

## B.Sc. Semester - III

### 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 III Botany **PAPER CODE 22-3001**

### PLANT MORPHOLOGY AND ANATOMY

**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

The basic body plan of flowering plants, modular type of growth.

Diversity of plant forms in annuals, biennials and perennials.

convergence of evolution of tree habit in gymnosperms, monocotyledons and dicotyledons,

largest and longest-lived plants. Simple and complex permanent tissues, secretory tissues, tissue systems.

#### UNIT - II

**The shoot system:** The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; formation of internodes; branching pattern; monopodial and sympodial growth; canopy architecture; cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals;

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characteristics of growth rings; sapwood and heartwood; secondary phloem – structure and function; periderm. Anomalous secondary growth.

### UNIT – III

**The leaf:** origin, development, arrangement and diversity in size and shape. Stomata – structure and types, stomatal index. Vascularization of leaf – nodal structure and venation; internal structure in relation to photosynthesis and water loss. Senescence and abscission. The root system: root apical meristem; differentiation of primary and secondary tissues and their functions; structural modification for storage, respiration, reproduction and for microbial interaction with microbes.

### UNIT – IV

**Morphology and anatomy of seed** (monocotyledons and dicotyledons). Significance of seed, suspended animation; ecological adaptation; unit of genetic recombination and replenishment; dispersal strategies. Vegetative reproduction: Vegetative propagation, grafting; economic aspects.

#### Suggested readings:

- Cuttler, E.G. 1971. Plant Anatomy. Part III Organs, Edward Arnold Ltd., London.
- Cuttler, E.G. 1969. Plant Anatomy. Part I Cells and Tissue. Edward Arnold Ltd., London.
- Eames, A.J. and MacDaniels, L.H. 1987. An Introduction to Plant Anatomy. Tata MacGraw-Hill Publishing Company Ltd., New Delhi.
- Esau, k. 1985. Plant Anatomy. 2 nd Edition Wiley Eastern, New Delhi.
- Fahn, A. 1997. Plant Anatomy. Aditya Books (P) Ltd., New Delhi. 32
- Fahn, A. 2000. Plant Anatomy. Permagon Press.
- Gifford, E.M. And Foster, A.S. 1989. Morphology and Evolution of Vascular Plants. W.H. Freeman, New York.
- Pandey, S.N. and Chadha, A. 2014. A text book of Botany- Plant anatomy and Economic Botany. Vikas publishing house Pvt. Ltd, New Delhi.
- Vashishta, P.C. 1974. Plant Anatomy. Pradeep Publication, Jalandhar.
- Singh, V.P., Pandey, P.C. and Jain, D.K. 2011. A Text book of Botany- plant Morphology and anatomy. Rastogi Publication, Merrut.

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CELL BIOLOGY AND PLANT BIOCHEMISTRY

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

**Cell Biology** - Tools and techniques used in cell study; ultrastructure and functions of different cell organelles of eukaryotes and prokaryotes (cell wall, plasma membrane, nucleus, mitochondria, chloroplast, ribosomes, peroxisomes, golgi bodies etc.).

**Cell divisions:** *cell cycle, mitosis* phases, structure and functions of spindle apparatus; anaphasic chromosomes movement;

*Meiosis:* phases, synaptonemal complex formation and fate of chiasmata and significance of crossing over.

UNIT - II

**Chromosome organization:** eukaryotic and prokaryotic, Chromosomes - morphology; centromere, telomere;

specialized types of chromosomes (sex chromosomes, lampbrush chromosomes, polytene chromosomes).

Chromosomal aberrations (Deletion, Duplication, Translocation and Inversion); Aneuploidy and polyploidy.

UNIT - III

**Biomolecules:**

**Carbohydrates:** Importance, nomenclature, classification, structure and function of mono-, di- and polysaccharides, their properties, glycosidic linkages and glycoproteins.

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**Lipids:** Importance of fatty acids (Saturated and unsaturated), biosynthesis (alpha and beta oxidation and synthesis).

**Secondary metabolites:** Concept of Secondary metabolites, classification and significance of Secondary metabolites with special reference to flavonoides, alkaloids and steroids.

#### UNIT - IV

**Proteins:** Importance of amino acids, structure, electrochemical properties, peptide bonds, chemical bonds and nomenclature, structure and classification of proteins, protein synthesis, physical and chemical properties, protein changes during seed germination, seedling and senescence.

**Enzymes:** Discovery, nomenclature, EC number, characteristics of enzymes, enzyme kinetics, mechanism of action, Km value, active sites, holoenzyme, apoenzyme, coenzyme and factors, multienzyme system, regulation of enzyme activity.

#### Suggested Readings:

- Alberts, B., Johnson, A., Lewis, J., Roff, M., Roberts, K. and Walter, P., 2008. Molecular Biology of the Cell. Garland Publishers, New York.
- De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- Gupta, P.K. 2009. Cytology, Genetics, Evolution and Plant breeding, Rastogi publication, Meerut.
- Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley and Sons. Inc. New Jersey, USA.
- Lodish, H., Berk, A., Matsudaira, P., Kaiser, C. A., Krieger, M., Scott, P.M., Zipursky, L. and Darnell, J. 2008. Molecular Cell Biology. W. H. Freeman and company, Macmillan publishers, London.
- Roy, S.C. and De, K.K. 1999. Cell biology. New central Book Agency (P) Ltd., Calcutta.
- Verma, P.S. and Agrawal, V.K. 2012. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Co. Ltd., New Delhi.



- Berg, J.M., Tymoczko, J.L., Stryer, L. 2006. Biochemistry. 6th Edition, W.H. Freeman and Company, New York.
- Buchanan, B., Gruissem, W. and Jones, R. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists, USA.
- Conn, E.E., Stumpf, P.K. and Bruening, G. 2006. Outlines of Biochemistry. 4 th Edition, John Wiley and Sons Inc. New Jersey, USA. 28
- Elliot, W.H. and Elliot, D.C. 2009. Biochemistry and Molecular Biology. Oxford
- Voet, D. and Voet, J.G. 2000. Biochemistry, John Wiley, New York.
- Wilson, K. and Walker, J. 2008. Principles and techniques of Biochemistry and Molecular Biology, Cambridge University Press.

## B.Sc. Semester - IV

### 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 IV Botany

PAPER CODE 22-2001

### GENETICS AND PLANT BREEDING

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

Experimental basis for DNA as genetic material; nucleic acids

DNA and RNA-their structures, types, replication and functions.

RNA Primers, Okazaki-fragments, ideas about polymerase; exons and introns;

DNA Protein interactions, Nucleosome models.

Structure of Gene; Regulation of gene expression in prokaryotes and eukaryotes;

Genetic code: triplet codes their characteristics and significance.

#### UNIT II

**Genetic inheritance:** Mendel's laws of inheritance and their exceptions.

Allelic (complete dominance, co-dominance and incomplete dominance, lethality)

and non-allelic interactions (complementary genes, epistasis and duplicate genes)

Linkage and crossing over. Elementary ideas of chromosome mapping.

#### UNIT III

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**Cytoplasmic inheritance**- maternal influence, shell coiling in snails, Kappa particles in Paramecium.

**Multiple allelism**: characteristics; ABO blood groups in men. Multiple gene inheritance: characteristics; plant height; grain colour in wheat.

