SHANTILAL SHAH ENGINEERING COLLEGE

QUESTION BANK
(ENGINEERING PHYSICS – 2110011)

Even Term – 2018

(Electrical, EC, IT, IC)

Term Date

(11 January, 2018 to 24 April, 2018)

1 Dielectric

Summer – 2013	☞ What are dielectric materials? Distinguish between a dielectric material and an insulator. What are the different types of dielectric materials? Explain them in detail.	**4 Marks**
	☞ Describe the possible mechanism of polarization in a dielectric material.	**3 Marks**
	☞ Describe any two uses of dielectric material in detail	**2 Marks**
	☞ Calculate the electronic polarizability of an isolated Se atom. The atomic radius of Se atom is 0.12 nm. (Given: $\varepsilon_0 = 8.85 \times 10^{-12}$)	**3 Marks**
Winter - 2013	☞ What are dielectric materials? Distinguish between a dielectric material and an insulator. What are the different types of dielectric materials? Explain them in detail.	**4 Marks**
	☞ Describe the possible mechanism of polarization in a dielectric material.	**3 Marks**
	☞ Describe any two uses of dielectric material in detail	**2 Marks**
	☞ Calculate the electronic polarizability of an isolated Se atom. The atomic radius of Se atom is 0.12 nm. (Given: $\varepsilon_0 = 8.85 \times 10^{-12}$)	**3 Marks**
Summer – 2014	☞ Deduce Clausius-Mossotti equation. What is its significance?	**4 Marks**
	☞ Calculate the polarizability and relative permittivity in hydrogen gas with a density of 9.8×10^{26} atoms/m^3.Given the radius of hydrogen atom to be 0.5 Å.	**3 Marks**
	☞ Define : (i) Electric field Intensity (ii) Electric Polarization	**2 Marks**
Winter – 2014	☞ What do you understand by electronic and ionic polarisability?	**2 Marks**
	☞ Derive an expression for Claussius – Mosotti relation and explain the assumptions involved.	**4 Marks**
	☞ Calculate the polarisability and relative permittivity in hydrogen gas with a density of 9.8×10^{26} atoms/m^3. Given the radius of the hydrogen atom to be 0.50×10^{-10} m. ($\varepsilon_0 = 8.85 \times 10^{-12}$)	**3 Marks**
Summer – 2015	☞ Calculate the polarisability and relative permittivity in hydrogen gas with a density of 9.8×10^{26} atom/m^3. Given radius of the hydrogen atom to be 0.50 Å.	**3 Marks**
	☞ Deduce Clausis-Mossotti equation.	**4 Marks**
	☞ Define the term (1) Dielectric constant	**1 Mark**
Winter – 2015	☞ Derive the necessary expression for Clausius-Mossotti equation.	**3 Marks**
	☞ Explain types of Dielectric materials in detail. Mention its specific applications.	**7 Marks**
	☞ Define terms: (1) Dielectric constant (2) Polarization Vector P (3) Electric Flux Φ	**3 Marks**

Summer – 2016	☞ The maximum operating temperature of class Y insulating materials is __ (1) above 180 ^{0}C (2) 155 ^{0}C (3) 130 ^{0}C (4) 90 ^{0}C	**1 Mark**
	☞ ____ is a naturally available dielectric material (1) air (2) nitrogen (3) sulpharhexafluoride (4) inert gas	**1 Mark**
	☞ Calculate the polarizability and the relative permittivity in Hydrogen gas with a density of 9.8 X 10^{26} atoms/m^3. Given the radius of hydrogen atom as 0.50 Å.	**3 Marks**
	☞ Briefly discuss the types of dielectric materials with examples.	**3 Marks**
	☞ Derive Clausius Mossitti equation	**4 Marks**
	☞ Define the following: i) dielectric constant ii) electric flux density iii) polarization vector iv) electric susceptibility	**4 Marks**
Winter – 2016	☞ The polarization P in a solid dielectric is related to the electric field E and the electric flux density D by the relation (a) $E = \varepsilon_0 D + P$ (b) $D = E + \varepsilon_0 P$ (c) $D = \varepsilon_0 E + P$ (d) $D = \varepsilon_0 (E+P)$	**1 mark**
Summer – 2017	☞ The internal or Lorentz field equals to_____ (a) $E_i = E + E_c$ (b) $E = (P/3\varepsilon_0)$ (c) $E = E + (P^2/3\varepsilon_0)$ (d) $E_i = E + E = (P/3\varepsilon_0)$	**1 mark**
	☞ The electronic polarization of a solid material which contains N number of atoms are (a) $P_e = N2\pi\varepsilon_0 R^3 E$ (b) $P_e = N\pi\varepsilon_0 R^3 E$ (c) $P_e = N4\pi\varepsilon_0 R^3 E$ (d) $P_e = N4\pi\varepsilon_0 R^3$	**1 mark**
	☞ Explain briefly Polarization phenomenon and types of Polarization with definition and equation in dielectric material.	**4 marks**
	☞ Define polar and nonpolar dielectric materials. Calculate electronic polarizability of argon atom given $\varepsilon_r = 1.0024$ at NTP and N = 2.7 X 10^{25} atoms/m^3.	**3 marks**
Winter – 2017	☞ For water which type of polarization will be prominent? (a) Electronic polarization (b) Ionic polarization (c) Orientation polarization (d) Space charge polarization	**1 Mark**
	☞ By introducing dielectric materials between two plates of the charge capacitor, the intensity of the electric field will (a) increases (b) decreases (c) remains same (d) none of the above.	**1 Mark**
	☞ The polarization of a solid which contains N number of particles per unit volume is equal to (a) $P_e = N\alpha E$ (b) $P_e = 2N\alpha E$ (c) $P_e = N\alpha^2 E$ (d) $P_e = N\alpha^2 E^2$	**1 Mark**
	☞ What are the properties of good dielectrics?	**3 Marks**
	☞ A parallel plate capacitor has a capacitance of 2mF. The dielectric has permittivity, $\varepsilon_r = 80$. For the applied voltage of 1 *k*V, find the energy stored in the capacitor as well as the energy stired in the polarizing the dielectric.	**4 Marks**
	☞ List various polarization mechanism in dielectric materials. Derive an expression for atomic polarizability α_e.	**7 Marks**

