

**Syllabus of the B.Sc. (Biotechnology) Programme**

*(To be effective from 2013-14)*

**Course structure**

**First Year**

Semester	Paper no	Title of the Course	Theory/ Practical	Marks	Lecture/ Practical
I	I	Diversity and classification of the plant*/animal# kingdom	theory	75	45 theory
		Diversity and classification of the plant*/animal# kingdom	practical	25	13 practical
	II	Basic Microbiology	theory	75	45 theory
		Basic Microbiology	practical	25	13 practical
II	III	Plant */animal# physiology	theory	75	45 theory
		Plant* /animal# physiology	practical	25	13 practical
	IV	Essential Physics for Biologists	theory	75	45 theory
		Essential Physics for Biologists	practical	25	13 practical

\*for Chemistry- Zoology-Biotechnology subject combinations.

#for Chemistry-Botany-Biotechnology subject combinations.

**Second Year**

Semester	Paper no	Title of the Course	Theory/ Practical	Marks	Lecture/ Practical
III	V	Biochemistry	theory	75	45 theory
		Biochemistry	practical	25	13 practical
	VI	Biostatistics and Bioinformatics	theory	75	45 theory
		Biostatistics and Bioinformatics	practical	25	13 practical
IV	VII	Essential Mathematics for Biologists	theory	75	45 theory
		Essential Mathematics for Biologists - Problem solving	practical	25	13 practice sessions
	VIII	Immunology	theory	75	45 theory
		Immunology	practical	25	13 practical

**Third year**

<b>Semester</b>	<b>Paper no</b>	<b>Title of the Course</b>	<b>Theory/ Practical</b>	<b>Marks</b>	<b>Lecture/ Practical</b>
V	IX	Molecular Biology	theory	100	50 theory
	X	Plant Biotechnology	theory	100	50 theory
	XI	Industrial Biotechnology	theory	100	50 theory
	XII	Techniques in biotechnology	theory	100	50 theory
	Lab Course I	Molecular Biology & Plant Biotechnology	practical	100	15 practical
	Lab Course II	Industrial Biotechnology & Techniques in Biotechnology	practical	100	15 practical
VI	XIII	Concepts in Genetic Engineering	theory	100	50 theory
	XIV	Animal Cell Culture	theory	100	50 theory
	XV	Environmental Biotechnology	theory	100	50 theory
	XVI	Food Biotechnology	theory	100	50 theory
	Lab Course III	Genetic Engineering & Animal Cell Culture	practical	100	15 practical
	Lab Course IV	Environmental & Food Biotechnology	practical	100	15 practical
		Project work		100	

## SYLLABUS

### Semester I

#### \* PAPER I: DIVERSITY AND CLASSIFICATION OF THE PLANT KINGDOM

Sr.No.	Topic	Sub-topic	No. of Lectures
1	<b>Plant kingdom</b> Classification of kingdoms and the criteria	Three domain classification (Prokaryotes and Eukaryotes), life span, nutrition and ecological status. Origin, evolution and phylogeny of land plants.	6
2	<b>Algae</b>	General characters, Classification (Bold and Wynne), range of thalli and reproductive structures, types of life cycles with minimum one example each. Ecological, economic and biotechnological significance.	7
3	<b>Fungi</b>	General characters, nutritional modes, classification (G.C. Ainsworth), range of vegetative and reproductive structures,, important features of Mastigomycotina - <i>Pythium</i> ;; Zygomycotina - <i>Mucor</i> ; Ascomycotina - <i>Saccharomyces</i> ; Basidiomycotina - <i>Agaricus</i> ; Deuteromycotina - <i>Cercospora</i> General account of Lichens and Mycorrhizae; Ecological, economic and biotechnological significance of fungi.	7
4	<b>Bryophytes</b>	General characters, classification (G.M.Smith), study of morphology, anatomy, reproduction of Hepaticae, Anthocerotae and Musci; Ecological and economic importance of bryophytes.	7
5	<b>Pteridophytes</b>	Salient features of primary vascular plants; classification (Foster & Gifford), Comparative study of morphology, anatomy, reproduction of Psilopsida, Lycopsida, Sphenopsida and Pteropsida	7
6	<b>Gymnosperms</b>	Classification (Coulter and Chamberlain) and salient features Comparative general study of morphology, anatomy and reproduction of Cycadales, Coniferales and Gnetales; Economic importance.	6