**Extra nuclear genome**: presence and function of mitochondrial and plastid DNA; plasmids; transposons.

#### UNIT IV

**Plant Breeding**: Introduction and objectives of plant breeding; general methods of plant breeding (Introduction and acclimatization, selections, hybridizations); hybrid vigour and inbreeding depression.

Role of mutation and polyploidy in plant breeding.

Famous Indian and international plant breeders and their work.

National and international agricultural research institutes.

Plant breeding work done on wheat and rice in India and Green revolution.

Methods of breeding in self-pollinated, cross-pollinated and vegetatively propagated crop plants.

#### Suggested Readings:

- Brooker, R. J. 1999. Genetics: Analysis and Principles. Addison-Wesley, Boston.
- Choudhary, H. K. 1989. Elementary Principle of Plant Breeding. Oxford and IBM Publishing Co., New Delhi.
- De Robertis, E. D. P. and De Robertis, E. M. F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- Dnyansagar, V. R. 1986. Cytology and Genetics, Tata Mc Graw - Hill Pub Co. Ltd., New Delhi. 13
- Gardner, E. J., Simmons, M. J. and Snustad, D. P. 2008. Principles of Genetics. 8th Edition, Wiley India.
- Gupta, P. K. 2009. Cytology, Genetics, Evolution and Plant Breeding, Rastogi Publication, Meerut.
- Miglani, G. S. 2000. Advanced genetics. Narosa Publishing House, New Delhi.

- Shukla, R. S. and Chandel, P. S. 2000. Cytogenetics, Evolution and Plant Breeding, S. Chand and Co. Ltd., New Delhi.
- Singh, R. B. 1999. Text Book of Plant Breeding. Kalyani publishers, Ludhiana.

B.Sc. Semester IV Botany

PAPER CODE 22-4002

### PLANT PHYSIOLOGY AND METABOLISM

**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

**Water relations:** Water structure, physicochemical properties, importance to plant life, concept of water potential.

**Absorption of water and Transport of water:** Ascent of sap, Mechanism of process: Transpiration, Guttation, stomatal movement, limiting factors.

**Mineral Nutrition:** Essential micro and macro nutrients; their uptake, factors affecting, hydroponics and nutrient requirement, deficiency and toxicity symptoms.

**Transport of organic substances:** Mechanism of phloem transport, factors regulating the translocations of nutrients.

#### UNIT- II

**Photosynthesis:** Photosynthetic apparatus, photochemistry, pigments, light reaction, photo system I & II, Z scheme, photophosphorylation, C<sub>3</sub> Calvin cycle, C<sub>4</sub> cycle, photorespiration, Crassulacean acid metabolism and factors affecting the photosynthesis.

#### UNIT - III

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**Respiration:** ATP-the biological energy currency, aerobic and anaerobic respiration, Krebs's cycle, electron transport system, oxidative phosphorylation, Pentose phosphate pathway, respiratory inhibitors and factors affecting the process.

**Nitrogen Metabolism:** Biological N<sub>2</sub> fixation by free living organism, symbiotic N<sub>2</sub> fixation, root nodules, nitrogenase and ammonium assimilation.

#### UNIT- IV

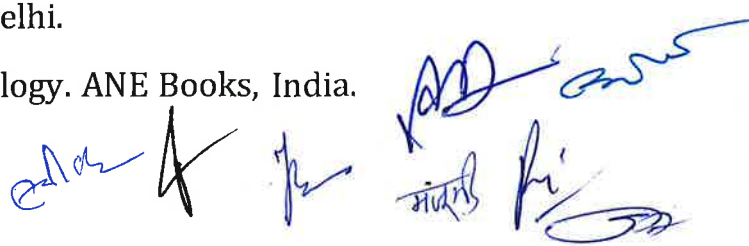
**Phases of growth and development:** Seed dormancy and germination, plant movement, senescence and biological clock- their regulatory factors.

**Photoperiodism & vernalisation,** Physiology and mechanism of action, concept of florigen and phytochrome.

**Plant hormones:** auxins, gibberellins, cytokinins, ethylene and growth retardants; discovery, bioassay & physiology.

#### **Suggested readings:**

- Hopkins, W.G. and Huner, P. A. 2008. Introduction to Plant Physiology. John Wiley and Sons, USA.
- Jain, V.K. 2013. Fundamental of Plant Physiology. S. Chand and Company Ltd., New Delhi.
- Malik, C. P. and Srivastava A.K. 1982. Text book of Plant Physiology. Kalyani publication, New Delhi.
- Mukherjee S., Ghosh A. K. 2006. Plant Physiology. New Central Book Agency, Calcutta.
- Parashar, A. N. and Bhatia, K. N. 1985. Plant Physiology. Trueman Book Company, New Delhi.
- Sinha, R. K. 2007. Modern Plant Physiology. 2 nd Edition Tata McGraw, New Delhi.
- Taiz, L. and Zeiger, E. 2006. Plant Physiology. 4 th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA.
- Verma, S. K. and Verma, M. 2000. A Text book of Plant Physiology, Biochemistry and Biotechnology. S. Chand and co. Ltd., New Delhi.
- Verma, V. 2007. Text Book of Plant Physiology. ANE Books, India.



## B. Sc. BOTANY PRACTICAL EXAMINATION

SEMESTER III & IV

SKELETON PAPER

P-22-4001  
PAPER CODE .....

MAX. MARKS: 100

TIME 4 HOURS

Q. No.	Practical	Marks
1.	Prepare T.S./L.S. of the material "A" provided to you and make its double stained glycerine preparation. Draw a well-labelled diagram. Identify giving reasons. Comment on special points of interest.	15
2.	A. Prepare the acetocarmine stained slide of the material "B" provided to you. Draw a well labelled diagram of anyone -stage of nuclear division. Identify it giving reasons. B. Perform the chemical test of the given material "C". Identify and discuss the observation giving reasons.	10 07
3.	Perform the given physiology experiment and write the principle, procedure & conclusions based on the observation of the experiment. Draw the diagram of the experiment set up and write precautions involved in the experiment.	15
4.	Comment and solve the problem of genetics allotted to you along with suitable reasons.	15
5.	Comment upon the spots (1-6), Identify giving reasons (3 Minutes for each Spot)	18
6.	Viva-Voce	10
7.	Practical Record	10
	<b>Total</b>	<b>100</b>

### Suggested Laboratory Exercises:

- **Plant morphology and anatomy**

1. Anatomical study of root, stem and leaf (dicotyledons and monocotyledons) by making double stained temporary and permanent slides.
2. Anatomical studies of anomalous secondary structure in stem of *Mirabilis*, *Bignonia*, *Borhavia*, *Nyctanthus*, *Salvadora*, *Leptadenia*, *Dracena* by making temporary and permanent slides.
3. Anatomical study of dicot and monocot seed (*Cicer*, *Maize* and *cotton*)

- **Cell biology**

1. Study of different stages of Mitosis and Meiosis in root tip cells and flower buds respectively of onion.

- **Biochemistry**

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

- **Plant Physiology**

1. To determine the osmotic potential of vacuolar sap by plasmolytic method.
2. To study the permeability of plasma membrane using different concentration of organic solvents.
3. To study the effect of temperature 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 demonstrate the rate of transpiration by use of potometers (Ganong's/Farmers)
7. To study the relative rate of transpiration from the leaf surfaces of the different plants using cobalt chloride paper.
8. To demonstrate that oxygen is evolved during the photosynthesis by inverted funnel method.
9. To demonstrate that light is necessary for photosynthesis.
10. To demonstrate the carbon-dioxide, light, water and chlorophyll are essential for photosynthesis by moll's experiment.
11. To compare the rate of photosynthesis under different condition by using Wilmott's bubbler.
12. Separation of chlorophyll pigments by the solvent method.
13. Separation of chlorophyll pigments by the paper chromatography.
14. comparison of the rate of respiration (R.Q.) of various plant parts or substrates with the help of Ganong's respirometer.
15. Bioassay of plant growth hormone (Auxin, Gibberellins and Cytokinin).

