BLOW-UP SYLLABUS

ENGINEERING PHYSICS (18PHY12/22)

(Common to all Branches)

(Effective from the academic year 2018-19)

MODULE – 1

Sl. No	Details	Duration	Remarks
1	**1.1 Free Oscillations:** Definition of SHM, Characteristics, Examples and Derivation of differential equation of motion for SHM starting from Hookes' law $\frac{d^2y}{dt^2}+\frac{k}{m}y=0$ and mention its solution	1/2hr	No numerical problems
2	Mechanical simple harmonic oscillator: Mass suspended to spring (vertical vibrations) - Description, Mention of Expression for time period/frequency, Definition of force constant and its significance, Derivation of expressions for force constants for series and parallel combination of springs.($k_s=\frac{k_1k_2}{k_1+k_2}$ and $k_p=k_1+k_2$) Complex notation of simple harmonic motion ($Ae^{i(\omega t+\varepsilon)}$), Phasor representation of simple harmonic motion	1and 1/2hr	Numerical problems on T,f and k
3	Definition of free oscillations with examples, mention the equation of motion, Natural frequency of vibration – Qualitative discussion.	1/2hr	Numerical problems on natural frequency
4	**1.2 Damped oscillations:** Definition with examples. Derivation of decaying amplitude, Discussion of 3 cases viz, over damping, critical damping and underdamping. Quality factor: Definition, equation and its significance,	1and 1/2hr	Numerical problems on damping and quality factor
5	**1.3 Forced oscillations:** Definition with examples. Derivation of expressions for amplitude and phase of forced vibrations	1and 1/2hr	Numerical problems
	Discussion of 3 cases (i) $p<<\omega$, (ii) $p=\omega$ and (iii) $p>>\omega$		
	Resonance: Definition, Examples, Condition for resonance and expression for maximum amplitude (just mention) .		
	Sharpness of Resonance: Definition and significance, mention the effect of damping on sharpness of resonance		
	Qualitative discussion of Examples of Resonance: Helmholtz Resonator- Description and mention of expression for resonant frequency		No numerical problems
6	**1.4 SHOCK WAVES:** Definition of Mach number, classification of objects based on Mach number (subsonic, supersonic, Transonic and hypersonic) Definition and properties of shock waves	1hr	Numerical problems on Mach number
7	Definition of control volume, Laws of conservation of mass, energy and momentum (Statement and equations)	1 and ½ hr	No numerical problems
8	Construction and working of Reddy shock tube Applications of shock waves: Qualitative (minimum 5 applications)		No numerical problems
9	Tutorial classes	2hr	Involvement of students in respect of their doubts about the module and numerical problems

MODULE-2

Sl. No	Details	Duration	Remarks
1	**2.1 Elasticity:** Explain elasticity and plasticity. Give some examples for good elastic materials. Mention the importance (Engineering) of elastic materials. concept of stress and strain. Discuss two types of stresses namely tensile stress and compressive stress. Briefly discuss the effect of stress, temperature, annealing and impurities on elasticity	1 and ½ hr	No numerical problems
2	Strain hardening and softening: just explain what is strain hardening (strengthening of material by plastic deformation) and hardening co efficient and softening. No detailed discussion of processes.	1/2hr	No numerical problems
3	State and explain Hookes' law, stress strain curve, elastic and plastic limits. Elastic modulus, define three different elastic moduli. Write equations for each moduli like $Y = \frac{FL}{A\Delta L}$ & so on.	1/2hr	Numerical problems on Y, η and K
4	**2.2 Poisson's ratio:** Define lateral strain and linear strain and hence Poisson's ratio σ=β/α (α= linear strain coefficient) and (β= lateral strain coefficient)	1hr	Numerical problems
5	Relation between shear strain, longitudinal and compression strain. Show that longitudinal strain + compression strain = shear strain by considering a cubical elastic body		No numerical problems
6	Derive the relation between Y, η and σ Derive the relation between K, Y and σ	1 and 1/2hr	Numerical problems
7	Derive the relation between K, η and Y		
8	Discuss the limiting values of σ and limitations of Poisson's ratio		No numerical problems
9	**2.3 Bending of beams:** Definition of beams, different types of beams and mention their Engineering applications. Definition of neutral surface/plane and neutral axis.	1/2hr	No numerical problems
10	Define bending moment. Derive the expression for bending moment in terms of moment of inertia ($BM = \frac{Y}{R} I_g$)	1 hr	No numerical problems
11	Mention the expression for bending moment for circular and rectangular cross sections		Numerical problems
12	Describe a single cantilever and hence derive the expression for Y (for rectangular beam) (only depression)	½ hr	Numerical problems
14	**2.4 Torsion of a cylinder:** Twisting couple on cylindrical wire, explain torsional oscillations, derive the expression for couple per unit twist for a solid cylinder	1 hr	Numerical problems
15	Mention the expression for Time period of torsional oscillations$T = 2\pi\sqrt{I_g/C}$. Brief explanation of applications of torsional pendulum		Numerical problems
16	Tutorial classes	2hr	Involvement of students in respect of their doubts about the module and numerical problems