2 Magnetic Materials

Winter – 2013	☞ Define magnetic materials. Classify diamagnetic, paramagnetic and ferromagnetic materials in detail giving their differences.	**4 Marks**
	☞ Define and describe magnetic dipole, magnetic dipole moment and magnetic susceptibility.	**3 Marks**
	☞ Define and distinguish between hard and soft magnetic materials	**2 Marks**
	☞ What are ferrites? Give properties and uses of ferrites	**3 Marks**
Summer – 2014	☞ Distinguish between hard and soft magnetic materials	**4 Marks**
	☞ Magnetic field strength of 2×105 A/m in applied to paramagnetic material with relative permeability of 1.01. Calculate the values of B and M.	**3 Marks**
	☞ Define: (i) Magnetic susceptibility (ii) Magnetization	**2 Marks**
	☞ Discuss in detail, the procedure of data recording and reading in floppy disc.	**4 Marks**
Winter – 2014	☞ What are hard and soft magnetic materials? Compare them on the basis of hysteresis curve, Give examples of each type.	**5 Marks**
	☞ Distinguish between magnetic and optical storage devices.	**2 Marks**
	☞ Mention the advantages of hard disk over floppy disk.	**2 Marks**
	☞ A silicon material is subjected to a magnetic field of strength 1000 A/m. If the magnetic susceptibility of silicon is -0.3×10^{-5}, calculate its magnetisation. Also calculate the magnetic flux density of the field inside the material. The permeability of free space is $4\pi \times 10^{-7}$ H/m.	**3 Marks**
Summer – 2015	☞ Compare Hard and Soft Magnetic materials.	**3 Marks**
	☞ Explain the producer of data recording and reading in magnetic tape.	**4 Marks**
	☞ A paramagnetic material has a magnetic field intensity of 10^4 A/m. If the susceptibility of the material at room temperature is 3.7×10^{-3}, calculate the magnetization and flux density of the material.	**3 Marks**
	☞ Define the term (1) Magnetic Susceptibility	**1 Mark**
Winter – 2015	☞ Describe the general properties of Diamagnetic, Paramagnetic and Ferromagnetic materials.	**7 Marks**
Summer – 2016	☞ _____ materials are used to make permanent magnets. (1) diamagnetic (2) paramagnetic (3) soft magnetic (4) hard magnetic	**1 Mark**
	☞ Which of the following is not true for soft magnetic materials ? They have (1) low coercivity (2) low retentivity (3) low permeability (4) high susceptibility	**1 Mark**
	☞ The chemical formula of ferrite is ____ (1) $MOFe_3O_4$ or MFe_2O_4 (2) $MOFe_2O_3$ or MFe_2O_4 (3) $MOFe_3O_3$ or MFe_3O_4 (4) $MOFe_2O_2$ or MFe_2O_3	**1 Mark**
	☞ Derive an expression for magnetic moment in terms of orbital angular momentum.	**4 Marks**
	☞ Compare properties of diamagnetic, paramagnetic and ferromagnetic materials	**7 Marks**