- **Genetics**

1. Genetic problems on monohybrid, dihybrid cross, test cross and back cross.
2. Genetic problems on allelic and non-allelic gene interactions, multiple alleles, blood group etc
3. Karyotype preparation.
4. Identification of chromosomes on the basis of their size and centomere position.
5. Pedigree analysis for dormant and recessive autosomal and sex linked traits



**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**

**Coordination Chemistry**

Werner's coordination theory, effective atomic number, chelates, nomenclature of coordination compounds, isomerism in coordination compounds.

**UNIT – II**

**Magnetic Properties of Transition Metal Complexes**

Type of magnetic behavior, methods of determination magnetic susceptibility, spin-only formula, L-S coupling, correlation of  $U_s$  and  $U_{eff}$  values, orbital contribution of magnetic moments, application of magnetic moment data for 3d metal complexes.

**UNIT – III**

**Theories of coordination compounds**

Valence bond theory of transition metal complexes, limitation of valences bond theory, crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters, jahn-Teller effect.

**UNIT – IV**

Application of crystal field stabilization energy in explaining ionic radii of divalent ions of first transition series, heat of hydration of divalent ions of first transition series.

**UNIT – V**

**Electronic spectra of transition metal complexes**

22/01/21  
Anjan Koley

Type of electronic transition, selection rules for d-d transition spectroscopic ground states, spectrochemical series, Orgel-energy level diagrams for  $d^1$  and  $d^9$  states. Discussion of the electronic spectrum of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  complex ion.



21/01  
Dipankar Sen

Organic 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**

Alcohols: Classification and nomenclature. Monohydric alcohols: primary, secondary & tertiary alcohols, method of preparation, hydrogen bonding, acidic nature, reactions of alcohols. Dihydric: alcohols-nomenclature, method of formation chemical reaction of vicinal glycerol oxidative cleavage [ $\text{Pb}(\text{OAc})_4$ ] and  $\text{HIO}_4$  and pinacol-pinacolone rearrangement. Trihydric alcohols-nomenclature and method of formation, chemical reaction of glycerol.

**UNIT – II**

Phenols: Nomenclature, Structure and bonding, preparations of phenols, physical properties and acidic character, comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion reaction of phenols, mechanism of fries rearrangement claisen rearrangement, gatterman synthesis, Hauben-Hoesch reaction. Laderer-Manases reaction and reimertieman reaction. Laderer-Manases reaction and reimertieman reaction.

**UNIT – III**

Ethers and Epoxides: Nomenclature of ethers and method of their formation, physical properties, chemical reaction cleavage and autoxidation, Ziesel's method, crown ethers. Synthesis of epoxides, acid and base catalyzed ring opening epoxides, orientation of epoxides ring opening reaction of grignard and organolithium reagent with epoxides.

**UNIT – IV**

Session 2020-21

a/y



Aldehydes and Ketones – I: Nomenclature and structure of the carbonyl group. Synthesis of Aldehydes and Ketones with particular reference to formaldehyde, acetaldehyde, acetone, benzaldehyde, acetophenone and benzophenone, physical properties, reactivity. Mechanism of nucleophilic addition to carbonyl group. Condensation with ammonia and its derivatives, benzoin aldol, perkin, Knoevenagel condensation, Wittig reaction, Mannich reaction and Cannizzaro's reaction. Use of acetyls as protecting group, oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, MPV, Clemmensen, Wolff-Kishner,  $\text{LiAlH}_4$  and  $\text{NaBH}_4$  reductions, halogenation of enolizable ketones.

#### UNIT – V

Aldehydes and Ketones – II: An introduction to  $\alpha$ ,  $\beta$ -unsaturated aldehydes and ketones, preparation and properties of acrolein, crotonaldehyde and vinyl methyl ketone, Michael reaction.

Acidity of  $\alpha$  – hydrogen, alkylation of diethyl malonate & ethyl acetoacetate (EAA) synthesis of EAA: the Claisen condensation, keto – enol tautomerism of EAA, synthetic importance of diethyl malonate and ethyl acetoacetate, alkylation & acylation of enamines.

21/01  
Dipak Jain



Physical 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

**Electrochemistry**

- (a) Electrolytic conductance, specific, equivalent and molar conductance and their determination, variation of conductance with dilution. Effect of temperature, pressure, solvent and viscosity on conductance. Kohlrouseh's law and its application in determination of
- (1) Degree of dissociation and dissociation constant of weak acids.
  - (2) Solubility of sparingly, soluble salt
  - (3) Hydrolysis constant
  - (4) Ionic product of water

## UNIT – II

Interionic attraction theory, quantitative treatment of theory of strong electrolytes, verification of the Debye Huckel Onsagar equation, conductometric titration.

- (b) Transference number and their determination by (I) Hitoff's method (2) Moving boundary method, Abnormal transference numbers, factors affecting the transport number.

## UNIT – III

**Thermodynamics-I:** Limitation of first law of thermodynamics, spontaneous processes, second law of thermodynamics carnot cycle, Kelvin scale of temperature, Concept of entropy. Entropy change for an

ideal gas, entropy change for physical transformation, Entropy of mixing, physical significance of entropy.

#### UNIT – IV

**Thermodynamics – II:** Free energy and work function. Criteria of chemical equilibrium Gibb's Helmholtz equation. Third law of thermodynamics and determination of absolute entropies, effect of temperature on free energy and enthalpy, maxwell's thermodynamic relations.

#### UNIT – V

**Spectroscopy:** Electromagnetic radiations and wave parameters, interaction of electromagnetic radiations with matter. Ultraviolet and visible spectroscopy having absorption interaction, chromophores and auxochromes, bathochromic and hypsochromic shift determination of wavelength ( $\lambda_{max}$ ) and molar extinction coefficient of compound, electronic transition, colours in complexes, applications of uv-visible spectroscopy.



Analytical 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**

Chromatography: principle of adsorption and partition chromatography, techniques and applications of column, paper and thin layer chromatography, electrophoresis and its applications in separation of amino acids and cations.

**UNIT – II**

Ion exchange methods, general discussions, action of ion exchange resins, column operation, experimental techniques, types of ion exchange resins, determination of the following pairs by ion exchange techniques (a) chloride and bromide (b) nickel and cobalt.

**UNIT – III**

Coductometric titration: The basis of coductometric titrations, apparatus and measurement. Application of coductometric titrations. High frequency titrations, advantages of the techniques, some examples of high frequency titrations.

**UNIT – IV**

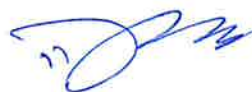
Potentiometric titrations: Introduction, electrodes, instrumentation, potentiometric titrations. Differential potentiometric titrations, automatic potentiometric titrations, location of end points, determination of some metals through potentiometric titrations.

**UNIT – V**

22/04  
Dipak Jain

Spectrophotometric titrations: Basic principle, instrumentation, experimental techniques, spectrophotometrics of Fe(III), Co(II), Ni(II), Fe(III) in presence of Al (III) with EDTA.