<b>7</b>	<b>Angiosperms</b>	Unique features of angiosperms; nomenclature (as per ICBN) and Classification; general account of morphology, anatomy, flower structure, reproduction and seed development.	<b>5</b>
----------	--------------------	---	----------

### Practical

<b>Topic</b>	<b>No of Practicals</b>
Study of algal types through temporary mounting and staining <ul style="list-style-type: none"> <li>- Nostoc</li> <li>- <i>Volvox</i></li> <li>- Sargassum –T.S. of main axis</li> </ul>	02
Study of fungi by mounting temporary slides <ul style="list-style-type: none"> <li>- Saccharomyces</li> </ul> Study of Lichens – Crustose, Foliose, Fruticose	01
Study of mycorrhizae <ul style="list-style-type: none"> <li>- trypan blue staining method</li> </ul>	01
Microscopic study of thallus structures <ul style="list-style-type: none"> <li>- Riccia – V.S. of thallus</li> <li>- Selaginella – T.S. of pinna passing through sorus</li> <li>- Cycas – T.S. of leaflet</li> </ul>	03
A study of the representative members of the following angiosperm families: <ul style="list-style-type: none"> <li>- Papilionaceae/Fabaceae (<i>Gliricidia sp.</i>),</li> <li>- Asteraceae (Sunflower /Chrysanthemum/ <i>Tridax sp.</i>),</li> <li>- Liliaceae (<i>Alium cepa</i>), (Bentham &amp; Hooker’s Classification)</li> </ul>	03
Anatomy of monocot root and stem <ul style="list-style-type: none"> <li>- maize/any other suitable material</li> </ul>	01
Anatomy of dicot root and stem <ul style="list-style-type: none"> <li>- sunflower / any other suitable material</li> </ul>	01
Embryology – study of anther, ovule, embryo sac, embryo and endosperm using permanent slides	01
<b>Total</b>	<b>13</b>

### Reference / Text Books:

1. Bold H.C., Alexopoulos, C.J. and Delevoryas, T. 1980. Morphology of Plant and Fungi. Harper and Foul Co., New York.
2. Bold H.C. and Wynne M.J. 1978. Algae - Structure and Reproduction. Prentice Hall, New Jersey.
3. Dube H.C. 1990. An Introduction to Fungi. Vikas Publishing House Ltd., Delhi.
4. Gangulee and Kar, 1980. College Botany. Vols. I and II. New Central Book Agency, Calcutta, India.
5. Parihar N.S. 1970. An Introduction to Embryophyta. Vol I Bryophyta. Central Book Depot, Allahabad.
6. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot, Allahabad.
7. Prescott G.W. 1969. Algae - A Review, Thomas Nelson & Son Ltd, London.
8. Sundarajan . 1997. College Botany, Vols. I and II, S. Chand & Co. Ltd., New Delhi.
9. Vasishta B.R. 1988. Algae. S. Chand and Company Ltd, New Delhi.
10. Webster J. 1970. Introduction to Fungi. Cambridge University Press, New York.
11. Pandey, Mishra and Trivedi. 1982. College Botany. S. Chand and Company Ltd., New Delhi.