Winter – 2016	☞ Magnetic susceptibility (χ_m) equals (a) dipole moment per unit volume (b) torque per unit area (c) magnetization per unit magnetic field intensity (d) none of these	**1 mark**
	☞ A magnetic field strength of 2 x 10^5 A/m is applied to a paramagnetic material with a relative permeability of 1.01, calculate the values of Intensity of magnetic field(B) and Magnetisation(M).	**3 marks**
	☞ Discuss the general properties of Paramagnetic and Diamagnetic materials.	**4 marks**
	☞ Explain: Meissner effect. Prove that a superconductor exhibits perfect diamagnetism	**4 marks**
Summer – 2017	☞ The magnetic susceptibility is equals to _____ (a) $\chi = mH$ (b) $\chi = mH/B$ (c) $\chi = m/H$ (d) $\chi = mB/H$	**1 mark**
	☞ Magnetostriction effect is obtained from _____ material. (a) Dia (b) Pera (c) Ferro (d) Ferri	**1 mark**
	☞ From the following , Soft magnetic materials are used in _____ (a) transformer cores (b) dc meters (c) microphones (d) compass needles	**1 mark**
	☞ Curie – Weiss law is _____ (a) $\chi = C/(T - \theta)$ (b) $\chi = C/(2T - \theta)$ (c) $\chi = C/(T + \theta)$ (d) none of this	**1 mark**
	☞ What are ferromagnetic domains? Draw B-H curve for hard and soft ferromagnetic materials and define remnant and coercive fields on the curve.	**4 marks**
	☞ Give difference between soft and hard magnetic material. Also give their applications.	**3 marks**
	☞ Magnetic field of 2 × 10^5 A/m is applied to a paramagnetic material with relative permeability of 1.01 Calculate the value of B and M.	**3 marks**
Winter – 2017	☞ In which materials magnetic dipoles are align anti-parallel with unequal magnitude (a) anti – ferromagnetic (b) Diamagnetic (c) Paramagnetic (d) Ferri magnetic	**1 mark**
	☞ Pen drive stores the data in the form of (a) only magnetic field (b) only electric field (c) both electric field and magnetic field.	**1 Mark**
	☞ For which type materials are of hysteresis curve is zero (a) Anti-ferromagnetic materials (b) Diamagnetic materials (c) Paramagnetic materials (d) None of the above	**1 Mark**
	☞ To reduce eddy current loss in transformer core materials will be (a) soft magnetic material (b) hard magnetic material (c) metallic glass (d) dielectric material	**1 Mark**
	☞ Which of the following represents the Bohr Magneton? (a) $\frac{e\hbar}{2\pi m}$ (b) $\frac{eh}{4\pi m}$ (c) $\frac{e\hbar}{4\pi m}$ (d) $\frac{eh}{2\pi m}$	**1 Mark**
	☞ Explain with neat diagram recording and reading of data is carried out in magnetic storage.	**7 Marks**

3 Acoustic

Winter – 2013	☞ Define and discuss the factors, reverberation, loudness, echelon effect and noise that affect the acoustics in a hall and the remedies for them.	**4 Marks**
	☞ The Volume of a room is 1500 m^2. The wall area of the room is 260 m^2, the floor area is 140 m^2 and the ceiling area is 140 m^2. The average sound absorption coefficient for the wall is 0.03 Sabine, for the ceiling is 0.8 Sabine and for the floor is 0.06 Sabine. Calculate the average absorption coefficient and reverberation time.	**3 Marks**
	☞ Describe any two characteristics of musical sound.	**2 Marks**
Summer – 2014	☞ Discuss briefly about types of sound absorbing materials.	**4 Marks**
	☞ A hall has a volume of 12,500 m^3 and reverberation time of 1.5 sec. If 200 cushioned Chairs are additionally placed in the hall, What will be the new Reverberation time of the hall? The absorption of each chair is 1 O.W.U.	**3 Marks**
Winter – 2014	☞ What is the resultant sound level in bel, when a 9 bel sound is added to a 90 dB sound?	**3 Marks**
Summer – 2015	☞ State any four factors affecting the acoustics of the building and give at least two remedies for each.	**4 Marks**
	☞ The reverberation time is found to be 1.5 sec for an empty hall and it is found to be 1.0 sec when a curtain cloth of 20 m^2 is suspended at the centre of the hall. If the dimension of the hall are 10 × 8 × 6 m^3. Calculate the coefficient of absorption of curtain cloth	**3 Marks**
Winter – 2015	☞ The volume of a room is 1500 m^3. The wall area of the room is 260 m^2, the floor area is 140 m^2 and the ceiling area is 140 m^2. The average sound absorption coefficient for the wall is 0.03, for the ceiling 0.8 and for the floor 0.06. Calculate the average absorption coefficient and the reverberation time.	**3 Marks**
	☞ Explain the factors affecting acoustics of buildings and their remedies.	**4 Marks**
	☞ Discuss the characteristics of Musical sound.	**4 Marks**
Summer – 2016	☞ The unit of absorption coefficient is _____ (1) W/*m*2 (2) dB (3) sabine (4) Bel	**1 Mark**
	☞ Weber Fechner law is given as ___ (1) L = K/log_{10}I (2) L = Klog_{10}I (3) I = K/log_{10}L (4) I = Klog_{10}L	**1 Mark**
Summer – 2016	☞ Unit of loudness is _____ (1) Hertz (2) phon (3) second (4) sabine – m^2	**1 Mark**
	☞ A hall has a volume of 12,500 m^3 and reverberation time of 1.5 sec. If 200 cushioned chairs are additionally placed in the hall what will be the new reverberation time of the hall? The absorption of each chair is 1 O.W.U.	**3 Marks**