Session 2020-21



Dr. Arun Kumar  
Dr. Arun Kumar

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**

**Thermodynamic and kinetic aspects of Metal complex:** A brief outline of thermodynamic stability of metal complexes and factors affecting the stability substitution reactions of square planar complexes.

**UNIT II**

**Chemistry of Lanthanide elements:** General study, Chemistry of separation of Np, Pu and Am from U, electronic configuration. Oxidation states magnetic properties, Complexation behaviour, comparison of lanthanides and actinides, super heavy elements.

**UNIT III**

**Oxidation and reduction:** Redox potential data and their analysis, redox stability in water, frost, Latimer and Pourbaix diagrams, principals involved in the extraction of the elements.

**UNIT IV**

**Acids and bases:** Arrhenius, Bronsted-Lowery, the lux-flood, solvent system and Lewis concept of acids and bases, Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness symbiosis, theoretical basis of hardness and softness, Electronegativity and hardness and softness.

**UNIT V**

20/11/21  
Anupam Jain

**Nonaqueous solvents:** Physical properties of solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$ .

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Organic 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**

**Carboxylic Acids – I:** Nomenclature structure and bonding, physical properties, acidity of carboxylic acids, effects of substitution on acid strength, comparison of acidity with phenols preparation of carboxylic acids, reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction, synthesis of acid chlorides, esters and amides, reduction of carboxylic acids, mechanism of decarboxylation.

Aromatic carboxylic acids: synthesis and reaction of Benzoic acid Salicylic acid, Pthalic acid and Cinnamic acid.

**UNIT – II**

**Carboxylic Acids – II:** Method of formation and chemical reactions of  $\alpha$ ,  $\beta$  and  $\gamma$  hydroxyl acids. Malic, tartaric and citric acids. Method of formation and chemical reactions of unsaturated monocarboxylic acids, dicarboxylic acids. Method of formation and effect of heat and dehydrating agents.

**UNIT – III**

**Carboxylic Acid derivatives:** Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides relative stability of acyl derivatives physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation of carboxylic acid derivatives, chemical reaction mechanism of esterification and hydrolysis (acidic and basic).






Fats, oil and detergents: natural fats, edible and industrial oil, vegetable origin common fatty acids, glycerides, hydrogenation of unsaturated oil, saponification value, iodine value, acid value soaps, synthetic detergents, alkyl and aryl sulphonates.

#### UNIT – IV

**Organic compounds of Nitrogen:** Preparation of nitroalkanes chemical reaction of nitroalkanes mechanism of nucleophilic. Substitution in nitroalkanes and their reduction in acid neutral and alkaline media. Picric acid structure and nomenclature of amines, physical properties, stereochemistry of amines, separation of a mixture of primary, secondary and tertiary amines, structural features affecting basicity of amines, amine salt acts phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds & nitriles). Reductive amination of aldehydic and ketonic compounds Gabrielphthalimide reaction. Hofmann bromamide reaction. Reaction of amines. Aryl diazonium salts, preparation and synthetic transformations, azo coupling diazomethane.

#### UNIT – V

**NMR Spectroscopy:** Proton magnetic resonance spectroscopy. Introduction, nuclear spin & energy levels transitions, equivalent & non equivalent protons, nuclear shielding and deshielding, chemical shift spin-spin coupling and coupling constant areas of signals, interpretation of PMR spectra of simple organic molecules like  $C_2H_5Br$ ,  $C_2H_5OH$ ,  $CH_3CHO$ , 1,1,2-tribromomethane, ethyl acetate, toluene and acetophenone.

Note: Mechanism of reactions should be studied where possible.

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Physical Chemistry

PAPER CODE 22-4018

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**

Spectroscopy: IR Spectroscopy, conditions of IR Spectroscopy, modes of vibrations in diatomic, linear and non-linear polyatomic molecules, force constant and its significance. Applications of infrared spectroscopy in elucidation of structure of molecules.

**UNIT II**

Quantum Chemistry – I: Quantum theory of radiations, photoelectric effect and Compton effect. Limitations of Bohr models, Heisenberg uncertainty principle, wave nature of electron, De Broglie wave equation and its experimental verification, operator and their applications.

**UNIT III**

Quantum Chemistry – II: Sinusoidal wave motion, derivation of Schrodinger's wave equation, physical significance of  $\psi$  (psi) and  $\psi^2$  (psi)<sup>2</sup> eigenvalue and eigen functions Characteristics of wave function. Normalization and orthogonality of wave functions solution of Schrodinger wave equation particle in one dimensional box.

**UNIT IV**

Photochemistry – I: Absorption of light Grothus Draper law, Einstein's law of photo chemical equivalence quantum yield of photochemical reactions. Reasons for high and low quantum yield of photochemical equations. Primary and secondary process, chain reaction between  $H_2 + Br_2$ .

**UNIT V**

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Photochemistry – II: Photochemical reaction such as (1)  $H_2 + Cl_2$  reaction  
(2) photolysis of ammonia (3) hydrolysis of mono chloroacetic acid.  
Consequences of light absorption – phosphorescence fluorescence,  
chemiluminescence & photosensitization.

Session 2020-21

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Analytical Chemistry

PAPER CODE 22-4019

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**

Nephelometry & Turbidimetry: General discussion instrumentation some nephelometry determination (a) Sulphate (b) phosphate.

**UNIT II**

Atomic emission and atomic absorption spectrometry: Elementary theory instrumentation. Nebulization, flames and flame temperatures interferences flame spectrometric techniques.

**UNIT III**

Flame emission and atomic flame emission and spectrography: Spectroscopic instrument for emission spectroscopic analysis qualitative and quantitative spectrographic analysis quantitative spectrographic analysis of (a) a non ferrous alloy (b) a complex organic mixture.

**UNIT IV**

Thermal analysis: Thermogravimetry (TG), instrumentation, thermometric titration, applications.

**UNIT V**

Differential thermal analysis and differential scanning calorimetry instrumentation.

## CHEMISTRY PRACTICAL B.Sc.(Hons.) PT-II

5 hrs. Duration

4 hrs./ week

Max. Marks: 200

Min. Marks: 72

PAPER CODE P-22-4016

Exercises

Inorganic Chemistry

## Quantitative (Gravimetric) (any five)

Estimation of barium (as sulphate)

Lead (as chromate)

Copper (as cuprous thioeynate)

Nickel (as dimethyl glyoximate)

Silver (as chloride)

Zinc (as zinc amm.phospate)

Magnesium (as magnesium hydrogen phosphate:  $MgHPO_4$ )

Inorganic preparations (any four) of coordination compounds &amp; their characterization.

- Chloropentminecobalt (III) chloride.
- Chloropentminecobalt (III) chloride.
- Pyridine complex of copper.
- Copper tetrammine complex.
- Mercury tetrathiocyanatocobaltate.
- Hexaammonickel (II) chloride.

## Organic Chemistry

Simple one step organic preparation the students are expected to perform at least five of the following preparations.

- Preparation of m-dinitrobenzene from nitrobenzene.
- Preparation of acetanilide from aniline.
- Preparation of aspirin from salicylic acid
- Preparation of o-and p-bromo acetanilide from acetanilide.
- Preparation of o-and p-bromo aniline from o-and p-bromo acetanilide.
- Partial reduction m-dinitrobenzene into m-nitroaniline.
- Preparation of methyl orange from suphanilic acid.
- Preparation of acetylglycine from glycine.

