ENGINEERING PHYSICS QUESTION BANK

Module 1 : OSCILLATIONS AND WAVES

MQP-1

1. What are shock waves? Mention the characteristics of shock waves
2. What are damped oscillations? Give the theory of damped oscillations and hence discuss the case of under damping.
3. Define simple harmonic motion. Derive the equation for simple harmonic motion using Hooke's law.
4. Discuss the theory of forced vibrations and hence obtain the expression for amplitude.

MQP-2

1. Starting form Hookes' law derive the differential equation for SHM. Explain the Characteristics of SHM.
2. With a neat diagram explain the construction and working of Reddy tube. Mention any four applications of Shock waves
3. State and explain laws of conservation of mass, energy and momentum
4. What are damped oscillations? Derive the expression for decaying amplitude and hence discuss the case of critical damping

Dec -2018

1. What are shock waves? Mention the characteristics and applications of shock waves.
2. What are damped oscillations? Give the theory of Damped oscillations and hence discuss the case of critical damping
3. Define SHM. Mention the characteristics of SHM. Give one example of SHM.
4. With neat diagram explain the construction and working of Reddy's shock tube. Mention conservation of mass, energy and momentum expressions.

June -2019

1. Define SHM and mention two examples. Derive the differential equations of SHM using Hooke's law
2. With a neat diagram, explain the construction and working of Reddy's tube. Mention any three applications of shock waves.
3. Explain the basics of conservation of mass, momentum and energy.
4. What are forced oscillations? Derive an expression for steady state amplitude and phase angle in case of forced oscillations.

Dec-2019

5. Give the theory of forced Vibrations and obtain the expression for amplitude.
6. With a neat diagram explain the construction and working of Reddy tube. Mention the application of shock waves.
7. Define force constant and mention its physical significance. Derive the expression for force constant for springs in series and parallel combinations
8. Define simple harmonic motion. Derive the differential equation of motion for it using Hooke's law. Mention the characteristics and examples of simple harmonic motion.

Module 2: **Elasticity**

MQP-1

1. Explain in brief the factors affecting elastic property of a body
2. Derive the relation between Y, η and σ where the symbols have their usual meaning
3. What are torsional oscillations? Give the expression for time period of torsional oscillations. Mention theapplications of torsional oscillations
4. State and explain Hookes' law. Define elastic and plastic limit.
5. Define Poisson's ratio. Mention its limiting values. Obtain the relation between shear strain, elongation strain and compression strain

MQP-2

1. Explain tensile stress and compressive stress. What are the engineering importance of elastic materials?
2. Define lateral strain, linear strain and Poisson's ratio. Obtain the expression for Poisson's ratio
3. Define bending moment. Derive the expression for bending moment in terms moment of inertia.
4. Derive the relation between bulk modulus (K), Young's modulus (Y) and σ.What are the limiting values of Poisson's ratio?

Dec -2018

1. State and explain Hooke's law. Define elastic and plastic limits.
2. Define Young's modules of materials. Derive an expression for the Young's modulus of a beam using single cantilever method
3. What is Bending moment? Mention various types of beams and their engineering applications
4. What are the types of Elastic moduli? Derive the relation between Y, K and σ.

June -2019

5. Sate and explain Hooke's Law. Explain the nature of elasticity with the help of stress-strain diagram
6. Define Bending moment. Derive the expression for bending moment interms of moment of inertia.
7. Define Poisson's ratio. Obtain the relation between Y, n and σ, where the symbols have their usual meaning
8. What are Torsional Oscillations? Mention any two application of Torsional Pendulum. Derive the expression for couple per unit twist of the solid cylinder.

Dec-2019

9. Explain longitudinal stress, longitudinal strain, volume stress and volume strain. Discuss the effect of stress, temperature, annealing and impurities of elasticity
10. Derive the relation between bulk modulus (k), Youngs modulus (Y) and Poisson's ratio (σ). What are the limiting values of Poisson's ratio?
11. Describe a single cantilever and derive the expression for Young's modulus of the material of rectangular beam.
12. Derive an expression for couple per unit twist of Cylinder with a diagram.

Module 3: MAXWELLS EQUATIONS AND OPTICAL FIBERS

MQP-1

1. Explain the terms gradient of a scalar, divergence and curl of a vector. Derive Gauss divergence theorem.
2. What is displacement current? Obtain the expression for displacement current.
3. Mention the conditions for three types of polarization of electric vector.
4. Give the four Maxwell's equations in differential form in vacuum and hence derive the EM wave equation in terms of electric field using Maxwell's equations.
5. Name the three types of attenuation in optical fibre. Obtain the expression for attenuation coefficient.

MQP-2

1. Describe the concept of divergence. What is its physical significance? Derive Gauss divergence theorem
2. With neat diagrams explain different types of optical fibre. Define V number
3. With the help of Block diagram, explain point to point communication using optical fibre. Mention the merits and de merits of optical fibre communications
4. What is displacement current?. Derive the expression for displacement current

Dec -2018

1. What is Numerical Aperture? Derive an expression for the same.
2. State and explain Maxwell's equation for electromagnetic field. Starting from Maxwell's equations, deduce the wave equation for a plane wave in free space.
3. Explain the types of Fibre losses.
4. State and explain Gauss Divergence theorem. Mention the Stroke's theorem.