Winter – 2016	☞ Threshold of feeling is (a) 100dB (b)110dB (c)130dB (d)120dB	**1 mark**
	☞ Write a short note on: Sound absorbing materials	**4 marks**
	☞ What is the resultant sound level when 70dB sound is added to a 80dB sound.	**3 marks**
	☞ Explain: (a) Relative intensity (b) absorption coefficient	**4 marks**
	☞ What is an acoustic grating. Explain the acoustic grating method of determining the velocity of ultrasonic waves in liquids.	**7 marks**
Summer – 2017	☞ _____dB is the sound level for the threshold of pain. (a) 0 dB (b) 120 dB (c) 110 dB (d) 10^{-12} dB	**1 mark**
	☞ Define absorption coefficient and its unit. A hall has a volume of 1,20,000 m^3 It has a reverberation time of 1.5 seconds. What is the average absorbing power of the surface if the total absorbing surface area is 25,000 m^2?	**3 marks**
Winter – 2017	☞ Which of the following represents correct formula for intensity of sound? (a) $2\pi^2 f a^2 \rho v$ (b) $2\pi^2 f^2 a \rho v$ (c) $2\pi^2 f^2 a^2 \rho v$ (d) $2\pi f^2 a^2 \rho v$	**1 Mark**
	☞ Calculate the intensity level of turbine whose sound intensity is 100 W/m^2, when it is under operation. (Standard intensity level is 10^{-12} W/m^2)	**3 Marks**
	☞ What are the factors affecting the acoustics of buildings and its remedies?	**7 Marks**
	☞ What is an acoustic grating? Explain the acoustic grating method to determine the velocity of ultrasound in liquids.	**4 Marks**

4 Ultrasonic

Winter – 2013	☞ Explain with neat circuit diagram the generation of ultrasonic waves by magnetostriction oscillator method.	**3 Marks**
Summer – 2014	☞ Explain with neat circuit the generation of ultrasonic waves using piezo-electric Oscillator.	**4 Marks**
	☞ Describe any six applications of ultrasonic waves.	**3 Marks**
	☞ Explain with neat circuit diagram the generation of ultrasonic waves by magnetostriction oscillator method.	**3 Marks**
Winter – 2014	☞ The pulse arrival times from the steel bar of 30 cm thickness during the detection of possible defects using pulse echo method are 30 µs and 60 µs. Find out the distance of defect in a steel bar from the entrance end of ultrasonic waves.	**3 Marks**
	☞ Write the answers of below given questions based on the ultrasonic waves production method using ferromagnetic material. o What is the principle for ultrasonic wave production? o Draw a figure of the oscillatory circuit. o Write the working of the ultrasonic wave production method. o Give merits and demerits of the method.	**1 Mark** **1 Mark** **3 Marks** **2 Marks**