Exercises

Organic Chemistry

Identification of simple compound and preparation of its suitable derivative.

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1. At least three experiments are to be performed not less than one from each part.

(A) Chemical Dynamics experiments:

1. To find velocity <sup>constant</sup> of the hydrolysis of methyl acetate catalyzed by an acid.
2. To determine the order of saponification of ethyl acetate by NaOH.
3. To find out the rate constant and order of reaction between potassium persulphate and potassium iodide.
4. To study reaction between acetone and iodine.

(B) 5. Determination of transition temperature by thermometric method and dilatometric method.

(C) 6. Determination of molecular weight of non-volatile solute by cryoscopic method and application of technique for determination of the Vant Hoff factor or degree of dissociation of an electrolyte.

2. Conductometric titrations.

- (a) To find the strength of strong acid by titrating it against a strong alkali.
- (b) To find strength of weak acid titrating it against a strong alkali.
- (c) To find strength of hydrochloric acid and acetic acid in a mixture of both by titrating it against sodium hydroxide.

3. Determination of equivalent conductivity of electrolyte at different dilutions.

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Anupam Jain

**REAL ANALYSIS**

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**

Real number as complete ordered field, properties of continuous functions on closed intervals

**UNIT - II**

Limit point, Bolzano-weierstrass theorem, Closed and Open sets, Union and Intersection of such sets. Concept of compactness. Heine-Borel theorem. Connected sets. Properties of derivable functions, Darboux's and Rolle's theorem.

**UNIT - III**

Real sequences- Limit and Convergence of a sequence, Monotonic sequences.

**UNIT - IV**

Cauchy's sequence, Subsequence, cauchy's general principle of convergence. Notion of limit and continuity for functions of two variables

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**DIFFERENTIAL EQUATIONS - 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**

Degree and order of a differential equation. Equations of first order and first degree. Equations in which the variables are separable. Homogeneous equations and equations reducible to homogeneous form.

**UNIT - II**

Linear equations and equations reducible to linear form. Exact differential equations and equations which can be made exact. First order but higher degree differential equations solvable for  $x$ ,  $y$  and  $p$ .

**UNIT - III**

Clairaut's form and singular solutions with extraneous Loci. Linear differential equations with constant coefficients. Complimentary function and particular integral.

**UNIT - IV**

Homogenous linear differential equations, Exact linear differential equations of  $n$ th order.

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**NUMERICAL 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**

Differences. Relation between differences and derivatives. Differences of a polynomial.

**UNIT - II**

Factorial function, Newton's formulae for forward and backward interpolation. Divided differences. Newton's divided difference, Interpolation formula. Lagrange's interpolation formula.

**UNIT - III**

Central differences. Gauss's, Stirling's and Bessel's interpolation formulae. Numerical Differentiation. Derivatives from interpolation formulae.

**UNIT - IV**

Numerical integration, Newton-Cote's formula, Trapezoidal rule, Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae.

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**REAL ANALYSIS AND METRIC SPACE**

*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**

Riemann integration - Lower and Upper Riemann integrals, Riemann integrability, Mean value theorem of integral calculus, Fundamental theorem of integral calculus.

**UNIT II**

Sequence and series of functions – Point wise and Uniform convergence, Cauchy's criterion, Weierstrass M-test, Abel's test, Dirichlet's test for uniform convergence of series of functions, Uniform convergence and Continuity of series of functions, Term by term differentiation and integration. Metric space - Definition and examples.

**UNIT III**

Metric space, definition & simple properties of open and closed sets, Interior and Closure of a set, Limit point of a set. Subspace of a metric space, Product space.

**UNIT IV**

Continuous mappings, Sequence in a metric space, Cauchy sequence. Complete metric space, Baire's theorem, Compact sets and Compact spaces, Connected metric spaces.

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**DIFFERENTIAL EQUATIONS - 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**

Linear differential equations of second order. Linear independence of solutions. Solution by transformation of the equation by changing the dependent variable/the independent variable, Factorization of operators.

**UNIT II**

Method of variation of parameters, Method of undetermined coefficients. Partial differential equations of the first order. Lagrange's linear equation. Charpit's general method of solution.

**UNIT III**

Simultaneous differential equations. Existence and uniqueness theorem.

**UNIT IV**

Homogeneous and non-homogeneous linear partial differential equations with constant coefficients. Equations reducible to equations with constant coefficients.

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**NUMERICAL ANALYSIS – II & VECTOR CALCULUS**

*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**

Numerical solution of algebraic and transcendental equations. Bisection method, Regula-Falsi method, Method of iteration, Newton-Raphson method.

**UNIT II**

Gauss elimination and Iterative methods (Jacobi and Gauss Seidal) for solving system of linear algebraic simultaneous equations. Solutions of ordinary differential equations of first order with initial and boundary conditions using Picard's and modified Euler's method.

**UNIT III**

Runge – Kutta Method, Scalar point function. Vector point function. Differentiation and integration of vector point functions. Directional derivative.

**UNIT IV**

Gradient, Divergence, Curl and identities involving three operators. Gauss divergence theorems, Green's and Stokes theorems (without proof) their application.

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## PHYSICS – I

## Statistical and Thermodynamical Physics – I

(MM33)

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. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will be of short answer type covering entire course with no choice. The candidates will be required to attempt all the five questions.

## UNIT – I

First law of thermodynamics: Microstates of the systems Thermal interaction, Thermal insulation, Adiabatic interaction and Enthalpy, Concept of temperature and Zeroth law of thermodynamics, idea of temperature scales, thermodynamical parameter, distribution of energy, first law of thermodynamics.

## UNIT – II

Second Law of Thermodynamics & Heat Engines: Second law of thermodynamics (Different statement and their equivalence). System in contact with a heat reservoir (Canonical distribution). Partition function. Reversible and irreversible processes. Heat engines, Carnot cycle, Carnot's ideal Engine and Refrigerator. Thermodynamical scale as an absolute scale.

## UNIT – III

General Thermodynamic Interactions: Dependence of number of states on External parameters, General relations in equilibrium, equilibrium conditions, Infinitesimal quasistatic process, entropy of an ideal gas, equilibrium of an isolated system, equilibrium of system in contact with a reservoir (Gibb's free energy).

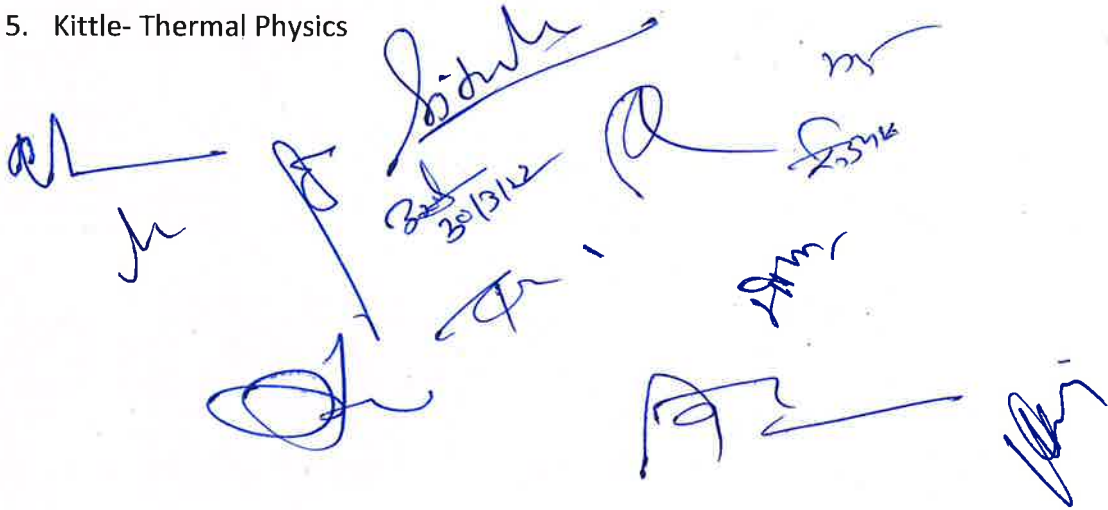
## UNIT – V

Thermodynamic Relations: Equilibrium between phases, Clausius Clapeyron equation. Triple point, vapor pressure in equilibrium with a liquid or solid, equilibrium conditions for a system of fix volume in contact with heat reservoir (Helmholtz free energy). Deduction of Maxwell's relations and their applications.

