin and magnetic moment, Spin orbit coupling and qualitative explanation of fine structure, Atoms in magnetic field Zeeman spliting, Stark Effect.

Molecular Spectroscopy: Qualitative features of molecular spectra, Rigid rotator discussion of energy, eigenvalues and eigenfunction, rotational energy levels of diatomic molecules, Rotational spectra, vibrational energy levels of diatomic molecules, vibrational spectra, vibrational rotational spectra.

PHYSICS PRACTICAL

Duration 5 hrs.   **Min. Pass Marks 27**   **Max.Marks 75**

The college may set a few experiments more at their level at par with the standard of B.Sc. Part III
Total number of experiments to be performed by the students during the session should be 16
selecting any eight from each section.

Section –A

1. Determination of Planck's constant by photo cell (retarding potential method using optical filters, preferably five filters).
2. Determination of Plank's constant using solar cell.
3. Determination of Stefan's constant.
4. Study of the temperature dependance of resistance of semiconductor (four probe method).
5. Study of Iodine spectrum with the help of grating and spectrometer using ordinary bulb light.
6. Study of the characteristics of a GM counter and verification of inverse square law for the same strength of a radioactive source.
7. Study of b- absorption in a foil using GM counter.
8. To find the magnetic susceptibility of a paramagnetic solution using Quinck's method.Also find the ionic molecular susceptibility of the ion and magnetic moment of the ion in terms of Bohr magneton.
9. Determination of coefficient of rigidity as a function of temperature using torsional oscillators (resonance method).
10. Study of polarization by reflection from a glass plate with the help of Nicol prism and photo cell and verification of Brewsters law of Malus.
11. e/m measurement by Helical method.

12. Measurement of magnetic field using ballistic galvanometer and search coil study of variation of magnetic field of an electromagnet with current .
13. Measurement of electronic charge by Millikan's oil drop method.

Section-B

1. Study of a R-C transmission line at 50 Hz.
2. Study of a L-C transmission line(i) at fixed frequency (ii) at variable frequency.
3. Study of resonance in an LCR circuit (using air core inductance and damping by metal plate).(i)at fixed frequency by varying C and(ii) by varying frequency.
4. (i)Recovery time of a junction diode and point contact diode.
   (ii)Recovery time as a function of frequency of operation and switching.
5. Design a Zener regulated power supply and study the regulation with various loads.
6. Study the characteristic of field effect transistor (FET) and design and study amplifier of finite gain .
7. Study the frequency response of transistor amplifier and measure the input and output impedances (frequency response with change of value of R and C components).
8. Design and study of an R-C phase shift oscillator.
9. Study voltage multiplier circuit to generate high voltage D.C. from A.C.
10. Using discrete components, study OR, AND, NOT logic gates compare with TTL integrated circuits IC's.
11. Applications of operational amplifier as(minimum two of the following exercises) : (i) Inverter (ii) Non-Inverter (iii)Differantiator (iv) Integrator.

"Distribution of marks for Regular students"

Experiments:- Two experiments each of 22½ marks in which the distribution of marks is as follows.

a.	Figure ans Formula	:	6 marks
b.	Observation and calculation	:	12 marks
c.	Result (with unit) and precaution	:	4½ marks
2.	Record	:	15 marks
3.	Viva-Voce	:	15 marks

Total   **:**   **75 marks**

"Distribution of marks for Non-Collegiate students"

1. *Experiments :-* Two experiments each of 27½ marks in which the distribution of marks is as follows:

a.	Figure and formula	:	8 marks
b.	Observations and calculations	:	15 marks
c.	Result (with unit) and precautions	:	4½ marks
2.	Viva-Voce	:	20 marks

Total   **:**   **75 marks**

बी.एससी. भौतिक विज्ञान पार्ट –III परीक्षा 2023

योजना

तीन प्रश्न पत्र	न्यूनतम उत्तीर्णाक 54 (सैद्धान्तिक)	अधिकतम अंक 150
प्रश्न पत्र I	समय 3 घण्टे	अधिकतम अंक 50

UNIVERSITY OF KOTA

FACULTY OF SCIENCE
B. SC. (PASS COURSE)