### # PAPER I: DIVERSITY AND CLASSIFICATION OF THE ANIMAL KINGDOM

Sr. No.	Topics	Sub topic	No of lectures
1.	Animal Classification	Non-chordates and Chordates. Binomial nomenclature, Characteristic features of non-chordates, Concept of major and Minor Invertebrate Phyla. General features of chordates	3
2.	Phylum Protozoa	General characteristics and classification (upto class), Locomotion, nutrition, Disease causing protozoa.	3
3.	Phylum Porifera	General characteristics and classification (upto class), Cell types, canal system, reproduction. Economic importance of sponges.	3
4.	Phylum Coelenterata	General characteristics and classification (upto class), Alternation of generation, Polymorphism, corals and coral reefs	3
5.	Phylum Platyhelminthes	General characteristics and classification (upto class), parasitic adaptation, Diseases caused by platyhelminths	3
6.	Phylum Aschelminthes	General characteristics and classification (upto class), Economic importance of nematodes.	3
7.	Phylum Annelida	General characteristics and classification (upto class), Metamerism, coelom and nephridia	3

8.	Phylum Arthropoda	General characteristics and classification (upto class), Metamorphosis in insects, Economic importance of insects. Social insects.	3
9.	Phylum Mollusca	General characteristics and classification (upto class), Torsion in gastropoda, Edible mollusks.	3
10.	Phylum Echinodermata	General characteristics and classification (upto class), water vascular system,	3
11.	Phylum Chordata	Classification (upto class) General characters of vertebrates, Important features of Agnatha and Gnathostomata.	2
12.	Superclass:Pisces	Class :Chondrichthyes (cartilaginous fishes) Class: Osteichthyes (bony fishes) Characteristic features, Economic importance of fishes.	2
13.	Class Amphibia	Characteristic features, Parental care in amphibia	2
14.	Class: Reptilia	Characteristic features Adaptive radiation in living reptiles. Venomous and non venomous reptiles.	3
15.	Class: Aves	Characteristic features, Migration in birds	3
16.	Class: Mammalia	Characteristic features, Dentition in mammal.	3

### Reference / Text Books:

1. Ayyar Ekambaranatha M. and T.N. Ananthakrishnan. 1992. Manual of Zoology Vol. 1 [Invertebrata], Parts I and II. S. Viswanathan (Printers and Publishers) Pvt. Ltd; Madras.
2. Barnes R. D. 2000. Invertebrate Zoology. Hall Saunders International Edns.
3. Ganguly B.B., Sinha A.K., & Adhikari S. 2000. Introduction Biology of Animals, New Central Book Agency, Calcutta.
4. Jordan E. L. & Verma P.S. 2000. Invertebrate Zoology, S. Chand & Co. Pvt. Ltd. New Delhi.
5. Kotpal R. L. 2000. Invertebrates. Rastogi Publication, Meerut.
6. Ayyar Ekambaranatha M. and Anantha Krishnan, T. N. 1992. Manual of Zoology Vol. II (Chordata). S. Viswanathan (Printers and publishers) Pvt. Ltd., Madras.
7. Jordan E. L., & Verma, P.S. 2006. Chordate Zoology. S. Chand & Co. Pvt. Ltd. New Delhi.
8. Sinha A.K., Adhikari S., Ganguly B.B. 1997. Biology of Animals. Vol. II. New Central Book Agency, Calcutta.

**PRACTICALS:**

Topic	No of Practical
Study of specimens with reference to Habit, Habitat, Characteristic Features: At least three examples from each Invertebrate major phyla and three from each class of phylum chordata.	06
Survey of protozoans in a water body	01
Identification of mosquitoes.	01
Identification of local edible fishes.	01
Listing and identifying terrestrial and fresh water molluscs in the surroundings of college.	01
Preparation of checklist of butterflies of college campus.	01
Preparation of checklist of birds of college campus.	01
Demonstration of digestive system of cockroach.	01
<b>Total</b>	<b>13</b>

**Paper II: Basic Microbiology**

S.No	Topics	Sub Topics	No. of periods
1	Classification of microorganisms	Brief description of classification schemes proposed by Linneaus, Haeckel, Whittaker, Woese. Classification of viruses by Baltimore, Cryptogram	4
2	Bacterial identification	Bergey's Manual of Systematic/Determinative Bacteriology and rDNA sequencing	2
3	Organization and Ultrastructure of a Bacterial cell	Cell wall: structure and chemical composition in gram positive and gram negative bacteria. Flagella and pili. Cell membrane: structure and function. Slime and capsule: composition & function. Nuclear material: nature and function. Endospore: structure, sporulation and germination. Reserve materials: glycogen, lipid granules, gas vesicles, cyanophycin, carboxysomes, polyhydroxyalkanoate, volutin, sulphur inclusions.	6
4	Viruses	Structure, Viral replication Assays of infectivity (plaques, pocks)	3

