

B.Sc. Semester - V

Scheme of examination

Continuous Assessment (CA)	=	15 Marks
Term Test	=	10 Marks
Home Assignment	=	05 Marks
Semester End Examination (SEE)	=	35 Marks
Total	=	50 Marks

B.Sc. Semester V Botany

PAPER CODE

22-5001

PLANT TAXONOMY

Scheme of examination:

MM: 35

1. In Semester-End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 will be compulsory having 07 short answer type questions (one mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT - I

Introduction, Principles of Taxonomy, Units of Classification, Concept of Genus and Species. Binomial Nomenclature, International Code of Botanical Nomenclature. Taxonomic Literature; Botanical Gardens and Herbaria.

UNIT - II

Development of Taxonomy and History of Different System of Classification. Bentham and Hooker's System of Classification. Engler and Prantle System of Classification. Evolutionary Trends in Angiosperms. Primitive and Advanced Characters.

UNIT - III

Diversity of flowering plants as illustrated by members of the families and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae, Asteraceae.

UNIT - IV

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Diversity of flowering plants as illustrated by members of the families and economic importance of the following families: Apocynaceae, Asclepiadaceae, Convolvulaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Poaceae.

Suggested readings:

- Naik, V.N. 2011. Taxonomy of Angiosperms. TATA McGraw Hill, New Delhi.
- Pandey, S.N. and Misra, S.P. 2008. Taxonomy of Angiosperms. Ane Books India, New Delhi.
- Saxena, N.B. and Saxena, S. 2011. Plant Taxonomy. Pragati Prakashan, New Delhi.
- Sharma, B.D. 1984. Flora of India vol. I. Botanical Survey of India, Calcutta.
- Sharma, O.P. 1996. Plant Taxonomy. TATA McGraw Hill, New Delhi
- Simpson, M.C. 2006. Plant Systematics. Elsevier, Amsterdam.
- Singh, G. 2001. Plant systematics. Oxford and IBH, New Delhi.
- Sivarajan, V.V. 1991. Introduction to Principles of Plant Taxonomy. Oxford and IBH, New Delhi.

PAPER CODE 22-5002

B.Sc. Semester V Botany Paper II

EMBRYOLOGY AND ECONOMIC BOTANY

Scheme of examination:

MM: 35

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 will be compulsory having 07 short answer type questions (one mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT - I

Ontogeny of the flower parts- development and variations.

Structure of anther and microsporogenesis (Tapetum- types and function, development of male gametophyte, structure of pollen grains.)

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Types of ovules & Megasporogenesis (development of female gametophyte (Embryosac) Pollination, Pollination types. Fertilization, double fertilization, significance of double fertilization.)

UNIT - II

Embryo: Development of Dicot and monocot embryo, Formation of embryo, Types of embryos.

Endosperm: Types of endosperms, Endosperm haustoria.

Polyembryony, Induced polyembryony. Parthenocarpy, Apomixis and adventive embryony.

UNIT - III

Basic concept of centre of origin of cultivated plants.

Food plants: rice, wheat, maize, potato, sugarcane.

Vegetables: General account with a note on radish, onion, garlic, cabbage, spinach, cauliflower, cucumber, tomato, lady finger and pea.

Fruits: General account with a note on apple, banana, ber, mango, mulberry, jamun, watermelon, muskmelon, guava and orange.

Vegetable oil: groundnut, mustard and coconut.

UNIT - IV

Spices: General account with an emphasis on those cultivated in Rajasthan: (Cumin, Capsicum, Coriander).

Beverages: Tea and coffee.

Medicinal plants: General account with an emphasis on plant species cultivated in Rajasthan (Senna, Isabgol, Safed musli).

Fibers: Cotton and jute.

Wood: General account of sources of firewood, timber and bamboos;

Rubber.

Ethnobotany: a general account.

Suggested Readings

- Bhojwani, S.S. and Bhatnagar, S.P. 2004. The Embryology of Angiosperms. Vikas Publishing House, New Delhi.

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- Davis, C.L. 1965. Systematic Embryology of Angiosperms. John Wiley, New York.
- Johri, B. D. 1984. Embryology of Angiosperms. Springer Verlag, Berlin.
- Maheswari, P. 1985. Introduction to Embryology of Angiosperms. Mac Graw Hill House (P) Ltd., New York.
- Raghavan, V. 2000. Developmental Biology of Flowering plants. Springer, Netherlands.
- Gupta, S.K. and Kaushik, M.P. 1973. An Introduction to Economic Botany. K. Nath and Co., Meerut.
- Hill, A.W. 1952. Economic Botany. McGraw Hill Book Co., New York.
- Jain, S.K. 1981. Glimpses of Indian Ethnobotany. Oxford and IBH, New Delhi.
- Jain, S.K. 1987. A Manual on Ethnobotany. Scientific Publisher, Jodhpur.
- Prakash, G., Sharma, S. K. 1975. Introductory Economic Botany. Jai Prakash Nath and Cosec, Meerut.
- Sambamurthy, A.V.V.S. and Subrahmanyam, N.S. 1989. A Text Book of Economic Botany. Wiley Eastern Ltd., New Delhi.
- Sen, S. 1992. Economic botany. New Central Book Agency, Calcutta.
- Singh, V., Pandey, P.C. and Jain, D.K. 1998-99. Economic Botany. Rastogi Publications, Meerut.
- Verma, V. 1974. A Text Book of Economic Botany. Emkay Publications, New Delhi.

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B.Sc. Semester - VI

Scheme of examination

Continuous Assessment (CA)	=	15 Marks
Term Test	=	10 Marks
Home Assignment	=	05 Marks
Semester End Examination (SEE)	=	35 Marks
Total	=	50 Marks

B.Sc. Semester VI Botany

PAPER CODE 22-6001

MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

Scheme of examination:

MM: 35

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 will be compulsory having 07 short answer type questions (one mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

Unit - I

History of molecular biology, work of Chargaff, Watson and Crick model of DNA, Meselson and Stahl replication experiment; Hershey and Chase experiment, Chromatin structure and gene expression, S. Benzer and gene concept.

Kary Mullis and Polymerase chain reaction, Application of PCR technique, an overview of DNA fingerprinting and its use.

Unit-II

Central dogma, Reverse transcriptase and its application,

Transcription in eukaryotes: RNA processing, capping, splicing and polyadenylation,

Translation: initiation, elongation and termination.

Jacob-Monod and Lac operon, Negative and positive control, attenuation and antitermination, structure of promoter.

Unit-III

29



Biotechnology: Functional definition. Basic aspects of Plant tissue culture, basal medium, media preparation and aseptic culture technique. Concept of cellular totipotency.

Differentiation and morphogenesis, Micropropagation and synthetic seeds. Protoplast culture and somatic hybridization. Anther culture for androgenic haploid. Ovule and embryo culture and their application.

Unit-IV

Recombinant DNA technology: Techniques used in rDNA technology. Restriction enzymes. Vectors for gene transfer, Plasmids and cosmids, cDNA library, gene amplification; Transgenic plants.