Summer – 2015	☞ An ultrasonic source of 0.07 MHz sends down a pulse towards the seabed which returns after 0.65 sec. The velocity of sound in water is 1700 m/s. Calculate the depth of the sea and wavelength of pulse.	**3 Marks**
	☞ Define piezoelectric effect and draw the circuit diagram of piezoelectric oscillator and explain the production of ultrasonic waves using it.	**4 Marks**
Winter – 2015	☞ Give the properties of Ultrasonic waves. Describe basic principle, construction and working of Piezoelectric method to produce the ultrasonic waves.	**7 Marks**
Summer – 2016	☞ How can the depth of sea be measured using ultrasonic waves?	**4 Marks**
	☞ Find the frequency of the first and second modes of vibration for a quartz crystal of piezoelectric oscillator. The velocity of longitudinal waves in quartz crystal is 5.5×10^3 m/s. thickness of quartz crystal is 0.05 m.	**3 Marks**
	☞ Discuss Piezo electric method of producing ultrasonic wave	**7 Marks**
Winter – 2016	☞ Material used for the production of ultrasonic waves in magnetostriction effect is (a) paramagnetic (b) diamagnetic (c) ferromagnetic (d) can't say	**1 mark**
	☞ Which of the following waves does not belong to the electromagnetic spectrum (a) X-rays (b) Microwave (c) Infrared (d) Ultrasonic wave	**1 mark**
	☞ Draw the circuit diagram for Magnetostriction and Piezoelectric oscillator method	**4 marks**
Summer – 2017	☞ The dimensional formula for frequency of ultrasonic sound is (a) $M^0L^0T^0$ (b) $M^0L^{-1}T^0$ (c) $M^0L^0T^{-1}$ (c) $M^0L^{-1}T^{-1}$	**1 mark**
	☞ Give difference between NDT and DT. Explain general objectives of NDT.	**4 marks**
	☞ In one of the quality testing lab ion slab with thickness 40 cm is tested with the help of ultrasound echo method. If the two passing pulses through specimen returns after 30 µs and 80 µs respectively. Find the physical distance (depth) of the defect in specimen.	**3 marks**
	☞ If an Ultrasonic welding machine uses frequency 10 MHz. Explain with neat sketch diagram principle, working, merits and demerits of traducer which will be used to generate this high frequency.	**4 marks**
Winter – 2017	☞ The value of threshold intensity 10^{-12} W/m^2 is set at frequency (a) 20 Hz (b) 20 *k*Hz (c) 50 Hz (d) 1 *k*Hz	**1 Mark**
	☞ A nickel of 10 *cm* length with a density of 8.1×10^3 kg/m^3 and Young's modulus of 8.2×10^{11} N/m^2 is used in a magnetostriction oscillator. Determine the fundamental frequency of the ultrasound generator.	**3 Marks**

5 Superconductivity

Winter – 2013	☞ Define superconductivity. Write definitions of the three important factors to define a superconducting state? Also, discuss few important properties of superconductors.	**4 Marks**
	☞ The critical temperature of the Nb is 9.15 K. At zero Kelvin, the critical field is 0.196 T. Calculate the critical field at 6 K.	**3 Marks**
	☞ Compare type-I and type-II superconductor	**2 Marks**
	☞ Give applications of superconductivity mentioning Josephson devices and magnetic levitation in detail.	**3 Marks**
Summer – 2014	☞ Write a short note on followings: (i) Isotopic effect (ii) Meissner effect	**4 Marks**
	☞ Calculate the critical current for a superconducting wire of lead having diameter 1 mm at 4.2 K. Critical temperature for lead is 7.18 K and $H_0 = 6.5 \times 10^4$ A/m.	**3 Marks**
Winter – 2014	☞ The critical temperature TC for Hg with isotopic mass 199.5 is 4.185 K. Calculate the critical temperature for its isotopic mass 204.5.	**3 Marks**
	☞ Discuss: Maglev effect.	**3 Marks**
	☞ What is Meissner effect?	**1 Mark**
	☞ Prove that superconducting materials are perfect diamagnetic materials.	**3 Marks**
Summer – 2015	☞ Discuss the properties of superconductors.	**4 Marks**
	☞ Compare Type-I and Type-II superconductors.	**3 Marks**
Winter – 2015	☞ Compare Type-I and Type-II Superconductors	**3 Marks**
	☞ Discuss the properties of Superconducting materials.	**4 Marks**
	☞ For mercury of mass number 202, the α value is 0.50 and Tc is 4.2 K. Find the critical temperature for the isotope of mercury of mass number 200	**3 Marks**
Summer – 2016	☞ The relation between transition temperature Tc of a superconductor and its isotopic mass M is given as_____ (1) $T_c \alpha M^{-1/2}$ (2) $T_c \alpha M^{1/2}$ (3) $T_c \alpha 2M^{-1/2}$ (4) $T_c \alpha 2M^{1/2}$	**1 Mark**
	☞ For superconductors magnetic susceptibility χ = ___ (1) 0 (2) 1 (3) -1 (4) ∞	**1 Mark**
	☞ Find the critical current for a superconducting wire of lead having a diameter of 1 mm at 4.2 K . Critical temperature of lead is 7.18 K and $H_c(0) = 6.5 \times 10^4$ A/m.	**3 Marks**
	☞ What are superconductors? Discuss Type-I and Type-II superconductors.	**7 Marks**
Winter – 2016	☞ Cooper pairs are formed between electrons (a) of same spin (b) of opposite spin (c) of same velocity (d) of different velocity	**1 mark**
	☞ Explain Josephson effect and its application.	**7 marks**

Summer – 2017

- ☞ The resistivity of liquid helium drops to zero at _____ K **1 mark**

  (a) 3.8 K (b) 4.2 K (c) 6 K (d) 0 K

- ☞ What is superconductivity? Compare Type-1 and Type-2 superconductors. Which of these two has wider application? Why? **4 marks**

