महाराजा सुहेल देव विश्वविद्यालय, आजमगढ़
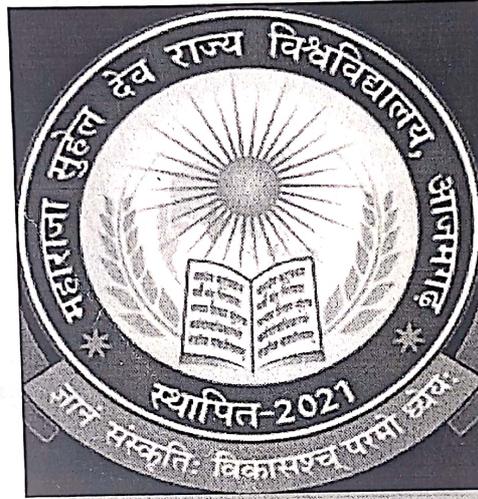
Choice Based Credit System (C.B.C.S.)

SYLLABUS (Minor Physics)

Effective from 2024-25

07.10.24

YEAR : FIRST	SUBJECT: PHYSICS (MINOR) (ELECTIVE)	SEMESTER I/II
COURSE CODE:	COURSE TITLE: MECHANICS, THERMAL PHYSICS AND BASIC ELECTRONICS	CREDIT: 06
		Min. Passing Marks:
Max. Marks: 25+75		

UNIT	TOPIC	No of Lectures
I	**Mathematical Preliminaries:** Basic idea about 2D & 3D Cartesian, Spherical and Cylindrical coordinate systems, Basic idea about scalars, vectors, (include physical examples). Component form in 2D and 3D. Geometrical and physical interpretation of addition, subtraction, dot product, cross product and triple product of vectors. Position, separation and displacement vectors. Geometrical and physical interpretation of vector differentiation, Gradient, Divergence and Curl and their significance. Vector integration, Line, Surface (flux) and Volume integrals of vector fields. Gradient theorem, Gauss-divergence theorem, Stoke-curl theorem (without proof). Expressions for displacement vector, arc length, velocity and acceleration, area element, volume element, gradient, divergence and curl in different coordinate systems (derivation not required).	15
II	**Newtonian Mechanics & Wave Motion** Review of historical development of mechanics up to Newton. Dynamics of a system of particles, centre of mass motion and conservation laws & their deductions. Rotating frames of reference, general information about pseudo forces (Euler, Coriolis & centrifugal) in rotating frame, and effects of Coriolis force. Angular momentum, torque, rotational energy. Rotational inertia for simple bodies (ring, disk, rod, solid and hollow sphere, solid and hollow cylinder, rectangular lamina derivation not required). The combined translational and rotational motion on horizontal and inclined planes. Elasticity, relations between elastic constants, general idea about bending of beam and torsion of cylinder. Study of simple harmonic motion and its application. General ideas about damped and forced oscillations, composition of simple harmonic motion, Lissajous figures. Plane progressive waves in fluid media, principle of superposition of waves, stationary waves, examples of stationary waves in strings and pipes with different harmonics.	15
III	**Motion of Planets & Satellites** Newton's law of gravitation, gravitational field and gravitational potential. Kepler's laws of planetary motion. Basic idea about Time period .Binding Energy, Orbital velocity, Escape velocity, weightlessness etc. for a satellite. Motions of geo-synchronous & geo-stationary satellites and basic idea of Global Positioning System (GPS).	10
IV	**Laws of Thermodynamics** Heat and work done, terminology of thermodynamics. Zeroth law. First law, internal energy, Work done in various thermodynamical processes. Enthalpy, relation between CP and CV. Carnot's engine, efficiency and Carnot's theorem. Second law of thermodynamics, entropy and its physical significance. Third law of thermodynamics and unattainability of absolute zero. Clausius- Clapeyron equation, Joule-Thompson effect.	10