Suggested Readings:

- 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.
- Brown, T. A. 2010. Gene cloning and DNA analysis: An Introduction. Blackwell Publication, USA.
- Buchanan, B., Gruissem, W. and Jones, R. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists., USA.
- Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press and Sunderland, Washington, D.C. Sinauer Associates, MA. 18
- De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- Glick, B.R. and Pasternak, J.J. 2003. Molecular Biotechnology: Principles and Applications of recombinant DNA. ASM Press, Washington.
- Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley and Sons. Inc. New jersey, USA.
- Mascarenhas, A.F. 1988. Hand book of Plant tissue culture. Publication and information. Div., ICAR, New Delhi.
- Purohit, S.S. and Mathur, S.K. 1996. Biotechnology Fundamental and Application. Agro Botanical Publisher, Bikaner.

- Razdan, M.K., 1993. An introduction to Plant tissue culture. Publication and Information Div., ICAR, New Delhi.
- Rana, S.V.S. 2012. Biotechnology theory and practice. (Third Ed.) Rastogi Publication, Meerut.
- Rastogi, V.B. 2008. Fundamentals of Molecular Biology. Ane Books, Meerut, India.
- Smith, R. H. 2000. Plant Tissue Culture: Techniques and Experiments. 2nd edition, Academic Press, USA.

PAPER CODE 22-6002

B.Sc. Semester VI Botany

PLANT ECOLOGY

Scheme of examination:

MM: 35

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 will be compulsory having 07 short answer type questions (one mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

UNIT-I

Plants and Environment: Atmosphere (gaseous composition and properties of four distinct zone viz. stratosphere, troposphere, mesosphere and thermosphere).

Water (distribution in biosphere and properties of water cycle).

Morphological, anatomical and physiological responses of plants to water (Hydrophytes and Xerophytes).

Light: global radiation, photosynthetically active radiation.

UNIT-II

Zonation in water body: littoral, limnetic and profundal zones.

photoperiodism, heliophytes and sciophytes,

Temperature (Raunkier's classification of plants: megatherm, mesotherm, microtherm, heikistotherm; themoperiodicity and vernalisation).

Soil (soil profile, development - weathering and maturation. Soil texture, soil types, role of pH, organic matter, soil water, soil nutrients.

Interactions among organisms: Neutralism, amensalism, allelopathy, competition, predation, parasitism, proto cooperation, mutualism.

UNIT-III

Population, Community, Ecosystem and Phytogeography:

Population, ecotypes, ecades.

Community characteristics: stratification, life forms and biological spectrum, frequency density and cover.

Ecological succession: types (primary and secondary), mechanism: nudation, migration, ecesis, reaction and climax; xerosere, hydrosere.

UNIT-IV

Ecosystems: Structure, abiotic and biotic components,

Trophic level, food chain, food web, ecological pyramids.

Energy flow (Box and Pipe model of Odum).

Biogeochemical cycles of carbon and phosphorus.

Vegetation types of India.

Suggested Readings:

- Banerjee, P.K. 2006. Introduction to Biostatistics. S. Chand and Co., New Delhi.
- Koromondy, E.J. 1996. Concepts of Ecology. 4th Edition Prentice-Hall of India Pvt. Ltd., New Delhi.
- Misra, K.C. 1988. Manuals of Plant Ecology. (3rd Edition) Oxford and IBH Publishing Co., New Delhi: 38
- Odum, E.P. 1983. Basic Ecology. 5th Edition Thomson Business International Waldis Pvt. Ltd., Baricahd.
- Odum, E.P. 2008. Ecology. Oxford and IBH Publisher. • Sharma, P.D. 2010. Ecology and Environment, (8th Edition) Rastogi Publications, Meerut.
- Singh, J.S., Singh, S.P. and Gupta, S. 2006. Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi.

B. Sc. BOTANY PRACTICAL EXAMINATION

SEMESTER V & VI

SKELETON PAPER

PAPER CODE P-22-6001

MAX. MARKS: 100

TIME 4 HOURS

Q. No.	Practical	Marks
1.	Plant Taxonomy 1. Taxonomy- Flower description 2. Study of reproductive organs of given flower	14 06
2.	Comment on the embryological exercise. Or Comment on the Tissue culture / Biotechnology technique.	10
3.	Plant Ecology (A) Ecological anatomy (B) Ecological exercise	14 06
4.	Economic Botany (A) Histochemical test OR (B) Comment on the botany and morphology of economic part of specimen	10
5.	Spotting (1-5 spots)	20
6.	Viva-Voce	10
7.	Practical Record	10
	Total	100

Suggested Laboratory Exercises:

- **Plant Taxonomy:** 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. Rubiaceae: Ixora,
 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. Liliaceae: Asphodelus, Asparagus
15. Poaceae: Avena, Triticum, Hordeum

- **Embryological exercise**

1. T.S. of anther, to study the wall layers and pollen sac with pollen grains.
2. Study of different types of placentation.
3. Study of different types of ovules.
4. Study of female gametophyte through permanent slides/ photographs: types and ultra-structure of mature embryo sac.
5. Pollen germination test.
In vitro germination using sugar solution
Tetrazolium test
6. Study of monocotyledons and dicotyledons embryo of angiosperms through slides/photographs.

- **Biotechnology:**

1. Introduction of the instruments/techniques- laminar air flow/ sterile bench, Centrifuge, Autoclave, Incubator, Spectrophotometer, PH meter, Gel electrophoresis.
2. Preparation of M.S and P.D.A. culture media.
3. Explant culture- Shoot tip nodal segment
4. Callus culture
5. Protoplast isolation

- **Ecological anatomy**

1. Morphological & Anatomical adaptations in some hydrophytes & xerophytes: (Specimens/slides/section cutting) *Hydrilla, Typha, Eichhornia, Opuntia, Euphorbia, Capparis, Casuarina, Nerium, Calotropis*
2. Ecological instruments and their working

- **Ecological exercise**

1. To determine frequency of plant species of campus vegetation by quadrat method.
2. To determine density and abundance of plant species of campus vegetation by quadrat method.
3. To determine water holding capacity of soil of grass land or wood land
4. To determine the pH of given soil samples.
5. Study of soil moisture in relation to depth, bulk density, porosity and water holding capacity of different soil samples.
6. Find out transparency of a water body by secchi disc.
7. Determine the dissolved oxygen content in polluted and unpolluted water samples.

• **Economic Botany:**

Histochemical test – Lignin, Cellulose, Starch, Fat, Protein and Tannin.

Study of starch grains in Wheat, Rice, Potato and Pea.