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## Reference Books

1. Berkeley Series Vol V, Statistical Physics.
2. Reif- Thermodynamics and Statistical Physics
3. Loknathan and Khandelwal- Thermodynamics and Statistical Physics
4. Sears- Thermodynamics, Kinetic theory of gases and Statistical Physics
5. Kittle- Thermal Physics



## B.Sc.Part-II Semester III

## PHYSICS-II

## Mathematical Physics – I

(MM33)

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. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will be of short answer type covering entire course with no choice. The candidates will be required to attempt all the five questions.

## UNIT – I

**Orthogonal Curvilinear Coordinate System:** Orthogonal curvilinear coordinate systems, scale factors, expression for gradient, divergence, curl and their application to Cartesian, circular cylindrical and spherical polar coordinate.

## UNIT – II

**Tensors:** Coordinate transformation and Jacobian, Transformation of covariant, Contravariant and mixed tensor. Addition, multiplication and contraction of tensors. Metric tensor and its use in transformation of tensors. Dirac Delta function and its properties.

## UNIT – III

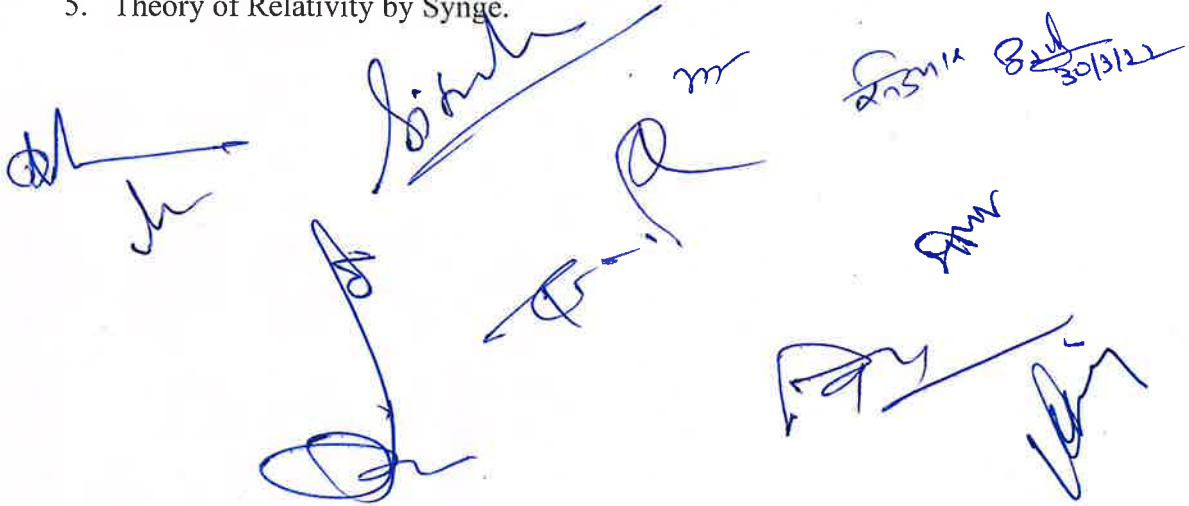
**Four Vectors:** Four-vector formulation, energy-momentum four vector, Relativistic equation of motion, invariance of rest mass, Orthogonality of four force and four velocity, Lorentz force as an example of four force, Transformation of four frequency vector, Longitudinal and transverse Doppler's effect.

## UNIT – IV

**Relativistic Dynamics:** Transformation between laboratory and center of mass system, four momentum conservation, kinematics of decay products of unstable particles and reaction thresholds; Pair production, inelastic collision of two particles, Compton effect. Lorentz transformation and rotation in space-time like and space like vectors, world line, macro causality.

## Reference Books

1. Mathematical methods for Physicists by George Arfken, Academic Press.
2. Applied Maths for engineers and Physicists by Pipes and Harvell (Mc Graw Hill).
3. Mathematical methods by Potter and Goldberg (Prentice Hall, India).
4. Special Relativity by A.P. French (English Language Book Society).
5. Theory of Relativity by Synge.



## PHYSICS -III

## Electronics – I

(MM34)

Note: 34 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. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will be of short answer type covering entire course with no choice. The candidates will be required to attempt all the five questions.

## UNIT – I

**Circuit Analysis: Networks** – Some important definition, loop and nodal equations based on DC and AC circuits. **Kirchhof's Laws** - Four terminal network Ampere-volt conventions, open, close and Hybrid parameters of any four terminal network. **Network Theorems** – Superposition, Thevenin, Norton and Reciprocity, Compensation, Maximum power transfer.

## UNIT – II

**Semiconductor and Semiconductor diodes:** Energy band in solids. Intrinsic and extrinsic semiconductors, charge densities in N and P materials. Conduction by drift and diffusion of charge. P-N junction diode equation, capacitance effect. P-N junction and Zener Diode and their I-V characteristics.

## UNIT – III

**Rectifiers and Power Supplies:** Diode as a rectifier, Halfwave, full wave and Bridge rectifiers, calculation of ripple factor, efficiency and regulation. **Filters** – Series inductor, Shunt Capacitor, L-section and  $\pi$  section filters. **Voltage Regulation** – Voltage regulation and voltage stabilization by Zener diode. Voltage multiplier.

## UNIT – IV

**Transistor and Transistor Amplifiers:** Notations and volt ampere characteristics for bipolar junction transistors. Concept of load line and operating point, Hybrid parameters, CB, CE, CC configurations. Analysis of transistor amplifiers using hybrid parameters and its gain, frequency response. Stability factors, various types of bias circuit for thermal bias stability, Fixed bias, collector to base feed back bias and four resistor bias.

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## Reference Books

1. John D. Ryder, Electronics Fundamentals and Applications, Prentice Hall of India Pvt. Ltd., New Delhi.
2. John D. Ryder, Engineering Electronics, McGraw Hill Book Company, New Delhi.
3. Jacob Millman and Christoc Halkias, Integrated Electronics, Analog and Digital Circuits and Systems, McGraw Hill Ltd.
4. Albert Paul Malvino, Digital Computer Electronics, Tata McGraw Hill Pub. Co, Ltd., New Delhi.
5. Kumar and Gupta, Handbook of Electronics.
6. G. K. Mithal, Handbook of Electronics.
7. G. K. Mithal, Electronic Devices and Applications
8. R.P. Jain, Digital Electronics.

