

ELECTROSTATICS

Guess Questions- 2007

1. Define electric dipole moment? What is direction of electric dipole moment?
2. Find electric field due to an electric dipole (i) at point on the axial line. (ii) at point on equatorial line.
3. Deduce an expression for a potential at a point due to point charge.
4. Find potential at point due to dipole (i) at any point (ii) at axial point (iii) at equatorial point.
5. State the Gauss's theorem and prove it (Statement and its proof)?
6. Gauss's theorem and its application – (i) to find electric field due to long straight wire (infinitely) (ii) Electric field due to uniformly charged infinite plane sheet and (iii) uniformly charged thin spherical shell.
7. What is principle of capacitor? Find the capacitance of parallel plate capacitor.
8. Find the capacitance of parallel plate capacitor when dielectric slab is inserted between two parallel plates.
9. Find energy stored in capacitor?
10. Van de Graff generator-principle, construction, working and theory.
11. A capacitor is charged to potential V_1 . The power supply is then disconnected and the capacitor is then connected in parallel to another capacitor (uncharged)
 - (a) Derive the expression for the common potential of the combination of capacitors.
 - (b) Show that the total energy of combination is less than the sum of the energy store in them before they are connected.

ELECTROMAGNETIC WAVE

GUESS QUESTIONS-2007

1. Give any two characteristics of electromagnetic waves. Write the expression for the velocity of electromagnetic waves in terms of the permittivity and permeability of medium.
2. Draw a labelled diagram of Hertz's experimental set-up to produce electromagnetic waves. Explain the generation of electromagnetic waves using this set-up. [3]
3. State four properties of electromagnetic waves?
4. Arrange the following electromagnetic radiations in the ascending order of their wavelength: microwaves, γ -rays, radio waves, ultraviolet light.
5. Give one use of each of the following:
 - (i) Microwaves (ii) infra-red waves (iii) ultraviolet radiation (iv) gamma ray
6. Transmission of T.V. signals is not possible using sky waves. Why?
7. Give a reason to show that microwaves are better carriers of signals for long range transmission than radio waves.
8. Name the electromagnetic radiations used for studying crystal structure of solids.
9. What is the nature of waves used in Radar? What is their wavelength range?
10. Write the frequency limit of visible range of electromagnetic spectrum in kHz
11. Write the following radiations in an ascending order in respect of their frequencies: X-rays, microwaves, ultraviolet rays and radio waves.

CURRENT ELECTRICITY

GUESS QUESTIONS-2007

1. Derive the condition for balance Wheatstone bridge.
2. State the Faraday law of electrolysis. Define the Faraday constant. Deduce the relation $E_1/E_2 = Z_1/Z_2 = m_1/m_2$. All have usual meaning. Define Electro chemical Equivalent of a substance.
3. What is seebeck effect? State factors on which temperature of inversion for a thermocouple depends.
4. Which of the two thermocouple Sb, Bi, or Cu, Fe produce the maximum thermo emf for the same temperature difference between hot and cold junctions? Give reasons?
5. If the temperature of cold junction of thermocouple is lowered. What will be effect on its neutral temperature.
6. Define the thermoelectric power. Draw the graph between thermoelectric power and variation of hot junction.
7. Thermo emf of a thermocouple is given by the expression $E = \alpha\theta - \beta\theta^2$. Where θ is the temperature of hot junction. If $\alpha = 42\mu\text{V } ^\circ\text{C}^{-1}$, $\beta = .0035 \mu\text{V } ^\circ\text{C}^{-1}$, Calculate the (i) neutral temperature and (ii) temperature of inversion of thermocouple, if the cold junction is at 20°C .
(OR)
The thermo emf of a thermocouple varies with the temperature of hot junction according to the relation $E = 14\theta - 0.02\theta^2$, where θ is the temperature of hot junction. Calculate
(i) Neutral temperature of the thermocouple.
(ii) temperature of inversion assuming that cold junction is at 20°C and
(iii) Value of seebeck coefficient at neutral temperature.
8. How much current will flow through an electric heater, rated at 1 kW when connected to a 220V supply? [1]
9. A current of 5.0A flows through an electric press of resistance 44Ω . Calculate the energy consumed by the press in 5 minutes. [1]
10. Two electric bulbs A and B are marked 220W and 100W respectively. Which one of the two has greater resistance?
11. Two bulbs whose resistances are in the ratio 1 : 2, are connected in parallel to a source of constant voltage. What will be the ratio of power dissipation in these?
12. Mention two defects of a simple cell.
13. Define 'Electro Chemical Equivalent' of a substance.
14. Give two defects of a voltaic cell.
15. Give the role of MnO_2 in a dry cell.
16. A steady current is passed through a copper voltmeter for 10 minutes. The mass of copper deposited is 0.0128 gram. Calculate the value of current passing through the voltmeter. (E.C.E. of copper = 0.00032 g/C). [2]
[Ans. $I = 6.7 \times 10^{-2}\text{A}$]
17. A heater coil is rated 100W, 200V. It is cut into two identical parts. Both parts are connected together in parallel, to the same source of 200V. Calculate the energy liberated per second in the new combination.
18. State main difference between a primary cell and a secondary cell.