Utilization of plants

1. Food plants – Wheat, Maize, Rice, Potato, Sugarcane.
2. Fibres – Cotton, Jute
3. Vegetable oils – Ground nut, mustard and coconut
4. A general account of the fire wood, timber yielding plants and Bamboos
5. Spices and condiments – Clove, Black pepper, Cinnamon, Cardamom.
6. Medicinal Plants – *Rauwolfia*, *Withania*, *Cinchona*, *Papaver*, *Ocimum*,
Datura, *Ephedra*, *Taxus*, *Aloe*, *Azadirachta*
7. Beverages – Tea, Coffee
8. Rubber – *Ficus elastica*, *Hevea*

Approved,

CHAIRMAN
Academic Council
Raj Rishi Govt. Autonomous College
Alwar (Rajasthan)

(Dr. Seemata Agarwal)
HOB BOTANY

CHAIRPERSON
Governing Body
Raj Rishi Govt. Autonomous College
Alwar (Rajasthan)

Inorganic Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Metal-Ligand Bonding: Limitations of crystal field theory, molecular orbital theory of octahedral, tetrahedral and square planar complexes, π -bonding and molecular orbital theory.

UNIT – II

Organometallic Compounds: Definition and classification of organometallic compounds, synthesis, properties and structures of organometallic compounds of magnesium, aluminium, tin and lead.

UNIT – III

Inorganic Polymers - I: Type of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones, phosphonitrilic halides and condensed phosphates.

UNIT – IV

Nuclear Chemistry - I: Fundamental particles of nucleus (nucleons), concept of nuclides. Representation of nuclides, isotopes, isobars and isotones with specific examples. Applications of radioisotopes, size concept in nucleus and atom. Qualitative idea of the stability of nucleus (n/p ratio).

UNIT – V

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Bioinorganic Chemistry – I : Role of bulk and trace metal ions in biological systems with special reference to Na,K,Mg,Ca,Fe,Cu and Zn. Chlorophylls and their role in photosynthesis.

2021



Ajay Jain

Scheme of examination:

MM: 52

- 1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Heterocyclic Compounds: Nomenclature, Five and six membered heterocyclic compounds, Aromatic Character, preparation, reactions, chemical reactivity, orientation (Electrophilic and nucleophilic substitution reaction), basicity of pyrrole, furan, thiophene and pyridine. Condensed five and six membered heterocycles, structure, preparation and reactions of indole, quinoline and isoquinoline.

UNIT – II

Polymers and Polymerization: Addition and condensation polymerization, their mechanism, copolymerization, coordination polymerization, Ziegler-Natta catalyst, plastics, thermoplastic and thermosetting resins, plasticizers, polystyrene, PVC, polyacrylates, polyacrylonitrile, Dacron, terylene, nylon-66, bakelite, melamine and polyurethanes. Elementary idea of the stereochemistry of polymers. Synthetic and natural rubber.

UNIT – III

Amino Acids: Classification, structure and stereochemistry of amino acids. Physical properties, zwitter ion structure, isoelectric point and electrophoresis. Preparation and reaction of α -amino acids.

UNIT – IV

Carbohydrates: Introduction, classification, constitution and reaction of glucose and fructose, mutarotation and its mechanism, cyclic structure, pyranose and furanose forms, Haworth projection formulae, configuration

of monosaccharides, determination of ring size, conformational analysis of monosaccharides, Epimerization, chain lengthening and chain shortening in aldoses. Interconversion of aldoses and ketoses.

Disaccharides: Structure determinations of maltose, lactose and sucrose.

Polysaccharides: Structure of starch and cellulose.

UNIT – V

Organosulphur Compounds: Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides.



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Scheme of examination:

MM: 52

- 1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Quantum Mechanics: Schrodinger's wave equation for particle in three dimensional box, H-atom, quantum no. and their importance, hydrogen like wave functions, radial wave function's angular wave functions.

M.O. Theory, basic ideas-criteria for forming M.O. from A.O.

construction of M.O's by LCAO – H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ , σ^* and Π , Π^* orbitals and their characteristics.

Hybrid orbitals SP , SP^2 , SP^3 , Calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2 , comparison of M.O. and V.B. model.

UNIT – II

Photochemistry: Introduction of radiation with matter, difference between thermal and photochemical processes, laws of photochemistry: Grothus – Dropper law, stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of the fluorescence, phosphorescence, non radioactive processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple example).

UNIT – III

Physical properties and molecular structure: Optical activity, polarization (Clausius Mossotti equation), orientation of dipole in the 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.

UNIT – IV

Chemical Kinetics : Catalysis:- The simple catalysis mechanism $S+C \rightarrow SC \rightarrow P + C$. Its mathematical treatment and its consequences. Specific and general acid base catalysis, Enzyme catalysis, Surface catalysis and Langmuir Adsorption Isotherm, Mechanism of surface catalysis.

UNIT – V

Macromolecules :- Linear, Branched, network and homopolymer. Polymer Classification – Condensation polymers and addition polymers, number average and weight average, molecular weight, Determination methods of polymers by (I) Osmotic pressure (II) Viscosity (III) Light scattering. Properties of macromolecules.

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Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT – I

Electrogravimetry – I: Theory, electrode reactions, over potential, completeness of deposition, electrolytic separation of metals, character of the deposit, electrolytic separation of metals with controlled cathode potential.

UNIT – II

(A) Electrogravimetry – II: Electrolytic determinations at constant current-Copper and Lead. Electrolytic determinations with controlled cathode potential antimony, copper, lead and tin in an alloy.

(B) Coulometry: Coulometry at controlled potential, separation of Ni & Co by coulometric analysis at controlled potential, coulometry at constant current, coulometry titrations.

UNIT – III

Polarography: Principle and experimental set-up. Diffusion current and Half wave potential – Qualitative and quantitative applications of polarography in analytical chemistry.

- (i) wave height concentration graph.
- (ii) Internal standard (piloton method)
- (iii) Standard addition method

Use of polarography in :

- (i) Zn and Cu in brass
- (ii) Dissolved oxygen in sample.

UNIT – IV



(A) Amperometry : Amperometric titrations, technique of amperometric titrations with the dropping mercury electrode, titration with the rotating platinum micro electrode, biamperometric titrations.

(B) Modified Voltammetric methods: Current sampled (TAST) Polarography, pulse polarography, Differential pulse polarography, Cyclic Voltammetry, Sinusoidal Alternating current polarography, Stripping Voltammometry.

UNIT – V

Mass spectrometry : Instrumentation & technique, Elementary idea about electron impact, chemical ionization and matrix assisted laser desorption ionization (MALDI), mass spectrometer techniques. Principle of Fragmentation, Molecular ion peak, base peak isotopic peaks and metastable ion peak. Determination of molecular formula, mass spectra of alkanes, alkenes, alkynes, cycloalkanes and arenes, alcohols and ethers, aldehydes and ketones.

Inorganic Chemistry

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT - I

Metal carbonyls: Preparation, properties and bonding of transition metal carbonyls. Detailed study of mononuclear and polynuclear carbonyls.

UNIT II

Inorganic Polymers-II: Metal Clusters: Higher boranes, carboranes, mettaloboranes and mettalocarboranes, metal carbonyl and halide clusters, compounds with metal - metal multiple bonds.