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**B.Sc.Part-II Semester IV**

**PHYSICS (401) Statistical and Thermodynamical Physics – II (MM33)**

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

<b>Continuous evaluation</b>	<b>10 marks</b>
<b>Term End Main Exam</b>	<b>23 marks</b>

**Duration : 3 hour**

**Note:- In all five questions are to be set. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will be of short answer type covering entire course with no choice. The candidates will be required to attempt all the five questions.**

**UNIT – I**

**Production of Low Temperatures and Applications:** Joule Thomson expansion and J.T. coefficients for ideal as well as Vander Wall's gas, porous plug experiment, Temperature inversion, Regenerative cooling and cooling by Adiabatic expansion and demagnetization, Liquid Helium, He-I and He-II, super fluidity, Refrigeration through Helium dilution Quest for absolute zero, Nernst heat theorem.

**UNIT – II**

**The Distribution of Molecular Velocities:** The distribution of molecular velocities, most probable, average and RMS velocities, the energy distribution function, effusion of molecular beam, experimental verification of Maxwell velocity distribution, The principle of equipartition of energy. Mean free path, distribution of free paths. Transport phenomena; Coefficients of viscosity. Thermal conductivity. Diffusion and their interrelations.

**UNIT – III**

**Classical Statistics:** Validity of classical approximation, Phase space, Micro and macro state, Thermodynamical probability, Relation between Entropy and Thermodynamical probability, The monatomic ideal gas, the barometric equation, specific heat capacity of diatomic gas, Heat capacity of solids.

**UNIT – IV**

**Quantum Statistics:** Black body radiation and failure of classical statistics. Postulates of quantum statistics, indistinguishability, wave function, exchange degeneracy, a priori-probability. Bose Einstein's Statistics and its distribution function. Planck's distribution function and radiation formula, Fermi-Dirac statistics and its distribution function, contact potential. Thermionic emission, specific heat anomaly of metals, nuclear spin statistics (para and ortho hydrogen).

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## B.Sc.Part-II Semester IV

## PHYSICS-II

## Mathematical Physics – II

(MM33)

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. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will be of short answer type covering entire course with no choice. The candidates will be required to attempt all the five questions.

## UNIT – I

**Relativistic Electrodynamics:** Law of conservation of charge and equation of continuity. Lorentz transformation of charge and current densities. Lorentz transformation of an electric field and Magnetic field. Description of Maxwell's equation in tensor form.

## UNIT – II

**Differential Equations of Second Order and Special Functions - 1:** Linear differential equation with variable coefficient and singular points, series solution method and its application to the Legendre's differential equation. Rodrique's formula, Integral properties of Legendre polynomials, generating functions of  $P_n(x)$ , Recurrence relations of  $P_n(x)$ , Associated Legendre's polynomials graphical representations.

## UNIT – III

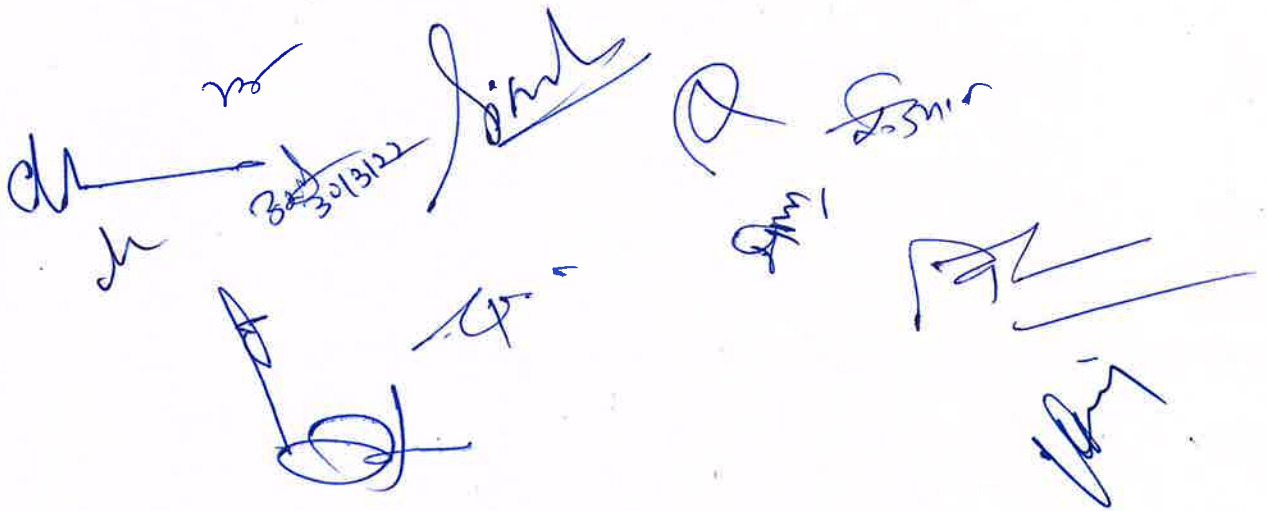
**Differential Equations of Second Order and Special Functions -2 :** Hermite differential equation, generating functions of  $H_n(x)$ , Recurrence relations of  $H_n(x)$ , Orthogonality relation for Hermite equation. Laguerre differential equation, generating functions of Leguerre polynomials, Recurrence relations of  $L_n(x)$ , Rodrique's formula for  $L_n(x)$ , Orthogonality relation for Laguerre polynomials. Associated Leguerre equation.

## UNIT – IV

**Boundary Value Problems:** Techniques of separation of variables and its application to following boundary value problem (i) Laplace equation in three dimension Cartesian coordinate system-line charge between two earthed parallel plates, (ii) Helmholtz equation in circular cylindrical coordinates – Cylindrical resonant cavity. (iii) Wave equation in Spherical Polar coordinates - vibration of a circular membrane (iv) Diffusion equation in two dimensional Cartesian coordinate system – Heat conduction in a thin rectangular plate (v) Laplace equation in spherical coordinate system – electric potential around a spherical surface.

## Reference Books

1. Mathematical methods for Physicists by George Arfken, Academic Press.
2. Applied Maths for engineers and Physicists by Pipes and Harvell (Mc Graw Hill).
3. Mathematical methods by Potter and Goldberg (Prentice Hall, India).
4. Special Relativity by A.P. French (English Language Book Society).
5. Theory of Relativity by Synge.



Note: 34 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. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will be of short answer type covering entire course with no choice. The candidates will be required to attempt all the five questions.

#### UNIT – I

**Amplifier with Feed Back:** Concept of feed back, Positive and negative feedback. Voltage and current feedback circuits. Advantage of negative feedback, Stabilization of gain, effect of negative feedback on output and input resistances, reduction of nonlinear distortion, effect of gain frequency response.

#### UNIT – II

**Oscillators:** Criterion for self excited and self sustained oscillations, Circuit requirement for build up of oscillations. Basic transistor oscillator circuit and its analysis, Colpitt's and Hartley oscillators, R-C Oscillators, Crystal oscillators and its advantages.

#### UNIT – III

**Field Effect Transistor:** Junction field effect transistors (JFET), Metal oxide semiconductor field effect transistors (MOSFET), Circuit symbols, biasing, volt-ampere characteristics, Source follower operation of JFET, FET as variable voltage resistor.

#### UNIT – IV

**Digital Circuits:** Binary number system, Binary arithmetic. Logic fundamental AND, OR, NOT, NOR NAND, XOR. Boolean algebra, Simplification of Boolean expressions. De Morgan's theorems. Positive and Negative logic. Logic gate realization using DTL and TTL.