V	**Kinetic Theory of Gases and radiation** Kinetic model and deduction of gas laws. Degrees of freedom, law of equipartition of energy (no derivation) and its application to specific heat of gases (mono, di and poly atomic). Basic idea about Blackbody radiation, spectral distribution. Planck's law and its importance, Stefan- Boltzmann law and Wien's displacement law.	10
VI	**Study of Circuits and Bridges** Basic idea about Current, voltages and emf. Ohms law and resistivity, Kirchoff's current and voltage law, AC Bridges - measurement of inductance (Maxwell's, Owen's and Anderson's bridges) and measurement of capacitance (Schering's, Wein's and de Sauty's bridges). Basic idea and applications of Thevenin's and Norton's theorems.	10
VII	**Semiconductors: Diodes and Transistors** P and N type semiconductors, Formation of depletion layer in PN junction diode, mechanism in forward & reverse biased diode. PN junction diode and its characteristics, characteristics and applications of Zener, Light Emitting, Photo diodes. Half and Full wave rectifiers, voltage regulation. **Transistors** Bipolar Junction PNP and NPN transistors. Study of CB and CE configurations and characteristics, active, cutoff & saturation regions; Qualitative discussion of RC coupled amplifier (frequency response not included).	10
VIII	**Electronic Instrumentation** Basic ideas about Multimeter: Principles of measurement of dc voltage, dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, electron gun, Applications of CRO to study the waveform and measurement of voltage, current, frequency & phase difference.	10

Suggested Readings :

1. M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill, 1997, 7e
2. S. Garg, R. Bansal, C. Ghosh, "Thermal Physics", McGraw Hill, 2012, 2e
3. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
4. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
5. B.G.Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
6. J.D.Ryder,"Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited,1975
7. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e
8. A.W. Joshi, "Matrices and Tensors in Physics", New Age International Private Limited, 1995, 3e
9. D.S. Mathur, P.S. Hemne, "Mechanics", S. Chand Publishing, 1981, 3e

B. Sc. Physics (Minor) Syllabus

Programme/Class: **B.Sc.**   Year:**Second**   Semester-**III/IV**

Course Code: Course Title: Minor (Compulsory)
                                   Modern Physics.

Credits: **06**   Lectures: **90** Max. Marks: **25+75**

Unit-I Classical Mechanics:

Kepler's Laws, central force, motion under attractive inverse square force, equation of orbit, bound and unbound orbits.

Unit-II EMT and Optics:

Gradient, divergence and curl, Faraday's laws, Lenz's law, Maxwell equations, displacement current, electromagnetic energy density and Poynting vector, plane electromagnetic wave in free space, polarization of light, qualitative discussion of linearly, circularly and elliptically polarized light.

Unit-III Statistical Mechanics:

Micro-state and macro-state, accessible micro-states, Boltzmann equation, concept of phase space and density of states, accessible micro-states for a free particle in 1, 2 and 3 dimensions, Maxwell- Boltzmann, Bose-Einstein and Fermi-Dirac statistics, application of Fermi-Dirac statistics to free electron gas, Fermi energy.

Unit-IV Solid State Physics:

Lattice, basis and crystal structure, lattice translation vectors, primitive and non primitive cells, Crystal bindings (Ionic, covalent, metallic, Van der Waals/molecular and hydrogen bindings), attractive and repulsive interaction (Van der Waals and London), concept of phonons, lattice heat capacity, Dulong-Petit law & Einstein's Theory of Lattice heat capacity.

Unit-V Spectroscopy:

Bohr-theory of Hydrogen Atom, Magnetic dipole moments, electron spin and vector atom model, fine structure of hydrogen, Helium atom and its spectrum, Zeeman effect, Paschen-Back effect, Stark effect, Hyper fine structure of spectral lines, Raman spectra.

References:

1.Classical Mechanics- H. Goldstein, C. Poole, J. Safko (Pearson,2001)

2.Classical Mechanics- N.C. Rana, P.S Jaog (Pergamon)

3.Introduction to Electrodynamics-D.J Griffiths 4th ed. (Cambridge University Press)

4. Optics-AjoyGhatak 7th ed. (McGraw Hill)

5. Introduction to Solid State Physics- Charles Kittel (Wiley)

6. Statistical Physics part-1- Landau and Lifshitz (Pergamon Press Oxford)

7. Atomic & Molecular Spectra:Laser- Raj Kumar (KNRN)

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