UNIT III

Nuclear Chemistry-II: Shell and liquid drop model, Natural and artificial radioactivity, disintegration series, disintegration rates, half life, average life, nuclear binding energy, Mass defects, Einstein's mass energy relations, Artificial transmutation, Nuclear reactions, spallations, Nuclear fission & Fusion. Nuclear reactors. Hazards of radioactive emanations.

UNIT IV

Bionorganic Chemistry-II: Metalloporphyrins: Hemoglobin and Myoglobin and their role as oxygen carriers. Cytochrome-c.

UNIT V

Nitrogen fixation: Mechanism, Nitrogenase enzymes, dinitrogen complexes as models for nitrogen fixation.

Metalloenzymes: General discussion of enzymes, functions of metal ions, inhibition (explanation based on coordination elemistry), Carboxypetidase-A.

Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT - I

Polynuclear Compounds: Structure of naphthalene, mechanism and orientation of electrophilic substitution in naphthalene, preparation and properties of naphthalene and anthracene, some important derivatives of naphthalene like naphthols and naphthylamines. Preparation and reaction of diphenyl, diphenylmethane and triphenylmethane.

UNIT- II

Synthetic Dyes: Color and constitution (electronic concept).

Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, phenolphthalein, Fluorescein, Alozarin and Indigo.

Drugs: Chemotherapy, Synthetic uses and side effect of:

Analgesics- Aspirin, Phenacetin, Paracetamol.

Antimalarials – Chloroquine, Plasmoquine.

Antibiotics- Chloramphenicol (Chloromycetin)

Sulpha drugs and their mechanism of action. Synthesis of sulphadiazine, sulphapyridine, sulphathiazole, sulphaguanidine and sulphamethazole.

UNIT- III

Peptides and Proteins: Structure and nomenclature of peptides and proteins. Classification of proteins, peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide

synthesis, solid-phase peptide synthesis. Structure of peptides and proteins. Levels of protein structure. Protein denaturation / renaturation.

Nucleic Acids: Introduction, constituents of nucleic acids (RNA and DNA) Ribonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT- IV

Mass Spectroscopy: Introduction, instrumentation, factors affecting fragmentation, ion analysis, ion abundance, fragmentation modes, mass spectral fragmentation of simple organic compounds – alkanes, primary alcohols, aliphatic ketones, aldehydes and carboxylic acids, Types of peak: molecular ion peak, isotopic peak, base peak, metastable peak, doubly charged ion, Mc Lafferty rearrangement, retro Diels-Alder fragmentation, Nitrogen rule.

UNIT- V

Organometallic Compounds: Organomagnesium compounds: The Grignard reagents-formation, structure and chemical reactions.

Organozinc Compounds: Formation and chemical reactions.

Organolithium Compounds: Formation and chemical reactions.

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Scheme of examination:

MM: 52

- 1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT - I

Electrochemistry-I: Types of reversible electrodes- Gas-metal ion, metal-metal ion, metal insoluble salt anion, and redox electrodes, Electrode reactions, Nernst's equation, derivation of cell E.M.F and single electrode potential. Standard hydrogen electrode, reference electrode, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells- Reversible and irreversible cells, conventional representation of electrochemical cells. E.M.F. of cell and its measurements. Computation of cell e.m.f. Calculation of thermodynamic quantities of cell reaction(ΔG , ΔH and k).

UNIT- II

Electrochemistry-II: Polarization, Overpotential and Over Voltage, Structure of double layer, theories by Helmholtz, Guoy-Chapman and Stern. Concentration cells with and without transport, Liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods. Introduction of Polarographic technique. Classification of electrochemical cells, Requirement of power source, Lead storage cell and fuel cell.

Corrosion- Types, Theories and methods of combating it.

UNIT- III

Phase Equilibrium-I: Solid Solutions:- Compound formation with congruent M.Pt.(Mg-Zn) and Benzophenone – dimethylamine incongruent M.Pt NaCl-H₂O, Picric acid & Benzene, FeCl₃-H₂O and CuSO₄-H₂O system.

Liquid – Liquid Mixtures – Ideal liquid mixtures, Rault's law and Henry's law, non ideal system, Azeotropes – HCl-H₂O and Ethanol-Water system.

Partially miscible liquids-pheno-Water, Trimethylamine-Water, Nicotine-Water system, Lower and upper consolute temperature, Effect of impurities on consolute temperature.

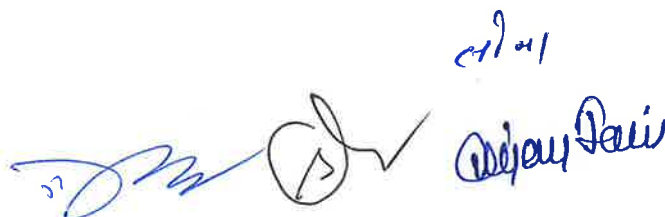
Immiscible liquids- steam distillation.

UNIT- IV

Phase Equilibrium-II: Surface Phenomena, Micelles: Surface active agents, classification of surface active agents, micellization, hydrophilic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization. Phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

UNIT- V

Adsorption: Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (Electro kinetic phenomenon), catalytic activity at surfaces, Electrode/electrolyte interface.

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Scheme of examination:

MM: 52

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT - I

Gas Chromatography & HPLC: Introduction, gas chromatographs, detectors, programmed temperature gas chromatography, quantitative analysis by GLC, gas – solid chromatography.

High performances liquid chromatographic methods - Adsorption Chromatography. Liquid – liquid partition chromatography, Ion exchange, HPLC, exclusion chromatography.

UNIT- II

Diffraction Pattern-I: Fundamental principles, instrumentation, use of X-ray, electron and neutron in diffractometry and applications of X-ray. Application of X-ray in C.T. Scan.

UNIT- III

Diffraction Pattern-II: Electron and neutron diffractometry in biological and as analytical techniques.

UNIT- IV

Automated Methods of analysis: Automatic instruments and automation. Automation of sampling and preliminary treatment for air, water and soil, continuous flow method, Discrete methods, Automatic Analysis based on Multilayer Films.

UNIT- V

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NMR Spectroscopy: Theory of nuclear magnetic resonance,
experimental methods of NMR spectroscopy, applications of proton
NMR including application in MRI technique

Session 2020-21


2021
Dr. Anurag Jain

B.Sc. (Hons.) Part III
CHEMISTRY PRACTICAL
INORGANIC CHEMISTRY

Session 2022-23

6 hrs. Duration: 48

Max. Marks: 200

PAPER CODE P-22-6016

6 hrs./ week 48

Min. Marks: 72

Inorganic Chemistry

1. Quantitative estimation of any three of the following mixture by volumetric and gravimetric methods.
 - a. Copper-Zinc
 - b. Zinc-Nickel
 - c. Silver-Copper
 - d. Silver-Nickel
 - e. Silver-Zinc
 - f. Copper-Nickel.