ZOOLOGY

SYLLABUS AND SCHEME OF SEMESTER EXAMINATION FOR THE ACADEMIC YEAR

2023-24

Semester-I (PAVAS)   :   July - December 2023
Semester-II (BASANT) :   January - June 2024

UNIVERSITY OF KOTA

MBS Marg, Near Kabir Circle, Kota (Rajasthan) 324 005

Syllabus Practical Paper: B. Sc. (Semester-I) Zoology

ZOO5134P: LAB COURSE/PRACTICALS (60 hrs. & 2 Credits)

1. Organization and Working of Optical Microscopes: Dissecting and Compound Microscopes.
2. Generalized Methods of Preparation for the Microscopic Slides: Single and Double Staining Techniques.
3. Composition, Preparation and Commonly Uses of Fixatives, Staining media and Reagents in the Zoology Laboratory.
4. **Study of Microscopic Slides and Museum Specimens:**

   Protozoa: *Entamoeba, Polystomella, Monocystis, Euglena, Noctiluca, Leismania, Nyctotherus, Paramecium* and *Vorticella.*

   Porifera: *Sycon, Hyalonema, Euplectella, Spongilla* and *Euspongia*

   Coelenterata: *Obelia, Millipora, Physalia, Porpita, Aurelia, Alcyonium, Gorgonia, Pennatula, Metridium* and *Madrepora.*

   Platyhelminthes: *Dugesia, Fasciola, Schistosoma,* and *Taenia*

   Nematoda: *Enterobius, Ascaris, Ancylostoma* and *Wuchereria.*

   Annelida: *Neries, Heteronereis, Aphrodite, Arenicola, Pontobdella, Hirudinaria* and *Polygordius.*

   Arthropoda: *Peripatus, Limulus,* Spider, Scorpion, Crab, Centipede, Millipede *Lepas, Balanus, Saculina, Palinurus, Eupagurus, Lepisma, Schistocerca, Mantis,* Termite, *Pediculus, Belostoma, Apis,* Moth, Butterfly and Dung beetle.

   Mollusca: *Neopilina, Chiton, Dentalium, Patella, Aplysia, Mytilus, Pinctada, Teredo, Sepia, Loligo, Octopus* and *Nautilus.*

   Echinodermata: *Echinus, Holothuria, Antedon, Asterias,* and *Ophiothrix.*
5. **Study of Animal Body Sections and Developmental Stages:**

   Platyhelminthes: Miracidium, Sporocyst, Redia, Cercaria, Metacercaria, Bladderworm and Cysticercus larva

   Arthropoda: Nauplius, Cypris, Zoea, Megalopa, Mysis, and Wriggler larva.

   Mollusca: Veliger and Glochidium larvae: Unio: T.S. of Gill

   Echinodermata: Pedicellariae, Pluteus and Bipinnaria larva.
6. **Permanent Mountings:** *Euglena, Parameciam,* Spicules, Spongin fibers and gemmules of Sponges, *Hydra, Obelia* colony, Scolex of *Taenia,* Nephridia of Earthworm, Parapodia of *Nereis,* Mouthparts of Cockroach, Statocyst of Prawn, *Cyclops & Daphnia.*
7. **Anatomy/Dissection:**

   Earthworm: Morphology, Alimentary Canal, Reproductive System and Nervous System

   Cockroach: Morphology, Salivary Glands, Alimentary Canal, and Nervous System

   Prawn: Morphology, Appendages, Alimentary Canal and Nervous System

   ***Pila*:** Morphology, Pallial Organs, Radula, Osphradium and Nervous System
8. **Study of Local Non-chordate Faunal Diversity:** Zooplanktons, Crustaceans, Arachnids, Chilopods, Insects, Snails and Slugs.