- ☞ What is isotopic effect for superconducting material? The critical temperature for a metal with isotopic mass of 199.5 is 4.185 K. Calculate the isotopic mass if the critical temperature falls to 4.133 K. **3 marks**

- ☞ Explain Josephson Junction and its application. Also explain application of superconductor in Cryotron **4 marks**

Winter – 2017

- ☞ The current required to destroy the superconductivity is equal to **1 Mark**

  (a) $I_c = 2\pi r H_0$ (b) $I_c = 2\pi H_c$ (c) $I_c = 2\pi r H_c$ (d) $I_c = 4\pi r^2 H_c$

- ☞ In Josephson junction made by **1 Mark**

  (a) superconductor sandwich between two conductors

  (b) insulator sandwich between two superconductors

  (c) semiconductor sandwich between two superconductors

  (d) superconductor sandwich between two insulators

- ☞ Define superconductivity. What are different types of superconductors? Explain them in detail. **7 Marks**

- ☞ Calculate the critical current for a wire of lead having a diameter of 1 *mm* at 4.2 K. Critical temperature for leads is 7.18 K and H_e (0) = 6.5 X 10^4 A/*m*. **3 Marks**

6 LASER

Winter – 2013	☞ Expand LASER. Describe the construction and working of Nd:YAG laser with a suitable energy-level diagram	**4 Marks**
	☞ Discuss the applications of lasers in various fields.	**3 Marks**
Summer – 2014	☞ Discuss the properties of LASER in detail.	**4 Marks**
	☞ Define: (i) Metastable state (ii) Population Inversion (iii) Pumping	**3 Marks**
	☞ Compare between spontaneous and stimulated emission.	**4 Marks**
Winter – 2014	☞ Draw a schematic diagram of the construction of Nd-YAG laser.	**1 Mark**
	☞ What are the active medium and active centers of the Nd-YAG laser?	**1 Mark**
	☞ Draw the energy level diagram for Nd-YAG LASER.	**1 Mark**
	☞ Write the working of Nd-YAG laser.	**3 Marks**
	☞ Write applications of Nd-YAG laser.	**1 Mark**
Summer – 2015	☞ Describe the construction and working of Nd: YAG Laser with a suitable energy level diagram	**4 Marks**
	☞ Define the term (1) Pumping	**1 Mark**
Winter – 2015	☞ What are the characteristics of LASER? Describe the principle, construction and working of Nd-YAG Laser with suitable diagrams	**7 Marks**
Summer – 2016	☞ Life time of an atom in meta stable state is of the order of ____ s (1) $10^{-9} – 10^{-8}$ (2) $10^{-8} – 10^{-6}$ (3) $10^{-6} – 10^{-3}$ (4) $10^{-3} – 10^{-2}$	**1 Mark**
	☞ Electrical pumping is adopted in ____ LASER (1) Nd:YAG (2) CO_2 (3) Ruby (4) Semiconductor	**1 Mark**
	☞ Describe the construction and working of Nd:YAG laser with suitable energy level diagram.	**7 Marks**
Winter – 2016	☞ Nd-YAG LASER emittes _ μ*m* wavelength (a) 1.063 (b) 1.062 (c) 1.064 (d) 1.406	**1 mark**
	☞ Laser beam is highly coherent so it can be used in (a) Polarization (b) Interference (c) Diffraction (d) Scattering	**1 mark**
	☞ Describe the principle, construction and working of Nd-YAG Laser with suitable diagrams	**7 marks**
	☞ Discuss the characteristics of LASER.	**4 marks**
	☞ Define: Pumping, Life time, Metastable state	**3 marks**

Summer – 2017	☞ In Nd: YAG laser _____ kind of pumping is used. (a) optical pumping (b) direct electron excitation (c) inelastic atom collision (d) none of these	**1 mark**
	☞ The mathematical expression for existence of stimulated emission is proposed by _____ (a) Newton (b) Ohm (c) Pascal (d) Einstein	**1 mark**
	☞ Explain basic component of laser generation. Also give types of laser. Give applications of laser in various fields.	**7 Marks**
Winter – 2017	☞ Which event is likely to take place when a photon of energy equal to the difference in energy between two levels is incident in a system? (a) absorption (b) emission (c) absorption and emission (d) prominently scattering	**1 Mark**
	☞ Describe the construction and working of Nd-YAG LASER with a suitable energy level diagram.	**7 Marks**