MODULE-3

Sl No	Details	Duration	Remarks
1	**Only Cartesian co ordinates must be used in both theory and problems** **3.1 Maxwell's equations:** Fundamentals of vector calculus: Briefly explain scalar product, vector product, ∇ operation, concept of divergence, gradient and curl along with physical significance and examples like Div and curl of E and B	1 and ½ hr	Numerical problems of div and curl
2	Discuss the three different types of integrations *viz* linear, surface and volume integrations. Derivation of Gauss divergence theorem, mention Stokes' theorem		No numerical problems
3	Explain briefly Gauss flux theorem in electrostatics and magnetism, Ampere's law, Biot-Savart's law and Faraday's laws of electromagnetic induction	½ hr	Numerical problems
4	Discuss continuity equation, definition of displacement current(I_d), expression for displacement current, Maxwell-Ampere's law	½ hr	Numerical problems on (I_d)
5	List of four Maxwell's equations in differential form and in vacuum	½ hr	No numerical problems
6	**3.2 EM Waves:** Derive wave equation in terms of electric field using Maxwell's equations. Mention of plane electromagnetic waves in vacuum along with the equations for E, B and *c* in terms of μ_0 and ε_0 and E and B	1 and ½ hr	Numerical problems on calculation of 'c' and on equations of E and B
7	Explain the transverse nature of electromagnetic waves, three types of polarization namely linear, elliptical and circular polarization of E.		Numerical problems
8	**3.3 Optical fiber:** Description of propagation mechanism of light through an optical fiber. Angle of acceptance and numerical aperture(NA): Theory with condition for propagation	1 and ½ hr	Numerical problems on θ_C Numerical problems on angle of acceptance, NA, V number, modes of propagation
9	Modes of propagation and V number and types of optical fibers(qualitative)		
10	Attenuation: Definition of attenuation, name the three types of attenuation, Causes of attenuation: Explain absorption, scattering and radiation losses. Mention the expression for attenuation coefficient	2hr	Numerical problems on attenuation coefficient
11	Application of optical fiber: Point to point communication: Explain with the help of block diagram. Merits and de merits of optical fiber communication.		No numerical problems
12	Tutorial classes	2hr	Involvement of students in respect of their doubts about the module and numerical problems

MODULE-4

Sl No	Details	Duration	Remarks
1	**4.1 Quantum Mechanics:** Introduction to need of Quantum mechanics with a discussion of Planck's equation for energy density	½ hr	No numerical problems
2	Wave nature of particles–De Broglie hypothesis followed by wavelength equations, extended to accelerated electron	½ hr	Numerical problems
3	Heisenberg's uncertainty principle-Statement and mention the three uncertainty relations. Applications of uncertainty principle- to show the non confinement of electrons in the nucleus (by considering diameter of nucleus). Energy relativistic equation shall not be considered.	1 hr	Numerical problems
4	Schrodinger's time independent wave equation –Setting up of Schrodinger's time independent wave equation using $\psi=Ae^{i(kx-wt)}$.	1 hr	No numerical problems.
5	Significance of Wave function –qualitative statement regarding wave function, Probability density, Max born interpretation, Normalization, and Properties of wave function		No Numerical problems
6	Application Schrodinger's wave equation to particle in 1-D potential well of infinite height and obtain the energy Eigen values and eigen functions. Probability densities	1hr	Numerical problems
7	**4.2 Laser:** Brief discussion of spontaneous and stimulated processes – Explanation of the process of induced absorption, spontaneous and stimulated emission.	½ hr	No numerical problems
8	Einstein's coefficients (expression for energy density) – derivation of energy density in terms of Einstein's co efficients	1 hr	Numerical problems
9	Requisites of a Laser system – a brief explanation about active medium, resonant cavity and exciting system.		No numerical problems
10	Conditions for laser action-To explain population inversion and meta stable state		Numerical problems
13	Principle: mention different modes of vibrations of CO_2, explain construction and working of CO_2 laser with energy level diagram experimental setup.	2 hr	No numerical problems
14	Principle, Construction and working of semiconductor Lasers – Explain principle, construction and working of homo junction semiconductor laser with energy level diagram and experimental setup.		numerical problems
15	Application of Lasers in Defense (Laser range finder) – qualitative explanation about application of laser as laser range finder.	1/2hr	No numerical problems
16	Application of Lasers in Engineering (Data storage) - qualitative explanation about application of laser in data storage (compact disc, DVD).		No numerical problems
17	Tutorial classes	2 hrs	Involvement of students in respect of their doubts about the module and numerical problems