2. Inorganic Preparations (any four) & characterization of coordination compounds:
 - a. Bis (dimethylglyximate) nickel (II) complex.
 - b. Tetraamminecopper (II) sulphate.
 - c. Cis-Potassium diaquodixalatochromate (III) complex.
 - d. Hexaamminenickel (II) chloride.
 - e. Prussian blue.
 - f. Chloropentaamminecobalt (III) nitrate.
 - g. Carbonatotetraamminecobalt (III) chloride.

3. Qualitative Analysis of mixture containing six radicals one of which should be a rare ion. The mixture may contain radicals of any combination including interfering acid radicals and insolubles.

4. Analysis of (any three) of the following:

- a. Available chlorine in bleaching power.
- b. Water analysis-for total hardness.
- c. Analysis of two components by TLC
- d. Analysis of cement for Ca, Al or Mg.
- e. MnO_2 in pyrolusite

Organic Chemistry

1. Quantitative Estimation
Determination of neutralization equivalent of an organic acid.

2. Two step preparation of simple compounds-the students are expected to perform at least three of the following preparations.
 - a. Preparation of p-aminoazobenzene from aniline.
 - b. Preparation of p-nitroaniline from acetanilide.
 - c. Preparation of syn-tribromobenzene from aniline.
 - d. Preparation of m-nitroaniline from nitrobenzene.
 - e. Preparation of acetanilide from acetophenone (Beckmann rearrangement).
 - f. Preparation of anthranilic acid from phthalic anhydride.
 - g. Preparation of eosin from phthalic anhydride.

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3. Quantitative Estimation

- a. Determination of saponification value of an ester/oil.
- b. Estimation of glucose by titration with Fehling's solution/Benedict solution.

4. Qualitative Analysis

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

Physical chemistry:-

Potentiometry (Multimeters may also be used)

1. To find out the strength of acid by titrating it against alkali.
2. Determination of dissociation constants of weak acids.
3. Determination of no. of electrons involved in a cell reaction by setting up a concentration cell.
4. Determination of transport number of anion by e.m.f. measurements.

Kinetics

1. Determine the effect of ionic strength on the rate of persulphate iodide reaction.
2. Determination of mol. Wt. By Rast camphor method.
3. Determination of conc. of given solution of H_2SO_4 acid by measuring heat changes during dilution.
4. Compare cleansing powder of two samples of detergents by surface tension measurement.

pH-metric titrations

1. To find out the strength of strong acid by titrating it against strong base.
2. To find out the strength of strong acid by titrating it against weak base.
3. To find out the strength of weak acid by titrating it against strong base.
4. Find out the strength of HCl and CH_3COOH in a mixture of both by titrating it against NaOH .

- Spectrophotometer experiment or Colorimetric experiment
Verify Lambert Beers law & determine the concentration of the given aqueous solution of unknown concentration of salt.

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CHAIRPERSON
Governing Body
RajRishi Govt. Autonomous College
Alwar (Rajasthan)

Chairman
CHAIRMAN
Academic Council
RajRishi Govt. Autonomous College
Alwar (Rajasthan)

ABSTRACT ALGEBRA

Scheme of examination:

MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Definition and simple properties of Groups and Subgroups. Cyclic group.

UNIT – II

Permutation Groups. Cosets, Lagrange's theorem on the order of subgroups of a finite order group.

UNIT – III

Morphism of groups, Cayley's theorem. Normal subgroups and Quotient groups. Fundamental theorems of Isomorphism.

UNIT – IV

Definition and simple properties of Rings. Integral domain and field, Characteristics of a Ring and Field.

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COMPLEX ANALYSIS - I

Scheme of examination:

MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Complex plane, connected and Compact sets. Curves and Regions in complex plane. Jordan curve Theorem (Statement only). Extended complex plane. Stereographic projection.

UNIT – II

Complex valued function - Limits, Continuity and Differentiability. Analytic function, Cauchy- Riemann equations (cartesian and polar form). Harmonic functions, Construction of an analytic function.

UNIT – III

Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions. Power series - Absolute convergence, Abel's theorem, Cauchy-Hadamard theorem, Circle and Radius of convergence, Analyticity of the sum function of a power series.

UNIT – IV

Cauchy integral formula, Analyticity of the derivative of an analytic function, Morera's theorem, Poisson integral formula Liouville' theorem. Taylor's theorem. Laurent's theorem. Maximum modulus theorem.

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DYNAMICS AND COMPUTER PROGRAMMING IN 'C'

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Velocity and Acceleration – along radial and transverse directions, along tangential and normal directions.

UNIT – II

S.H.M. Hooke's law motion along horizontal and vertical elastic strings.

UNIT – III

Motion in resisting medium-Resistance varies as velocity and square of velocity.

UNIT – IV

Programming languages and problems solving on computers, Algorithm, Flow chart, Programming in C-constants, Variables, Arithmetic and logical expressions, input-output conditional statements, Implementing loops in Programs, Defining and manipulation arrays and functions.

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LINEAR ALGEBRA

Scheme of examination:

MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Subrings. Morphism of rings. Ideals and Quotient Ring. Maximal ideal and Prime ideal. Principal Ideal domain. Field of quotients of an integral domain. Prime fields.

UNIT II

Definition, Examples and Simple properties of Vector spaces and Subspaces.

UNIT III

Linear combination, Linear dependence and Linear independence of vectors. Linear span, Direct sum and Complement of subspaces. Generation of subspaces, sum of subspaces.

UNIT IV

Basis and Dimension. Quotient space and its dimension.

For *RL* *short* *21/09/19* *20/11*

COMPLEX ANALYSIS - II

Scheme of examination:

MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT - I

Singularities of an analytic function, Branch point, Meromorphic and Entire functions, Riemann's theorem, Casorati-Weierstrass theorem.

UNIT II

Residue at a singularity, Cauchy's residue theorem. Argument principle. Rouché's theorem. Fundamental theorem of Algebra.

UNIT III

Conformal mapping. Bilinear transformation and its properties.

Elementary mappings: $w(z) = 1/z, (z+1/z), z^2, e^z, \sin z, \cos z,$ and $\log z$.

UNIT IV

Evaluation of a real definite integral by contour integration. Analytic continuation. Power series method of analytic continuation.

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ADVANCED DYNAMICS

Scheme of examination:

MM: 22

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Work and energy; Cycloidal Motion

UNIT – II

Motion on a smooth curve in a vertical plane. Motion on the inside and outside of a smooth vertical circles

UNIT – III

Central orbits p-r equations. Apses. Time in an orbit. Kepler's laws of planetary motion.

UNIT – IV

Moments of inertia- M.I. of rods . circular rings, circular disks, solid and hollow spheres, Rectangular lamina, Ellipse and Triangle, Theorem of parallel axis, Product of inertia.

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Note: 34 marks assigned to theory papers are distributed in following manner

Continuous evaluation	10 marks
Term End Main Exam	23 marks

Duration : 3 hour

Note: In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.