7 FIBER OPTICS

Winter – 2013	☞ Give difference between step index fiber and graded index fiber.	**2 Marks**
	☞ A step index fiber has a numerical aperture of 0.26, a core of refractive index 1.5 and diameter of 100 μ*m*. Calculate (i) refractive index of cladding (ii) acceptance angle (iii) the maximum number of modes with a wavelength of 1 μ*m* that the filter can carry	**3 Marks**
Summer – 2014	☞ Discuss in detail the advantages of optical fiber over conventional metallic cable.	**4 Marks**
	☞ List out the difference between single mode fiber and multi mode fiber.	**3 Marks**
	☞ A silica optical fiber has a core of relative index 1.55 and a cladding of refractive index 1.47. Determine the critical angle, numerical aperture and the acceptance angle for fiber.	**3 Marks**
Winter – 2014	☞ An optical fibre has numerical aperture of 0.2 and cladding refractive index of 1.59. Determine the acceptance angle for the fibre in water which has refractive index 1.33.	**3 Marks**
	☞ What do you understand by index profile? List out the difference between step and graded index fibre.	**4 Marks**
Summer – 2015	☞ Explain the different types of fibers based on materials, mode and index profile.	**7 Marks**
	☞ A refractive index of core for step index fiber is 1.52, diameter is 2.9 μm and a fractional difference of refractive index is 0.0007. It is operated at a wavelength of 1.3 μm. Find the number of modes the fiber will support.	**3 Marks**
	☞ Define the term (1) Total Internal Reflection	**1 Mark**
Winter – 2015	☞ Give the differences between Step Index Fiber and Graded Index Fiber	**4 Marks**
	☞ Define and derive necessary expressions for acceptance angle and numerical aperture of a fiber.	**4 Marks**
Summer – 2016	☞ The basic principle behind fibre optic behind fibre optic communication is (1) reflection (2) refraction (3) total internal reflection (4) diffraction	**1 Mark**
	☞ Discuss in detail advantages of fibre optic cable over metallic cable	**7 Marks**
	☞ An optical fibre core and its cladding have refractive indices of 1.545 and 1.495 respectively. Calculate the critical angle Φ_c , acceptance angle $\Phi_{in(max)}$ and numerical aperture	**3 Marks**
Winter – 2016	☞ We prefer _____ fiber for short distance communication. (a) Single mode (b) Multi mode (c) Dual mode (d) None of these	**1 mark**
	☞ Which of the following is the transmission frequency in optical fibre (a) 10^{14} (b)10^{13} (c)10^{12} (d)10^{11}	**1 mark**
	☞ What do you mean by acceptance angle. Derive expression for them.	**7 marks**
	☞ An optical fiber core and cladding have refractive index of 1.545 and 1.495 respectively. Calculate critical angle, acceptance angle and numerical aperture.	**3 marks**
	☞ What is relative refractive index. Derive relation between numerical aperture and relative refractive index.	**3 marks**

Summer – 2017	☞ According to Snell's law (a) $\eta_1/\eta_2 = \sin\Phi_1/\sin\Phi_2$ (b) $\eta_1/\eta_2 = \sin\Phi_2/\sin\Phi_1$ (c) $\eta_1/\eta_2 = \sin\Phi_1 + \sin\Phi_2$ (d) $\eta_1/\eta_2 = \sin^2\Phi_1/\sin^2\Phi_2$	**1 mark**
	☞ What do you understand by refractive index profile? Draw the sketch of step index & graded index fibers? Also give one example of each fiber in real world application.	**3 marks**
	☞ Define numerical aperture for optical fiber and give its equation. Calculate the refractive indices of core and cladding materials of an optical fiber if its numerical aperture is 0.22 and relative refractive index difference is 0.012.	**3 marks**
	☞ Describe the construction of fiber optical cable and compare the advantage of fiber optic cable over metallic cable.	**7 marks**
Winter – 2017	☞ What is acceptance angle and numerical aperture? Derive the expression for them.	**7 Marks**
	☞ Calculate the refractive index of the core and cladding of a fiber from the following data. The NA is 0.027 and relative refractive index is 0.015	**3 Marks**