5	Reproduction in bacteria	Binary fission Definitions: cell growth, growth rate, generation time. Bacterial growth curve, characteristics of growth phases; diauxic growth curve.	3
6	Nutritional types of bacteria	Autotrophs, Heterotrophs, Phototrophs and Chemotrophs and obligate parasite with examples of each type.	3
7	Cultivation of microorganisms	Types of culture media: synthetic, complex, enriched, enrichment, selective, differential, dehydrated solid and liquid.	3
7	Preservation and Maintenance of microbial cultures	Basic principles of preservation Methods – periodic transfer, overlaying with mineral oil, preservation in liquid nitrogen, lyophilisation	3
8	Microbial diversity	Thermophiles, barophiles, halophiles, acidophiles and alkaliphiles	4
9	Medical microbiology	Causative agent, Spread, Pathogenesis, Symptoms, Microbiological diagnosis, Prevention and control: (i) Tuberculosis, (ii) Plague, (iii) Bacterial meningitis (iv) Herpes	4
10	Soil microbiology	Phosphate solubilization, Nitrification, Denitrification, Symbiotic /non symbiotic nitrogen fixing bacteria	4
11	Microbial interactions	<ul style="list-style-type: none"> <li>• Basic concepts: mutualism, commensalism, competition, antagonism, parasitism</li> <li>• Ectosymbiosis and Endosymbiosis. Examples of each</li> </ul>	6
<b>Total</b>			<b>45</b>

### Practical

Introduction to microbiology laboratory: Concepts of sterilization	1
Microscopy	1
Preparation of media, autoclaving,	1
Enumeration techniques: isolation of bacteria by streak method spread plate method and Neubauer chamber	3
Observation of microorganisms- Negative staining, gram staining, spore staining (Shaffer Fultons method), fungal staining (Lactophenol cotton blue)	4
Motility study by hanging drop method	1
Growth curve of bacteria	1



Use of biochemical tests for bacterial identification: IMViC test/ EMB agar/MacConkey agar .	1
<b>Total</b>	<b>13</b>

### Reference / Text Books:

1. Madigan M., Martinko., Parker J. 2007. Brock's Biology of Microorganisms. Pearson Prentice Hall.
2. Ingraham J. L., Ingraham C.A. 2004. Introduction to Microbiology, 3<sup>rd</sup> Edition. Thomson Brooks / Cole.
3. Dubey R.C, Maheshwari D.K. 2005. A textbook of Microbiology. S. Chand and Company Ltd, New Delhi.
4. Pelczar Jr. M J, Chan E C S, Krieg N R, 1986. Microbiology. McGraw- Hill Book Company, NY.
5. Prescott, Harley, Klein. Microbiology. 2008. McGraw-Hill Higher Education, Boston.
6. Stanier R.Y. 1993. General Microbiology. Cambridge University, Cambridge.
7. Frobisher M. 1968. Fundamentals of Microbiology: An Introduction to the Microorganisms with Special Reference to the Procaryons (8<sup>th</sup> ed), Saunders. Philadelphia.

## Semester II

### \*PAPER III PLANT PHYSIOLOGY

Sr. No.	Topic	Sub-topic	No. of Lectures
1	<b>Plant-water relations</b>	<ul style="list-style-type: none"> <li>▪ Water transport processes; diffusion and osmosis; water potential and chemical potential; absorption of water, water transport through tracheids and xylem (ascent of sap); transpiration and its significance</li> <li>▪ Factors affecting transpiration; mechanism of stomatal movement, root pressure, guttation, imbibition, mass flow, antitranspirant.</li> </ul>	12
2	<b>Mineral nutrition</b>	<ul style="list-style-type: none"> <li>▪ Criteria of essentiality of elements; macro- and micronutrients.</li> <li>▪ Role of essential elements, mineral deficiency symptoms and plant disorders.</li> <li>▪ Nutrient uptake and transport mechanisms.</li> <li>▪ Role of cell membrane, ion pumps and carriers.</li> </ul>	12