Unit- I

Bonding in Solids and Crystal structure: Force between atoms, Ionic bonds, Covalent and metallic bonds, Vander wall's and Hydrogen bonding. Periodicity in lattices, Basis, lattice point and space lattice, Translation vectors, Unit and primitive cell, Crystal systems, Packing fractions for Simple Cubic (SC), Body Centered Cubic (BCC), Face Centered Cubic (FCC) and Hexagonal lattice structures, Bravais space lattices.

Unit- II

Crystallography and Diffraction: Direction, planes and miller indices in a crystal lattice, Reciprocal lattice and its significance, Conversion of SC and FCC structures in reciprocal lattice frame, Concept of crystalline, polycrystalline and amorphous materials, X-ray diffraction by solids: Laue and Braggs equation, Study of crystals by X-rays: FWHM, Sherrer formula and lattice Constants (for simple cubic structure), Electron and Neutron diffraction (qualitative).

Unit- III

Band theory of solids: Formation of bands, Periodic potential and Bloch Theorem, Number of states in the bands, Kronig Penny model, Brilliuon zones, Crystal momentum and physical origin of effective mass, Negative Effective Mass and Holes, Energy dispersion relations: weak and tight binding.

Unit- IV

Semiconductors: Energy band Structures in Insulators, Conductors, Semiconductors, Concept of Direct and Indirect band gap in semiconductors, Generation and recombination of charge carriers, Mobility of current carriers, Hall Effect in semiconductors: Hall coefficient, Mobility, Charge carrier concentration, Conductivity and Hall angle.

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Reference Books (Solid State Physics)

1. Introduction to Solid State Physics, Charles Kittel (Wiley Publication)
2. Elementary Solid State Physics, M. All Omar (Pearson Education)
3. Elements of X-ray diffraction, B. D. Cullity (Prentice Hall)
4. Solid State Physics by G.I Epifanov (Mir R publisher)
5. Solid State Physics by S.O.Pillai, Willy Eastern Ltd.

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B.Sc. Pt-III SEMESTER-V

Physics -II

PAPER CODE 22-5011

Quantum Mechanics and Spectroscopy-I

(MM 33)

Note: 33 marks assigned to theory papers are distributed in following manner

Continuous evaluation	10 marks
Term End Main Exam	23 marks

Duration : 3 hour

Note: In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.

UNIT-I

Evolution of Quantum Mechanics : Difficulties of classical mechanics to explain: the black-body emission spectrum, specific heat of solids. Plank quanta concept and radiation law, Photo electric effect and Einstein's explanations. Compton effect, De- Broglie hypothesis, diffraction and interference experiments of particle (Davisson-Germer experiment). **Uncertainty principle:** position and momentum, angle and angular momentum, energy and time. Application of uncertainty principle: (i) Ground state energy of hydrogen atom, (ii) ground state energy of simple harmonic oscillator, (iii) Natural width of spectral lines, (iv) Non-existence of electron in nucleus.

UNIT-II

Operators in quantum mechanics: Operators: linear operators, product of two operators, commuting and non-commuting operators, simultaneous Eigen functions and Eigen values, orthogonal wave functions. Hermitian operators, their eigen values, Hermitian adjoint operators, eigenvalues and eigenfunctions; expectation values of operators: position, momentum, energy: Ehrenfest theorem and complementarity, Concept of group and phase velocity, wave packet, Gaussian wave packet, bra - ket notation.

UNIT-III

Schrodinger wave equation: general equation of wave propagation, propagation of matter waves, time dependent and time-independent. Schrodinger equation, wavefunction representation (Ψ), physical meaning of Ψ , properties and conditions on Ψ , postulates of wave mechanics, operators, observable and measurements; probability current density.

UNIT-IV

Solutions of Schrödinger wave equations in simple cases: Time independent Schrodinger equation, stationary state solution, one dimensional problem: particle in one dimensional box, eigenfunctions and eigenvalues, discrete energy levels, generalization into three dimension and degeneracy of energy levels, concept of potential well and barrier, step potential, penetration through rectangular barrier, reflection and transmission coefficients, barriers with special shapes (graphical representation), quantum mechanical tunneling (alpha decay).

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Reference books (Quantam Mechanics and Spectroscopy)

1. David J. Griffiths, Introduction to Quantum Mechanics, 2nd edition.
2. R. Shankar, Principles of Quantum Mechanics, 2nd edition.
3. Arthur Beiser, Perspective of modem Physics, 6th, edition.
4. AK Ghatak and S Lokanathan, Quantum Mechanics: Theory and application.
5. HS Mani, GK Mehta, Introduction to modern Physics.
6. C.N. Banwell and E.M McCash, Fundamental of Molecular Spectroscopy, 4th edition.



B.Sc. Pt-III SEMESTER-V**PAPER CODE 22-5012****Physics -III****Nuclear and particle Physics-I****(MM 34)**

Note: 33 marks assigned to theory papers are distributed in following manner

Continuous evaluation	10 marks
Term End Main Exam	24 marks

Duration : 3 hour

Note: In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.

Unit – I

Properties of Nucleus : Discovery of Nucleus, Rutherford Scattering, Constituents of the Nucleus: Mass, Charge, Size, Nuclear Density, Charge Distribution, Hofstadter's experiment, Nuclear Angular momentum, Nuclear Magnetic Dipole Moment, Electric Quadrupole Moment, Spin, Isospin, Wave Mechanical Properties: Parity and Statistics, Classification of Nuclei, Mass Defect and Binding Energy, Packing Fraction, Mass Spectrograph.

Unit- II

Nuclear Forces: Properties of Nuclear Forces, Yukawa Meson Theory, Nuclear Potential.
Nuclear Models: Segre Chart, Liquid Drop Model, Semi Empirical Mass Formula, Condition of Stability, Fermi Gas Model, Evidence for Nuclear Shell Structure, Nuclear Magic Numbers and Basic Assumptions of the Shell Model.

Unit- III

Radioactive Decays: Alpha Decay-Basics of α - Decay Processes, Theory of β - Emmission Spectrum, Gammow Factor, Geiger Nuttal Law, Range of Alpha Particles, Beta Decay-Energy Kinematics for β -Decay, β -Decay Spectrum, Position Emission, Electron Capture, Pauli's Neutrino Hypothesis. Gamma Decay- Gamma Ray Emission and Kinematics, Internal Conversion. Applications of Radioactivity.