8 NANO PHYSICS

Winter – 2013	☞ Explain with neat sketch carbon nanotubes giving its structure, properties and applications.	**4 Marks**
	☞ Justify and give comments on, "At macro scale, the physical and chemical properties are not dependent on the size of the material, but at the nanoscale everything will change including colour, melting point and chemical properties."	**3 Marks**
	☞ Define and describe 'surface to volume ratio' and 'quantum confinement effects'.	**2 Marks**
	☞ Give any six applications of nanomaterials.	**3 Marks**
Summer – 2014	☞ Discuss in detail how the different properties of nonmaterial changes with reduction in size.	**4 Marks**
	☞ Describe Electric arc method of CNT synthesis.	**3 Marks**
	☞ Discuss in detail quantum confinement.	**3 Marks**
Winter – 2014	☞ Explain: Quantum confinement	**4 Marks**
	☞ Define the term nanoparticle	**1 Mark**
	☞ Describe the ball milling and plasma arcing method to produce nanoparticles	**6 Marks**
	☞ Write the applications of Carbon nanotubes.	**4 Marks**
Summer – 2015	☞ Describe the Ball milling method to produce nano-particles	**4 Marks**
	☞ Discuss in detail the quantum confinement.	**3 Marks**
	☞ With a neat sketch explain how a CNT is synthesized using chemical vapour deposition technique.	**4 Marks**
	☞ Explain briefly the carbon nanotubes (CNT) and their different structure.	**4 Marks**
Winter – 2015	☞ List the important properties and applications of CNTs and explain the Chemical Vapour Deposition method to synthesis the CNT.	**7 Marks**
	☞ Write a note on: Quantum Confinement in nanoparticles	**3 Marks**
	☞ Discuss Ball Milling mechanical method to synthesis nanoparticles	**4 Marks**
Summer – 2016	☞ The grain sizeof nano materials is in the range of (1) 0.1 to 1 *nm* (2) 1 to 10 *nm* (3) 1 to 100 *nm* (4) 10 to 100 *nm*	**1 Mark**
	☞ Explain what quantum confinement is.	**4 Marks**
	☞ Give some properties and applications of nanomaterials.	**4 Marks**
Winter – 2016	☞ List out the techniques used in synthesis of Nanomaterials. Discuss any two of them in detail.	**7 marks**
Summer – 2017	☞ The following are the structure of CNT (a) Chiral (b) Armchair (c) zigzag (d) all of these	**1 mark**
	☞ List out properties and application of CNT's.	**3 marks**
Winter – 2017	☞ What is the importance of electron confinement in nanomaterial?	**4 Marks**
	☞ List important properties and applications of CNT.	**4 Marks**

9 ADVANCED ENGINEERING MATERIALS

Winter – 2013	☞ What are Shape Memory Alloys? Give some of its applications.	**2 Marks**
	☞ What are the properties of metallic glasses? Mention some important applications.	**2 Marks**
	☞ What are biomaterials? Explain the different types of biomaterials and their applications in the medical field.	**2 Marks**
	☞ What is solar cell? Discuss a few materials that are used in solar cell design.	**2 Marks**
	☞ Briefly discuss fuel cells.	**2 Marks**
	☞ Give the difference between metallic and non-metallic glasses.	**2 Marks**
Summer – 2014	☞ Explain the two function properties of shape memory alloys in detail.	**4 Marks**
	☞ Write a short note on ultra capacitor	**3 Marks**
	☞ Explain the melt spinning technique to prepare metallic glasses	**3 Marks**
Winter – 2014	☞ Write short note on bioceramics	**3 Marks**
	☞ What are metallic glasses? Write applications of metallic glasses.	**4 Marks**
	☞ Describe temperature & stress induced transformations in shape memory alloys.	**4 Marks**
Summer – 2015	☞ List out the properties and application of Metallic glasses.	**3 Marks**
	☞ What is the shape memory Alloys (SMA)? Explain the temperature induced and stress induced transformations in detail.	**7 Marks**
	☞ What is solar cell? Discuss a few materials that are used in solar cell design.	**3 Marks**
Winter – 2015	☞ What are the types of Metallic Glasses? Describe the preparation method to produce the metallic glasses with its applications.	**7 Marks**
Summer – 2016	☞ Explain temperature induced and stress induced transformations in shape memory alloys in detail.	**7 Marks**
Summer – 2017	☞ _____is the process to synthesize Metallic Glass (a) ball milling (b) plasma arching (c) melt spinning technique (d) CVD	**1 mark**
	☞ Define bio material? Which characteristics are desirable in ideal bio materials? List out types and application of biomaterials in medical field.	**7 marks**
	☞ Explain with suitable examples applications of SMA in different fields.	**4 marks**
	☞ Define Metallic Glasses. Give synthesis and applications of Metallic Glasses.	**4 marks**
	☞ List out techniques used in Synthesis of Nanomaterial. Briefly explain sole - gel techniques of preparing Nanomaterial and mention its advantage.	**4 marks**
Winter – 2017	☞ The characteristic temperature associated with the phase transformation are (a) M_s, M_f, A_g, M_d (b) M_s, M_f, A_s, A_f (c) M_s, M_d, A_s, A_f (d) M_s, M_f, A_s, M_f	**1 Mark**
	☞ Explain the two functional properties of SMA.	**4 Marks**
	☞ Explain why metallic glasses are used for core in transformer in power lines.	**4 Marks**
	☞ What is photovoltaic effect? List the different materials uses for solar cell.	**3 Marks**