Syllabus Practical Paper: B. Sc. (Semester-II) Zoology
ZOO5134P: LAB COURSE/PRACTICALS (60 hrs. & 2 Credits)

1. **Study of Microscopic Slides and Museum Specimens:** *Balanoglossus,* Tornaria larva, *Herdmania, Doliolum, Salpa, Oikopleura,* Ascidian tadpole larva, *Amphioxus, Petromzon, Myxine/Bdellostoma,* Ammocoete larva, *Acipenser, Amia, Lepidosteus, Labeo, Clarius, Anguilla, Hippocampus, Exocoetus, Echeneis, Protopterus, Ichthyophis, Proteus, Ambystoma,* Axolotl larva, *Siren, Alytes, Hyla, Bufo, Tadpole larva, Chelone, Testudo,* Terrapin, *Sphenodon, Hemidactylus, Phrynosoma, Draco, Chamaelion, Eryx, Hydrophis, Naja, Vipera, Bungarus, Cocodylus,* Alligator, *Archaeopteryx, Pavo cristatus, Psittacula, Collumba, Mylvus,* Great Indian Bustard, Saras Crane, *Gyps, Corvus, Ornithorhynchus, Tachyglossus, Macropus, Pteopus, Loris, Manis, Herpestes,* and *Erinaceous.*

2. **Histology of Chordate-Vertebrates:**

Hemichordata:	T.S. through Proboscis, Collar and Trunk regions of *Balanoglossus*
Urochordata:	Pharyngeal wall and Spicules of *Hermania.*
Cephalochordata:	T.S. of Amphioxus through Oral hood, Pharynx, Gonads & Caudal region.
Pisces:	Placoid, Ganoid, Cycloid and Ctenoid Scales.
Amphibia:	V.S. of Skin, T.S. of Intestine, Liver, Kidney, Lungs, Ovary, and Testis.
Aves:	V.S. of Skin, Types of Beaks and Claws
Mammalia:	V. S. of Skin, T.S. of Spinal cord, Stomach, Duodenum, Ileum, Rectum, Pancreas, Liver, Lung, Kidney, Bone, Cartilage, Testis, and Ovary.

3. **Anatomy/Dissection:**

   *Labeo***:** External features, General anatomy, Afferent and Efferent Branchial Vessels, Brain, Cranial Nerves, Eye Ball with muscles, Internal Ear, Urino-Genital System.

   3D anatomy of any one: Frog/Bird/Rat

6. **Permanent Mountings:** Placoid**,** Cycloid, Ctenoid scales, Striated muscle fibers, Filoplumes, and Blood film of vertebrates.

7. **Study of Local Vertebrate Faunal Diversity:** Fishes, Frogs, Toads, Chelonians, Lizards, Snakes, Crocodilians, Birds and Mammals.

Bachelor of Science- Zoology
Exam.- 2023

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pressure, gravity, biotic factors, intraspecific and interspecific relation, concept of limiting factors; Liebig's law of minimum, Shelford's law of tolerance, modern concept, importance.

UNIT - II

Population ecology : Determination of population density, factors affecting population density, demography, community ecology, characteristics of bio-community, interdependence for reproduction and protection , ecosystem homeostasis, ecosystem and productivity concept, its types and methods, energy flow, food chain and food web in ecosystem, ecological pyramids, ecological niche.

UNIT - III

Aquatic ecology, fresh water lotic and lentic fresh water habitat, fresh water biota, marine habitat, zonation, marine water biota, ecology and biota of deep sea zone, estuarine habitat and biota, terrestrial habitat, forest and desert ecosystem and biomes, ecology and human future, growth rate, role of man in modification of natural communities.

UNIT - IV

Natural resources, renewable resources (forest/wild life), non-renewable resources (water, mineral resources),aqua-culture and Mariculture, conservation, management of natural resources - renewable resources, non-renewable resources, environmental pollution, types (water, air, soil, pollution by insecticides, noise). Basic concepts of bioaccumulation, biomagnification, and biodegradation of pollutants, impact of urbanization, characteristics of urbanization in India, urban problems.

UNIT - V

Functions and importance of biostatistics, frequency - distribution, presentation of data, mean, mode, median, deviation, error, probability-distribution, correlation, significance-tests, biostatistical analysis of gene distribution in populations.