<b>3</b>	<b>Photosynthesis</b>	<ul style="list-style-type: none"> <li>▪ Structure of photosynthetic apparatus.</li> <li>▪ Photosynthetic pigments.</li> <li>▪ Accessory pigments, reaction center complexes, photochemical reactions.</li> <li>▪ Electron transport pathways in chloroplast membranes, photophosphorylation, the Calvin cycle, the C<sub>4</sub> carbon cycle, crassulacean acid metabolism.</li> <li>▪ Photorespiration.</li> </ul>	<b>10</b>
<b>4</b>	<b>Nitrogen metabolism</b>	<ul style="list-style-type: none"> <li>▪ Biological nitrogen fixation, reduction of N<sub>2</sub> into ammonia, <i>nif</i> genes.</li> <li>▪ Regulation of nitrate reductase and nitrogenase, nitrate and ammonium assimilation, pyridoxal phosphate.</li> </ul>	<b>06</b>
<b>5</b>	<b>Growth Regulators</b>	<ul style="list-style-type: none"> <li>▪ Physiological role and mechanism of action of the phytohormones -auxins, cytokinins, gibberellins, abscisic acid and ethylene.</li> </ul>	<b>05</b>
		Total	<b>45</b>

### Practical

<b>Topic</b>	<b>No of Practical</b>
To study the permeability of plasma membrane using different concentrations of organic solvents	01
To study the effect of temperature on permeability of plasma membrane	01
To determine the osmotic potential of vacuolar sap by plasmolytic method	01
To determine the water potential of given tissue (any tuber).	01
To determine stomatal index, stomatal frequency and percentage of leaf area open through stomata. To study the effect of ABA on stomatal closure.	02
Anatomical feature of C <sub>3</sub> and C <sub>4</sub> plants.	01
Photo-oxidation of photosynthetic pigments.	01
Effect of hormones on seed germination -auxins, ethylene, GA, ABA and cytokinin.(b-4)	02
Role of light in germination of photoblastic seeds, e.g. <i>Lactuca sativa</i> , <i>Arabidopsis</i> . (Demonstration only).	01
Comparative study of rate of respiration of various plant parts	01
Determination of IAA oxidase activity	01
<b>Total</b>	<b>13</b>

**Reference / Text Books:**

1. Galston A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag., New York, USA.
2. Hooykaas P.J.J., Hall M.A. and Libbenga K.R. 1999. Biochemistry and Molecular Biology of Plant Hormones. Elsevier, Amsterdam, The Netherlands.
3. Hopkins W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
4. Moore T.C. 1989. Biochemistry and Physiology of Plant Hormones. Springer-Verlag, New York, USA.
5. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. Wadsworth Publishing Co., California, USA.
6. Taiz L. and Zeiger E. 1998. Plant Physiology. Sinauer Associates, Inc., Publishers, Massachusetts, USA.

**#Paper III ANIMAL PHYSIOLOGY**

Sr. No.	Topics	Subtopics	No of Lectures
1.	<b>Developmental Biology</b>	Types of eggs, Fertilization (Activation, Amphimixis, mechanism in brief), cleavage (Types), Gastrulation in mammals, Embryonic induction and organizers.	8
2.	<b>Digestion</b>	Outline of digestive system and associated glands in mammals. Role of Pancreas, liver Intestinal digestion including symbiotic digestion (ruminants), gastrointestinal hormones. Absorption by villi, defecation..	8
3.	<b>Respiratory &amp; Circulatory system</b>	Respiratory pigments (haemoglobin), Respiratory organs (Lungs), Bohr Effect, Transport of gases [CO <sub>2</sub> +O <sub>2</sub> ], Circulation- Types-Composition, Properties & functions of blood-Types of heart (Neurogenic & Myogenic), Human-Cardiac cycle, Origin of heartbeat, Blood pressure regulation.	4