June -2019

5. State and prove Gauss Divergence Theorem
6. Define fractional index change (Δ). Derive an expression for Numerical aperture and acceptance angle of an optical fiber.
7. Derive wave equation in terms of electric field using Maxwell's equations for free space.
8. Describe different types of optical fibers with neat diagrams. Mention any two mechanisms involved in fiber loss.

Dec-2019

9. Explain Divergence and Curl. Derive Gauss Divergence theorem.
10. Define V-number and fractional index change. With neat diagrams, explain different types of optical fibres.
11. Derive the expression for displacement current. Mention 4 Mawell's equation in differential form for time varying fields.
12. Derive the expression for numerical aperture in an optical fibre and state the condition for propagation.

Module 4: **QUANTUM MECHANICS AND LASERS**

MQP-1

1. Setup 1-dimensional time independent Schrodinger wave equation. Explain Born's approximation.
2. Mention the three different vibrational modes of CO_2 molecule. With a neat energy level diagram explain the construction and working of CO_2 laser.
3. With a proper energy level diagram explain the working of Semiconductor laser. Explain the working of laser range finder.
4. State and explain Heisenberg Uncertainty principle. Show that the electron emitted during β-decay does not pre-exist inside the nucleus using uncertainty principle.

MQP-2

1. Staring from Schrodinger's time independent wave equation, derive the expression for energy eigen value and eigen function for an electron present in 1-d potential well of infinite depth.
2. What is a laser range finder? Give the qualitative explanation of construction and working of laser range finder.
3. Explain the terms (a) spontaneous emission, (b) stimulated emission (c) population inversion (d) active medium and (e) resonance cavity.
4. What are the properties of a wave function? Give the qualitative explanation of Max Born's interpretation of wave function.

Dec -2018

1. Setup one dimensional time independent Schrodinger wave equation.
2. Mention three modes of vibration in CO2 molecule. With a neat diagram explain the construction and working of CO2 laser.
3. Prove that electrons cannot exist inside the Nucleus of an atom.
4. Derive an expression for energy density in terms of Einstein's coefficients.

June -2019

1. Starting from Schrodinger's time independent wave equation, derive the expression for energy eigen values and eigen function for an electron in one dimensional potential well of infinite height.
2. Explain the construction and working of CO2 LASER with the rhelp of energy level diagram.
3. Define the terms Population inversion and meta-stable state. Derive the expressions for energy density of radiation at equilibrium interms of Einstein's coefficients.
4. Using Heisenberg's Uncertainty principle, Show that electrons do not exist inside the nucleus.

Dec-2019

1. State and explain Heisenberg's Uncertainty Principle. Show that the electron cannot exist inside the nucleus.
2. Define spontaneous emission and stimulated emission. Explain the construction and working of semiconductor laser.

3. Assuming the time independent Schrodinger wave equation, discuss the solution for a particle in one dimensional potential well of infinite height. Hence obtain the normalized wave function.
4. Derive the expression of energy density in terms of Einstein's coefficients.

Module 5: **Material Science**

MQP-1

1. Explain the failures of classical free electron theory.
2. What is Hall Effect? Obtain the expression for Hall voltage in terms of Hall co-efficient
3. Define Fermi factor. Explain the variation of Fermi factor with temperature.
4. Give the assumptions of quantum free electron theory and hence obtain the expression for Fermi energy at 0 K.
5. Define internal field in case of solid dielectrics. Derive Clausius-Mossotti equation.

MQP-2

1. Give the assumptions of quantum free electron theory. Discuss two success of quantum free electron theory.
2. What are dielectrics? Give the relation between dielectric constant and polarization. Discuss solid, liquid and gaseous dielectrics with one example for each.
3. Describe Fermi level in intrinsic semiconductor and hence obtain the expression for Fermi energy in terms of energy gap of intrinsic semiconductor.
4. Give a brief account for Fermi-Dirac distribution theory. Obtain the expression for Fermi energy at 0 K.

Dec-18

1. What are the assumptions of Quantum Free Electron Theory (QFET)? Explain the merits of QFET.
2. What is Hall Effect? Derive an expression for Hall voltage in terms of Hall coefficient.
3. What is polarization? Explain various types of polarization mechanisms.
4. What is Fermi Energy? Derive an expression for Fermi Energy at zero Kelvin for a metal.

June-19

5. Define Fermi Energy. Explain the variation Fermi energy with temperature.
6. What is Hall Effect? Obtain the expression for Hall coefficient, and express Hall voltage interms of Hall coefficient.
7. Mention the assumptions of Quantum free electron theory. Discuss the success of quantum free electron theory.
8. Define the term internal field in case of solid dielectrics with one dimensional equation. Explain polar and non polar dielectrics.

Dec-19

9. Give the assumptions of Quantum Free Electron Theory. Discuss two success of quantum free electron theory.
10. What are polar and non-polar dielectrics? Explain types of polarization.
11. Define internal field. Mention the expression for internal field, for one dimension, for three dimensional and Lorentz field for dielectrics. Derive Clausius-Mosotti equation.
12. Describe the Fermi level of the in an intrinsic semiconductor and hence obtain the expression for Fermi energy in terms of energy gap of intrinsic semiconductor.