ZOOLOGY PRACTICAL SYLLABUS

1. Study of animal diversity through museum specimens :-
   Arthropoda - *Peripatus* , *Limulus*, spider, *Lepas*, crab, lobster, *Balanus*, *Saculina*, butterfly, centipede, millipede, locust, cyclops.
   Mollusca - *Chiton*, *Patella*, *Aplysia*, *Dentalium*, *Teredo*, slug, *Loligo*, *Octopus*, *Nautilus*, *Mytillus*, pearl oyster.
   Echinodermata - *Antedon, Cucumaria, Echinus, Astropecten,Ophiothrix,Holothuria.*
   Invertebrate chordates -*Balanoglossus,Herdmania, Doliolum*, *Salpa*, *Oikopleura, Amphioxus*.

2. Study of sections of organs and developmental stages :
   Arthropoda - Larval stages of crustacea and insecta - *Nauplius, Zoea, Megalopa*, *Mysis*, *Cypris* larva, mosquito larvae .
   Mollusca - Veliger and glochidium larvae. unio gill T.S.
   Echinodermata - Pedicellaria, pluteus larva, bipinnaria larva.
   Hemichordata - T.S. through proboscis, collar and trunk regions of *Balanoglossus*, tornaria larva.
   Urochordata : Pharyngeal wall, spicules and tadpole larva of *Herdmania.*
   Cephalochordata: T.S. of Branchiostoma through oral hood, pharynx, gonads and caudal region.

3. Dissections : Thhrough Chart / Model / Photograph / CD
   a. Major -

Palaemon   -   digestive and nervous system.

Pila   -   general anatomy, nervous system.

b. Minor -
Palaemon   -   hastate plate, appendages, alimentary canal and statocyst.

Pila   -   gill lamella, radula, osphradium and pallial complex.

4. Permanent slide preparation/mounting :
Daphnia, cyclops, crustacean larvae, statocyst and hastate plate of prawn, Mouth parts of cockroach .
gill lamella, radula and osphradium of *Pila*, W.M. of *Branchiostoma.*

5. Endocrinology :
a.   Demonstration of major endocrine glands using models/ charts / computer software.
b.   Histological slides of major endocrine glands (pituitary, thyroid, parathyroid, adrenal glands, testes, ovary, pancreas), kidney, insect endocrine glands.

6. Ethology :
a.   Thigmotactic, phototactic and chemotactic response of Paramecium.
b.   Antennal grooming in cockroach.
c.   Phototatic response in *Triboleum* .
d.   Chemotactic response of Cockroach . (using synthetic pheromone)

7. Ecology (Environment) :
a.   Water analysis, pH, acidity, alkalinity, dissolved O_2 and free CO_2, chloride (salinity)
b.   Soil analysis - pH.

8. Biostatistics :
a.   Frequency tables, bar diagrams, histograms, polygons, pie charts.
b.   Exercises on mean, median and mode.

Note: Animals used for practical work must not be banned under the wild life protection act.

B.Sc. (Part-II) - Zoology Practical - Distribution of Marks

Regular / Non-collegiate /Ex-students

1.	Dissection - Through Chart / Model / Photograph / CD	08
2.	Dissection - Through Chart / Model / Photograph / CD	05
3.	Slide Preparation	05
4.	Ecological	06
5.	Ethological exercise	05
6.	Biostatistics	06
7.	Spots (10)	20
8.	Record	10
9.	Viva-voce	10
	Total	**75**

d.   Neuroendocrine regulation of reproductive organs; estrous and menstrual cycles.

UNIT-II - Gametogenesis and fertilization

a.   Gametogenesis: Definition; structure of gametes (sperm and egg).
b.   Spermatogenesis and oogenesis.
c.   Types of eggs; detailed structure of amphibian, avian and mammalian egg.
d.   Fertilization: Events of fertilization, polyspermy and preventing mechanism.
e.   Significance of fertilization; parthenogenesis; evolution of viviparity.

UNIT-III - Cleavage and Gastrulation

a.   Cleavage, creating multicellularity;definition of embryonic cleavage, morula; blastula, patterns and planes of cleavage; blastulation, types of blastula.
b.   Types of gastrulation mechanisms.
c.   Fate maps (with suitable examples); cell lineage.
d.   Reorganization of embryonic cells, gastrulation in amphibians, birds and mammals.
e.   Morphogenetic cell movements and their significance in gastrulation.