4.	<b>Excretion and Osmoregulation</b>	Kinds of excretory products, Mammalian kidney, Uriniferous tubule, Ornithine cycle-mechanism of urine formation in mammals, hormonal regulation of excretion.	6
5.	<b>Nervous system</b>	Neuron-structure, types of neurons and their distribution- Nerve impulse-definition-conduction of impulse-saltatory conduction, Synapse-synaptic transmission, Neurotransmitter, Autonomic Nervous system.	5
6.	<b>Muscular System:</b>	Types of Muscles, Muscle proteins, Sliding Filament Theory, muscle twitch, tetanus, muscle fatigue, isotonic and isometric contraction.	4
7.	<b>Endocrine and Reproductive system</b>	Types of hormone (based on chemical composition), Pituitary gland- divisions of pituitary, Secretion and functions of endocrine glands, Endocrine regulation of testicular and ovarian function, Menstrual cycle-contraception-family welfare, Artificial insemination. Endocrine pathology (Gigantism, dwarfism, Polycystic ovaries, Edison's disease)	10
		<b>Total</b>	<b>45</b>

#### Reference / Text Books:

- 1 Mohan P. Arora. 2011. Animal physiology. Himalaya publishing House, Mumbai.
- 2 Vander, Sherman, Luciano's Human Physiology: The Mechanisms of Body Function. 2004. MacGraw Hill publication, New Delhi.
- 3 Eckert R. 2005. Animal Physiology. CBS Publishers and Distributors, New Delhi.
- 4 Verma, Tyagi and Agarwal. 2000. Animal Physiology. S. Chand and Company, New Delhi.
- 5 Nagabhushanam R., M. S. Kadarkar, R. Sarojini, 2002. Text book of Animal Physiology, Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
- 6 Knut Schmidt-Nielsen. 1997. Animal Physiology: Adaptation and Environment. Cambridge University Press, Cambridge.

#### PRACTICALS:

Topic	No of Practical
Observation of embryology slides. Cleavage, early gastrula and late gastrula of frog.	03
Haemoglobin estimation of man (Sahli's method).	01

Measurement of blood pressure and determination of pulse rate in man.	01
RBC and WBC count using haemocytometer.	02
Effect of osmolarity on RBC	01
Urine analysis- Albumin, sugar, uric acid, ketone/ acetone bodies, chlorides, phosphates, calcium, bilirubin	04
Histological slides of Testis and ovary	01
<b>Total</b>	<b>13</b>

### Paper IV Essential Physics for Biologists

S. No	Topic	Sub - Topics	No. of lectures
1	Measurement of Physical quantities, standards and units.	Length: radius of proton to size to astronomical distances. Mass: atomic mass unit to mass of earth. Time: time for fast elementary particle to pass through nucleus to age of earth. Units in electricity: volts, Amperes, ohms. Units of Temperature: Celsius scale, Kelvin scale. International systems and units: Units used to measure physical quantities and their inter-conversion.	2
2	Mechanics and introduction to Properties of matter	Review of Newton's Laws, Friction, Drag, elasticity, surface tension and capillarity, fluid dynamics and viscosity, <i>Applications to life sciences</i> .	6
3	Fluid Statics and fluid dynamics	Fluids: Definition, Pressure and Density. The variation of pressure in a fluid at rest. Pascal's Principle. Measurement of pressure. Various units of pressure and their inter-conversion Reynolds number and its physical significance. Concept of pressure energy. Bernoulli's theorem and its applications- Venturi meter and Pitot's tube. Viscosity estimation by Oswald's viscometer. Relevance to life sciences.	6