MODULE-5

Sl. No	Details	Duration	Remarks
1	**5.1 Quantum free electron theory:** Review of classical free electron theory (just mention who proposed it and what for it was proposed), mention the expressions for electrical conductivity based on classical free electron theory, and explain the failures of classical free electron theory (in terms of relation between conductivity and temperature, and relation between conductivity and free electron density, with specific examples)	½ hr	No numerical problems
2	Assumptions of quantum free electron theory, definition of density of states and mention the expression for density of states (No derivation)	1 and 1/2hr	Numerical problems on density of states, Fermi energy, Fermi factor
3	Qualitative discussion of Fermi level, Fermi energy, Fermi-Dirac statistics, Fermi factor, Fermi factor at different temperatures (3 cases).		
4	Derivation of the expression for Fermi energy at zero Kelvin. Mention the expression Fermi velocity and Fermi temperature. Expression for electrical conductivity in terms of Fermi velocity, mean free path and effective mass (No derivation).	½ hr	Numerical problems on Fermi velocity, conductivity
5	Success of quantum free electron theory (in terms of relation between conductivity and temperature, and relation between conductivity and free electron density, with specific examples)	½ hr	No numerical problems
6	**5.2 Semiconductors:** Fundamentals of semiconductor. Description of Fermi level in intrinsic semiconductor. Mention of expression for electron and hole concentration in intrinsic semiconductors. Derivation of relation between Fermi energy and energy gap for an intrinsic semiconductor.	1hr	No numerical problems
7	Derivation of the expression for electrical conductivity of semiconductors, Explanation of Hall effect with Hall voltage and Hall field, derivation of the expression for Hall coefficient.	1 hr	Numerical problems on conductivity, Hall effect
8	**5.3 Dielectrics:** Fundamentals of dielectrics. Polarisation, mention the relation between dielectric constant and polarization. Types of polarization. Polar and non-polar dielectrics	1 hr	No numerical problems
9	Definition of internal field in case of solids and mention of its expression for one dimensional case. Mention the expressions for internal field for three dimensional cases and Lorentz field. Derivation of Clausius-Mossotti equation.	1 hr	Numerical problems on internal field and Clausius-Mossotti equation
10	Description of solid, liquid and gaseous dielectrics with one example each. Qualitative explanation of applications of dielectrics in transformers.	1/2hr	No numerical problems
11	Tutorial classes	2hr	Involvement of students in respect of their doubts about the module and numerical problems

Text Books:

1. A Text book of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand & Company Ltd, New Delhi
2. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017
3. Concepts of Modern Physics-Arthur Beiser: 6th Ed;Tata McGraw Hill Edu Pvt Ltd- New Delhi 2006

Reference books:

1. Introduction to Mechanics — MK Verma: 2nd Ed, University Press(India) Pvt Ltd, Hyderabad 2009
2. Lasers and Non Linear Optics – BB laud, 3rd Ed, New Age International Publishers 2011
3. Solid State Physics-S O Pillai, 8th Ed- New Age International Publishers-2018
4. Shock waves made simple- Chintoo S Kumar, K Takayama and KPJ Reddy: Willey India Pvt. Ltd. New Delhi2014
5. Introduction to Electrodynamics- David Griffiths: 4th Ed, Cambridge University Press 2017

Module wise text books/Reference Books

Module	**Article No**	**Text Book/Reference Book**
I	1.1	1. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017
	1.2	
	1.3	
	1.4	1. Shock waves made simple- Chintoo S Kumar, K Takayama and KPJ Reddy: Willey India Pvt. Ltd. New Delhi2014
II	2.1	1. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017 2. Introduction to Mechanics — MK Verma: 2nd Ed, University Press(India) Pvt Ltd, Hyderabad 2009
	2.2	
	2.3	
	2.4	
III	3.1	1. A Text book of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand & Company Ltd, New Delhi 2. Introduction to Electrodynamics- David Griffiths: 4th Ed, Cambridge University Press 2017
	3.2	
	3.3	
IV	4.1	1. A Text book of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand & Company Ltd, New Delhi 2. Concepts of Modern Physics-Arthur Beiser: 6th Ed;Tata McGraw Hill Edu Pvt Ltd- New Delhi 2006
	4.2	1. Lasers and Non Linear Optics – BB laud, 3rd Ed, New Age International Publishers 2011
V	5.1	1. Concepts of Modern Physics-Arthur Beiser: 6th Ed;Tata McGraw Hill Edu Pvt Ltd- New Delhi 2006 2. Solid State Physics-S O Pillai, 8th Ed- New Age International Publishers-2018
	5.2	
	5.3	1. A Text book of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand & Company Ltd, New Delhi