UNIT-IV- Induction, Differentiation, Organogenesis and Regeneration

a.   Embryonic induction, organizers, competence.
b.   Mechanism of cellular differentiation; sex determination during development. Government rules against sex determination during pregnancy.
c.   Neurula formation, growth and organogenesis.
d.   Regeneration: types and mechanism. Senescence and ageing.

UNIT-V- Embryonic adaptation

a.   Salient features of development of frog/toad; amphibian metamorphosis and its endocrine regulation.
b.   Extraembryonic membranes in chick, salient features of development of chick upto 72 hours of incubation.
c.   Placentation in mammals: Definition, types; classification on the basis of morphology and histology; functions of placenta.

B.Sc (Part-III) – Zoology - Practical

1. **Study of museum specimens / models / chart / photograph:**
    Petromzon, Myxine/Bdellostoma, ammocoete larva, *Acipenser, Amia, Lepidosteus, Labeo, Clarius, Anguilyla, Hippocampus,Exocoetus, Echeneis, Protopterus, Ichthyophis, Proteus, Ambystoma*, axolotl larva, *Siren, Alytes, Hyla, Chelone,Testudo,* fresh water tortoise, *Sphenodon, Hemidactylus, Phrynosoma, Draco, Chamaelion, Eryx, Hydrophis, Naja, Vipera, Bungarus, Cocodylus,* Alligator, *Archaeopteryx, Pavo cristatus, Psittacula, Collumba, Mylvus,* great Indian bustard, saras crane, vulture, crow,*Ornithorhynchus, Tachyglossus, Macropus,* bat, *Loris, Manis, Herpestes, Erinaceous.*

2. **Permanent slides:**
    Mammalian Histology: V. S. skin, T.S. spinal cord, stomach, duodenum, ileum, pancreas, liver, lung, kidney, bone, cartilage, testis, ovary, pituitary gland.

3. **Dissection:** Through Chart / Model / Photograph / CD.

Any bony fish : External features, general anatomy, afferent and efferent branchial vessels, brain, cranial nerves, eye ball, its muscles and innervation, internal ear.

4. **Permanent mounting:**
Cycloid and placoid scales, striated fibres, filoplume, blood film.

5. **Osteology:**
A comparative study of articulated and disarticulated (original / artificial) bones of frog, *Varanus*, fowl and rabbit.

6. **Developmental Biology:**
Study of development of chick: Whole mounts and sections of 18 to 72 hour's embryo. Histological study of development of frog/toad : Egg, early cleavage, blastula, gastrula, neurula and different stages of tadpole. Study of spermatogenesis, oogenesis, fertilization and metamorphosis of frog/toad.

7. **Physiology:**
a. Demonstration of catalase and ptyalin enzyme activity.
b. Haematocrit value.
c. RBC counting
d. WBC counting
e. Haemoglobin percentage.

Note: Animals used in practical are subject to the condition that these are not banned under the Wild Life Protection Act.

Scheme of distribution of marks:

		Regular/Non-collegiate/Ex	
1. Major Dissection	- Through Chart / Model / Photograph / CD	10
2. Minor Dissection	- Through Chart / Model / Photograph / CD	05
3. Preparation		07
4. Exercise in Developmental Biology		07
5. Physiology		06
6. Spots (10)		20
7. Record		10
8. Viva-voce		10
		75

बी.एससी.पार्ट–III : प्राणिशास्त्र

प्रश्नपत्र–I : जन्तु विविधता (भाग–III एकशेरुकी) एवं उद्विकास

समय अवधि – 3 घंटे   पूर्णांक – 50

प्रश्न पत्र तीन खण्डों (ए, बी, सी) का होगा।

खण्ड–ए :   छात्रो को प्रश्न संख्या 1 के सभी दस भाग (प्रत्येक इकाई में से दो प्रश्न) लगभग 20 शब्दों में हल करने होंगे ।   (1/2 X10 = 5 अंक)

खण्ड–बी :   छात्रों को प्रत्येक इकाई से एक प्रश्न चयन करते हुऐ 250 शब्दों की सीमा में कुल पाँच प्रश्न हल करने होंगे।   (5 X 5 = 25 अंक)