4	Acoustics	Sound as a longitudinal wave. Intensity level: Bel and Decibel. Production and detection of Ultrasonic waves and its applications. Doppler effect. Calculation of apparent frequency, (Normal incidence only), application to life sciences.	3
5	Electrostatics and Electricity	Basics of Electrostatics: Electric charge. Coulomb's law. Applications of electrostatics in life sciences. Basics of electricity: Current, voltage and resistance and their units, Ohm's law, Conductor, Semiconductor and Insulator, Transducers (sensors): basics, classification of transducers-electrical, mechanical, optical. Applications in biological instruments	5
6	The magnetic field	The definition of B. magnetic dipoles. Units of magnetism. Magnetism of earth. Molecular fields: Diamagnetism, Paramagnetism and Ferromagnetism Nuclear magnetism	2
		Motion of a charged particle in Electro-magnetic field.(only qualitative approach): Motion of a charged particle in a uniform constant (1) electric field, (2) magnetic field. Motion of a charged particle in a uniform constant electric field and magnetic field (crossed) in mutually perpendicular directions. Lorentz force.	3
7	Optics and Lasers	<b>Intensity of light:</b> Luminous intensity and its units. <b>Lenses:</b> Introduction to Lenses, optical properties of lenses, thin lenses & thick lenses, Cardinal points of an optical system, Aberrations; Spherical & Chromatic aberrations in lenses (only conceptual), methods of minimizing Spherical & Chromatic Aberrations.	5
		<b>Properties of light:</b> Reflection, refraction, dispersion,	1
		<b>Interference:</b> Interference by division of wave front & division of amplitude. One example of each kind with demonstration in Physics Laboratory.	2
		<b>Diffraction:</b> Concept of Diffraction, Fresnel and Fraunhofer class of Diffraction. Fresnel diffraction: thickness of symmetric obstacles Fraunhofer Diffraction: Width of diffraction maxima of Fraunhofer diffraction,	4

	Application of Fraunhofer diffraction to resolving power of optical instruments, Rayleigh's criterion for resolution, Resolving power of telescope and microscope.	
	<b>Polarization:</b> Concept of polarization, Plane of polarization, Polarization by reflection, Brewster's law, Polarization by refraction, Double refraction. Nicol prism, simple polarimeter.	3
	<b>Lasers:</b> Laser theory (qualitative), different kinds of laser, Applications of lasers in Medicine, and Science. Optical fibers: Basic principle and applications in medical field.	3
	<b>Total</b>	<b>45</b>

### Practical (demonstration) and/ or Problem solving

Topics	No. of Practicals
Fluid Statics and fluid dynamics <ul style="list-style-type: none"> <li>• Problem solving</li> <li>• To determine Coefficient of viscosity</li> </ul>	2
Mechanics and Properties of matter <ul style="list-style-type: none"> <li>• Problems on estimation of elastic moduli.</li> <li>• Measurement of surface tension by various methods (problem solving and demo experiments)</li> </ul>	2
Sound <ul style="list-style-type: none"> <li>• To determine velocity of sound (problem solving / demo experiments)</li> </ul>	2
Electrostatics and Electricity <ul style="list-style-type: none"> <li>• Problem solving</li> <li>• Verification of Ohm's law</li> </ul>	2
The magnetic field <ul style="list-style-type: none"> <li>• Frequency of AC mains (demo)</li> <li>• Demonstration of diamagnetic, paramagnetic and ferromagnetic property of materials</li> </ul>	1

Optics :demonstration of experiments in optics to visualize the concepts of <ul style="list-style-type: none"> <li>• Interference (biprism, Newtons rings)</li> <li>• Diffraction</li> <li>• Refractive Index of prism</li> <li>• Wavelength of LASER by grating</li> </ul>	4
	13

**Reference / Text Books:**

1. Verma, H. C. 2006. Concepts of Physics. Vols. I and II. Bharati Bhawan Publishers, Patna.
2. Halliday D., Robert Resnik and Jearl Walker, 2010. Fundamentals of Physics. John Wiley & Sons.
3. Mathur, D. S. 1974. Elements of Properties of Matter. S. Chand & Co Limited, New Delhi.
4. Khanna D. R. and R.S. Bedi. 1985. Text book of Sound, Atma Ram & Sons, New Delhi,
5. Beiser Arthur, Shobhit Mahajan and S. Rai Choudhury. 2009. Introduction to Modern Physics. Tata McGraw-Hill Education, New York.

\*\*\*\*\*