#### Reference Books

- John D. Ryder, Electronics Fundamentals and Applications, Prentice Hall of India Pvt. Ltd., New Delhi.
- John D. Ryder, Engineering Electronics, McGraw Hill Book Company, New Delhi.
- Jacob Millman and Christoc Halkias, Integrated Electronics, Analog and Digital Circuits and Systems, McGraw Hill Ltd.
- Albert Paul Malvino, Digital Computer Electronics, Tata McGraw Hill Pub. Co, Ltd., New Delhi.
- Kumar and Gupta, Handbook of Electronics.
- G. K. Mithal, Handbook of Electronics.
- G. K. Mithal, Electronic Devices and Applications.
- R.P. Jain, Digital Electronics.

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## B. Sc Part II

## 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. Study of dependence of velocity of wave propagation on line parameter using torsional wave apparatus.
2. Study of variation of reflection coefficient with nature of termination using torsional wave apparatus.
3. Using Platinum resistance thermometer find the melting point of a given substance.
4. Using Newton's rings method find out the wave length of a monochromatic source and find the refractive index of liquid.
5. Using Michelson's interferometer find out the wavelength of given monochromatic source (Sodium light).
6. To determine dispersive power of prism.
7. To determine wave length by grating.
8. To determine wave length by Biprism.
9. Determine the thermodynamic constant  $\gamma$  using Clements & Desorme's method.
10. To determine thermal conductivity of a bad conductor by Lee's method.
11. Determination of ballistic constant of a ballistic galvanometer.
12. Study of variation of total thermal radiation with temperature.

## Section - B

1. Plot thermo emf versus temperature graph and find the neutral temperature (Use sand bath)
2. Study of power supply using two diodes / bridge rectifier with various filter circuits.
3. Study of half wave rectifier using single diode and application of L and  $\pi$  section filters.
4. To study characteristics of a 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 ( $\cos\theta$ ) of a given coil using CRO.
7. Study of single stage transistor audio amplifier (Variation of gain with frequency).
8. To determine e/m by Thomson's method.
9. Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO.
10. Measurement of inductance of a coil by Anderson's bridge.
11. Measurement of capacitance and dielectric constant of a liquid and gang condenser by de-sauty bridge.

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**MAMMALIAN PHYSIOLOGY**

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****Nutrition & Digestion**

- Nature of Food stuff,
- Digestive enzymes & their action in alimentary canal,
- Hormonal control of digestion, Absorption

**UNIT - II****Circulation**

- Composition & Function of Blood and lymph,
- Blood clotting mechanism,
- Cardiac cycle, Heartbeat, blood pressure,
- Angina pectoris, Myocardial infarction, E.C.G

**UNIT - III****Respiration**

- Mechanism & control of Breathing,
- Gaseous exchange in tissues,
- Transportation of oxygen and carbon di oxide in blood,
- Mechanism & regulation of respiration

**Excretion**

- Structure & Function of Kidney,
- Mechanism of urine formation,
- Hormonal regulation of water & electrolyte balance

**UNIT - IV****Nervous system**

- Structure of neurons,
- Origin and propagation of nerve impulse,
- Synaptic transmission, Reflex action & reflex arc

**Muscular system**

- Structure & types of muscle,
- Mechanism of skeletal muscle contraction

**UNIT - V****Endocrine System**

- Endocrine glands and their Hormones, Mechanism of Hormone action,
- Role of hypothalamus,
- Role of hormones in Reproduction, Pregnancy & Lactation

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**BIOTECHNOLOGY AND IMMUNOLOGY**

22-3014

Scheme of examination:

MM: 35

- 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**

- Definition, History, scope and application of biotechnology, Major areas of biotechnology.
- Vectors for gene transfer (plasmids and phages).
- Recombinant DNA technology & its applications.

**UNIT - II**

- Applications of genetic engineering, GMO & their importance, hazards and regulations. Transgenic animals, their uses in biotechnology
- Brief account of cloning, its advantages and disadvantages.
- Biotechnology in Medicine (outline idea only): P.C.R., Antibiotics. Vaccines.

**UNIT - III**

- Hybridoma technology, Monoclonal antibodies and their applications
- Food, drink and dairy Biotechnology (outline idea only),
- Fermented food production: dairy products, alcoholic beverages, food preservation.
- Scope of biotechnology based industries.

**UNIT - IV**

- Immunity:** Innate & acquired immunity,
- Antigen, Antigenicity of molecules, haptens.
- Immunoglobulins: Structure and functions,
- Antigen-antibody reactions: Precipitation reaction, agglutination reaction, neutralizing reaction, complement and lytic reactions and phagocytosis.

**UNIT - V**

- Type of immune regulating cells
- Cytokines
- Mechanism of humoral & cell mediated immune response.
- Complement and its action,
- AIDS

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**BIOCHEMISTRY**

22-4013

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****Carbohydrates**

- Classification & Structure,
- Metabolism- Oxidation of glucose through glycolysis, Krebs's cycle & oxidative phosphorylation,
- Interconversion of glycogen and glucose in liver

**UNIT II****Lipids**

- Classification & structure.
- Metabolism- Beta-oxidative pathway of fatty acids
- Biosynthesis of Triglycerides.

**UNIT III****Proteins**

- Classification & structural properties,
- Amino acids & peptides- Properties & structure,
- Metabolism- Transformation of amino acids, Deamination, Transamination, Decarboxylation,
- Synthesis of Urea (Ornithine cycle)

**UNIT IV**

- pH and Buffers,
- Nature of chemical bonding,
- **Enzymes:** Classification & Characteristics of enzymes.
- Michaelis-Menten Equation.

**UNIT V**

- **Biochemical techniques** (Brief account): Chromatography, Colorimetry & pH Meter,
- Vitamins- Fat soluble and water soluble vitamins.

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**MICROBIOLOGY***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**

- Brief introduction to the history of Microbiology: Work of Anton Van Leeuwenhoek, Work of Louis Pasteur, John Tyndall, Robert Koch & Jenner
- Prokaryota(Bacteria): Size, shape & pattern of Arrangement
- Structural Organization—Slime layer (Capsule), Cell envelope, Cytoplasmic membrane (Inner membrane), Cell wall (Outer membrane) of gram-ve & gram +ve bacteria, Mesosomes; Cytoplasmic organization, Cell projections- Flagella & pili

**UNIT II**

- Virus- classifications, Life cycles (Lytic & Lysogenic cycles)
- COVID-19, Swine flu, SARS, AIDS.
- Genetic material of bacteria: Chromosomes, Plasmids,
- Replication of bacterial DNA

**UNIT III**

- Reproduction in Bacteria: Asexual reproduction: Binary fission, budding, Endospore formation & cyst formation,
- Sexual reproduction: Conjugation, Transduction & Bacterial recombination.
- Microbial nutrition culture of Bacteria
- Microbial growth
- Environmental factors: Temperature, pH

**UNIT IV**

- Bacterial of medical importance:
- Gram +ve:
  - Cocci : Staphylococci, Streptococci
  - Bacilli: Diphtheria, Tetanus
- Gram -ve:
  - Cocci: Gonorrhoea, Meningitis
  - Bacilli: Diarrhea

**UNIT V**

- Mycobacteria: Tuberculosis
- Hepatitis (with emphasis on B type)The causative agents, Transmission, Pathogenicity, Laboratory, Diagnosis, Treatment & Prevention

exam.

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