Unit- IV

Nuclear Fission and Fusion: Nuclear Fission, Spontaneous Fission and Potential Barrier, its Explanation by Liquid Drop Model, Chain Reaction, Controlled chain reaction, Four Factor Formula, Nuclear Reactors, Classification of Nuclear Reactor, Uncontrolled Chain Reaction, Nuclear Fusion, Energy released in Nuclear Fusion, Fusion in stars. **Nuclear Reactions:** Types of Reactions, Conservation Laws, Kinematics of Reactions, Q-Value, Threshold Energy, Reaction Rate, Reaction Cross-Section

Reference Books (Nuclear and Particle Physics)

1. Nuclear and Particle Physics, W. E. Burcham and M Jobs, Addison Wesley Longman Inc.
2. Nuclear and Particle Physics, Brian R Martin, John Wiley & Sons.
3. Introduction to Nuclear and Particle Physics, Das and Ferbal, World Scientific.
4. Elements of Nuclear Physics, Walter E. Meyerhof, McGraw-Hill Book Company.
5. Introductory Nuclear Physics, Kenneth S. Krane, John Wiley & Sons.
6. Introduction to Elementary Particles, David J. Griffiths, John Wiley & Sons.
7. Radiation Detection and Measurement, G.F. Knoll (John Wiley & Sons)
8. Introduction to Nuclear and Particle Physics, V. K. Mittal, R. C. Verma, S. C. Gupta, PHI
9. Concepts of Modern Physics, A. Beiser, McGraw-Hill Book Company.

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B.Sc. Pt-III SEMESTER-VI**PAPER CODE 22-6010****Physics-I****Solid State Physics-II****(MM 33)**

Note: 34 marks assigned to theory papers are distributed in following manner

Continuous evaluation	10 marks
Term End Main Exam	23 marks

Duration : 3 hour

Note: In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.

Unit-I

Thermal properties of Materials: Elastic waves, Phonon-Phonon dispersion relations in monatomic and diatomic linear lattice. Lattice heat capacity, Classical theory of specific heat, Dulong-Petit's law, Einstein and Debye's theory of specific heat of solids and limitations of these models, concept of Thermoelectric Power.

Unit-II

Electrical Properties of Materials: Drude-Lorentz theory, Sommerfeld's Model, Thermal conductivity, Electrical conductivity, Wiedemann-Franz relation, Thermionic Emission, Escape of electrons from metals, Hall Effect in Metals, Density of states.

Unit-III

Magnetic Properties of Materials: Classification of Magnetic Materials. Origin of Atomic Magnetism, Classical Langevin Theory of dia-and Paramagnetic Domains. Quantum theory of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism. Concept of Domain Wall, Magnetostriction, Heisenberg's Exchange Interaction, Relation between Exchange Integral and Weiss Constant.

Unit-IV

Superconductivity: Experimental features of superconductivity: Critical Temperature, Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation); Cooper Pair and Coherence length. Josephson Effect (No derivation)

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Reference Books (Solid State Physics)

1. Introduction to Solid State Physics, Charles Kittel (Wiley Publication)
2. Elementary Solid State Physics, M. All Omar (Pearson Education)
3. Elements of X-ray diffraction, B. D. Cullity (Prentice Hall)
4. Solid State Physics by G.I Epifanov (Mir R publisher)
5. Solid State Physics by S.O.Pillai, Willy Eastern Ltd.

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- Center: *Book* (with a checkmark)
- Bottom center: *Very*
- Right side: *25/11/21* and *Amir*
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B.Sc. Pt-III SEMESTER-VI**Physics -II****PAPER CODE 22-6011****Quantum Mechanics and Spectroscopy-II****(MM 33)**

Note: 33 marks assigned to theory papers are distributed in following manner

Continuous evaluation	10 marks
Term End Main Exam	23 marks

Duration : 3 hour

Note: In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.

Unit – I

Solutions of Schrödinger wave equations in special cases: Symmetric square well potential, reflection and transmission coefficients, resonant scattering; Bound state problems: particle in one dimensional infinite potential well and finite depth potential well, energy eigenvalues and eigenfunctions, transcendental equation and its solution; Simple harmonic oscillator, Schrodinger equation for simple harmonic oscillator and its solution, eigenfunction, eigenvalues, zero point energy, quantum and classical probability density, parity, symmetric and antisymmetric wave functions with graphical representation.

Unit – II

Schrödinger equation in spherical coordinates: Schrodinger equation in spherical coordinates, Schrodinger equation for one electron atom in spherical coordinates, separation into radial and angular variables, solution of radial equation and angular equation, qualitative discussion of spherical harmonics, series solution and energy eigenvalues, stationary state wave function. Wave-functions of H-atom for ground and first excited state, average radius of H-atom, Bohr correspondence principle, orbital angular momentum and its quantization, commutation relation, eigenvalues and eigenfunctions.

Unit – III

Hydrogen atom spectra: Energy level derivation for H-atom, quantum features of hydrogen spectra and hydrogen like spectra, Stern_Gerlach experiment, electron spin, spin magnetic moment, spin- orbit coupling, qualitative explanation of fine structure, Franck-Hertz experiment, Zeeman Effect, normal Zeeman splitting, Qualitative understanding about Stark effect.

Unit- IV

Molecular spectroscopy: rigid rotator: Absorption and emission spectroscopy, its block diagram, explanation about function of each elements and its limitations; single beam spectrophotometer. Molecular spectroscopy: concept of rigid rotator, rotational energy levels, rotational spectra, selection rules, intensity of spectral lines, isotopic effect; Vibrational energy levels, vibrational spectra, selection rules, isotopic effect, effect of anharmonicity in vibrational spectra, vibrational-rotational spectra of CO and HCl molecules. shapes (graphical representation), quantum mechanical tunneling (alpha decay).

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Reference books (Quantam Mechanics and Spectroscopy)

1. David J. Griffiths, Introduction to Quantum Mechanics, 2nd edition.
2. R. Shankar, Principles of Quantum Mechanics, 2nd edition.
3. Arthur Beiser, Perspective of modem Physics, 6th edition.
4. AK Ghatak and S Lokanathan, Quantum Mechanics: Theory and application.
5. HS Mani, GK Mehta, Introduction to modern Physics.
6. C.N. Banwell and E.M McCash, Fundamental of Molecular Spectroscopy, 4th edition.

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Note: 33 marks assigned to theory papers are distributed in following manner

Continuous evaluation	10 marks
Term End Main Exam	24 marks

Duration : 3 hour

Note: In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.

Unit- I

Interaction of Nuclear Radiation with Matter: Energy Loss by Heavy Charged Particles in Matter, Interaction of Electrons with Matter, Range of Charged Particle, Bremsstrahlung, Cherenkov Radiation, Gamma Ray Interaction With Matter.

Unit-II

Radiation Detectors: Gas filled detector, Avalanche, Geiger Discharge, Ionization Chamber, Proportional Counter, Geiger Muller Counter. **Particle Accelerators:** Ion Source, Van-de-Graff Accelerator (Tandem Accelerator), Linear Accelerator, Cyclotron, Synchrocyclotron, Betatron, Proton Synchrotron

Unit-III

Elementary Particles: Necessity of high energy to discover elementary constituents, historical introduction to discovery of elementary particles (electron, positron, neutrinos, strange mesons, charm quark, intermediate vector bosons, bottom quark, top quark and Higgs boson) Elementary particles and their quantum (charge, spin parity, isospin, strangeness, etc.), elementary particles included in the standard model.

Unit- IV

Fundamental Interactions: Four types of fundamental forces. Symmetries and Conservation Laws, Discrete symmetries C, P, and T invariance. Application of Symmetry arguments to particle reactions. Parity non-conservation in weak interaction, CP violation. **Quark Model:** Flavor symmetries, Gellmann-Nishijima formula, the eight fold way, Quark model, Octet Diagram for Mesons and Baryons, Concept of Quark model, Color Quantum Number and Gluons.

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Reference Books (Nuclear and Particle Physics)

1. Nuclear and Particle Physics, W. E. Burcham and M Jobs, Addison Wesley Longman Inc.
2. Nuclear and Particle Physics, Brian R Martin, John Wiley & Sons.
3. Introduction to Nuclear and Particle Physics, Das and Ferbal, World Scientific.
4. Elements of Nuclear Physics, Walter E. Meyerhof, McGraw-Hill Book Company.
5. Introductory Nuclear Physics, Kenneth S. Krane, John Wiley & Sons.
6. Introduction to Elementary Particles, David J. Griffiths, John Wiley & Sons.
7. Radiation Detection and Measurement, G.F. Knoll (John Wiley & Sons)
8. Introduction to Nuclear and Particle Physics, V. K. Mittal, R. C. Verma, S. C. Gupta, PHI
9. Concepts of Modern Physics, A. Beiser, McGraw-Hill Book Company.

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PHYSICS PRACTICALS SYLLABUS

Note:- Total number of experiments to be performed by the students during the session should be 16 selecting and 8 from each section.

Section – A

1. Determination of Planck's constant by photo cell using optical filters.
2. Determination of Planck's constant using solar cell.
3. Determination of Stefan's constant (Black body method).
4. Study of the temperature dependence of resistance of a semi-conductor (four probe method).
5. Study of Iodine spectrum with the help of grating and spectrometer and ordinary bulb light.
6. Study of characteristics of GM counter and verification of inverse square law for the same strength of a radioactive source.
7. Study of β -absorption in AL foil using GM Counter.
8. To find the magnetic susceptibility of 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 oscillator (resonance method).
10. Study of polarization by reflection from a glass plate with the help of Nichol's Prism and photo cell and verification of Brewster law and law of Malus.
11. e/m measurement by helical Method.
12. Measurement of magnetic field using ballistic galvanometers and search coil. Study of variation of magnetic field of an electromagnet with current.
13. Measurement of electric charge by Millikan's oil drop method.

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Section – B

1. Study of R-C transmission line at 50 Hz
2. Study of 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. Study of the characteristics of junction diode & Zener diode.
5. Study of
 - (i) Recovery time of junction diode and point contact diode.
 - (ii) Recovery time as a function of frequency of operation and switching current.
6. To design Zener regulated power supply and study the regulation with various loads.
7. To study the characteristics of a field effect transistor (FET) and design/study amplifier of finite gain.
8. To study the frequency response of a transistor amplifier and obtain the input and output impedance (frequency response with change of component of R and C).
9. To design and study of an R-C phase shift oscillator and measure output impedance (frequency response with change of component of R and C).
10. To study a voltage multiplier circuit of generate high voltage D.C. from A.C.
11. Using discrete components, study OR, AND, NOT logic gates, compare with TTL integrated circuits (I.C's).
12. Application of operational amplifier (OP-AMP) AS : Minimum two of the following exercises- (a) Buffer (for accurate voltage measurement) (b) Inverting amplifier (c) Non inverting amplifier.

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CHORDATES

22-5013

MM: 35

Scheme of examination:

1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

UNIT - I

- Classification and characters of phylum Chordata (excluding extinct forms) up to orders (up to subclass in mammals).
- Habit, habitat and Salient features of Herdmania, Branchiostoma and Petromyzon :
- Ascidian tadpole larva and its metamorphosis
- Ammocoete larva.

UNIT - II**Comparative Anatomy** (with special reference to *Scoliodon*, Frog, *Varanus*, *Columba* and Rabbit)-

- Integument - skin structure and development of placoid scales, feathers and hair.
- Basic plan of vertebrate endoskeleton
- Alimentary canal

UNIT - III**Comparative Anatomy** (with special reference to *Scoliodon*, Frog, *Varanus*, *Columba* and Rabbit)-

- Origin and evolution of Heart and aortic arches.
- Respiratory system.

UNIT - IV**Comparative Anatomy** (with special reference to *Scoliodon*, Frog, *Varanus*, *Columba* and Rabbit)-

- Brain
- Urinogenital system.

UNIT - V

- Pisces – Types of scales and fins, Migration Parental care.
- Amphibia - Parental care.
- Reptilia - Poisonous and non-poisonous snakes,
- Aves - Flight adaptation, Bird migration.
- Mammals - Dentition.

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chem

DEVELOPMENTAL BIOLOGY

Scheme of examination:

1. In Semester End Examination there will be 10 questions in all, 2 from each unit.
Candidate has to answer any 5 questions, taking one from each unit.

MM: 35

UNIT - I

- Historical review: types & scope of embryology
- Gametogenesis: Spermatogenesis and oogenesis
- Fertilization mechanism & its significance,
- Parthenogenesis

UNIT - II

- Types of eggs
- Planes and patterns of cleavage
- Morulation and blastulation
- Gastrulation - Fate maps, morphogenetic cell movements, significance.

UNIT - III

- Development of chick up to 4 – somite stage.
- Extra-embryonic membranes in chick.
- Mammalian placentation - types, classification & functions.

UNIT - IV

- Embryonic induction;
- primary organizer,
- differentiation,
- competence;
- Regeneration in vertebrates
- Apoptosis

UNIT - V

- Metamorphosis in Frog.
- Embryonic stem cells.
- Aging,
- Teratogenesis,
- Therapeutic cloning.

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ECOLOGY AND BIostatISTICS*Scheme of examination:***MM: 35**

1. In Semester End Examination there will be 10 questions in all, 2 from each unit.
Candidate has to answer any 5 questions, taking one from each unit.

UNIT - I

- Basic concepts of ecology & limiting factors.
- Biotic and Abiotic Factors.
- Ecosystem- Components of ecosystem,
- Energy flow,
- Ecological pyramids,
- Food chain and Food web

UNIT II

- Biogeochemical cycles (O₂, CO₂, H₂O, N and P).
- Populations- Characteristics, Growth and its analysis.
- Intraspecific & interspecific: Commensalism & Mutualism.
- Community ecology: Characteristics & structure, Ecotone, Edge effect

UNIT III

- Ecological Succession (Xerosere and Hydrosere).
- Major Biome.
- Habitat Ecology-Aquatic, Marine, Terrestrial - Desert, Forest.

UNIT IV

- Conservation and management of natural resources.
- Pollution.
- Green house effect, El-Nino and La-Nino effects.
- Wild life conservation and management.
- Biodiversity of Rajasthan, Concept of threatened species.

UNIT V

- Introduction, scope and application of Biostatistics.
- Frequency distribution,
- Graphical presentation of data.
- Mean, mode, median and their significance.
- Standard deviation and standard error.

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