MAGNETIC EFFECT OF CURRENT AND EARTH MAGNETISM

GUESS QUESTIONS- 2007

1. State the Biot-Savart law (i) Find the magnetic field due to an infinitely long current carrying conductor.
2. Find the magnetic field at the centre of the circular coil carrying current.
3. Find the magnetic field induction at a point due to current flowing in long straight conductor.
4. State and prove the Ampere's circuital law and by applying it find the
(a) Magnetic field at point well inside the solenoid carrying current .
(b) Derive an expression for magnetic field inductor due to current in a toroid. .
5. Find the force which is acting on a moving charge in a uniform magnetic field and electric field.
6. Define magnetic field and write its S.I unit.
7. Discuss the motion of a charged particle when it is projected to uniform magnetic field ,the direction of particle makes an angle $\theta = \pi / 2$ and $\theta = \alpha$ with the direction of magnetic field .
8. What is a cyclotron. Discuss its principle ,construction ,working, theory and limitation of cyclotron.
9. Find the force on a current carrying conductor placed in a uniform magnetic field.
10. Find the force between two parallel conductors carrying currents in (i) the same direction (ii) in opposite directions and hence define **one ampere**.
11. Find the torque acting on the rectangular current loop suspended in a uniform magnetic ,when placed inclined at an angle θ with direction of magnetic field .
12. Discuss the principle ,construction and theory of a moving coil galvanometer .
13. Define current sensitivity and voltage sensitivity of a moving coil galvanometer .How can galvanometer be made more sensitivity .
14. What is ammeter?. How can a galvanometer be converted into a voltmeter and into ammeter.+ (Numerical)
15. How will the magnetic field intensity at the centre of the circular coil carrying current change ,if the current through the coil is double and the radius of the coil is halved?
16. Energy of a charged particle moving in a uniform magnetic does not change. explain

MAGNETISM

1. Define magnetic moment of a dipole and give its S.I. unit.
2. Give one example each of ferromagnetic, paramagnetic and diamagnetic materials [1]
3. What type of magnetic material is used in making permanent magnets? [1]
4. The angle of dip at two places on the surface of the earth are respectively 0° and 90° .
Where are these places located? [1]
5. Horizontal component of Earth's magnetic field at a place is $\sqrt{3}$ times the vertical component. What is the value of angle of dip at this place? [1]
6. How will you distinguish a diamagnetic substance from a paramagnetic substance in respect of their behavior in a uniform and non-uniform magnetic field? [2]
7. The vertical component of earth's magnetic field at a place is $\frac{1}{3}$ times the horizontal component. What is the value of angle of dip at this place? [2]
8. Define (i) Angle of inclination (ii) Angle of declination (iii) Horizontal component.
9. Define neutral point. Locate the positions of neutral points when a small bar magnet is placed with its north pole: [3]
 - (i) towards north of the earth and
 - (ii) towards south of the earth.
10. Write any three characteristics, a ferromagnetic substance should possess, if it is to be used to make a permanent magnet. Give example of such material. [2]
11. Explain behavior of Dia, Para and Ferro magnetic substance, in magnetic field (uniform, non-uniform).
12. Explain magnetic dipole moment of a revolving electron?
13. A bar magnet of magnetic moment M is aligned parallel to the direction of a uniform magnetic field B . What is work done due to turn the magnet so as to align its magnetic (i) opposite to the field direction and (ii) normal to the field direction.
14. How does the (i) pole strength and (ii) magnetic moment of each part of a bar magnet change. If (a) it is cut into two equal pieces transverse to its length, (b) it is cut into two equal pieces along its length?

ELECTRO MAGNETIC INDUCTION, & ALTERNATING CURRENT

GUESS QUESTIONS-2007

1. State Faraday's laws of electromagnetic induction?
2. What is magnetic flux? Write the factors on which it is dependent?
3. State Lenz's law. Does it obey the principle of energy conservation?
4. What are eddy currents? Write any two applications of eddy currents.
5. What is self-induction? Define the coefficient of self-induction. Write its unit.
Calculate self-inductance of a long solenoid?
6. What is mutual induction? Define the coefficient of mutual induction. Write its unit.
Calculate coefficient of mutual inductance between two long solenoids.
7. With the help of appropriate diagram, derive the relation $\epsilon = Blv$ for motion of a loop where emf ϵ is produced in a wire of length l moving with a velocity v perpendicular to a uniform magnetic field B .

ALTERNATING CURRENT

1. What is meant by mean value of alternating current ? Derive an expression for mean value of A.C. & emf over first half cycle?
2. What is meant by r.m.s. value of alternating current ? Derive an expression for r.m.s value of A.C. & emf ?.
3. Calculate the frequency of the series resonance circuit ? Define the Q factor of this circuit?
4. Derive an expression for the average power in LCR circuit connected to A.C. supply. Hence define the power factor.
5. Show average power consumed in an circuit containing pure an ideal capacitor is zero.
6. Show average power consumed in an circuit containing pure an ideal inductor is zero.
7. With help of a phasor diagram obtain a relation for impedance in an a.c. series LCR circuit .
8. Discuss the phase relation between current and emf in an a.c. circuit containing a capacitor only.
9. Discuss the phase relation between current and emf in an a.c. circuit containing a pure inductance coil only.

WAVE OPTICS

1. What is meant by fringe width . Derive an expression for fringe width in interference pattern? What is meant by diffraction of light.
2. In a single slit diffraction pattern, how is the angular width of central bright maximum changed when (i) the slit width is decreased (ii) the distance between the slit and screen is increased . (iii) light of smaller wavelength is used.
3. Derive condition for brightness or constructive interference in single slit experiment.
4. Define resolving power of an optical instrument. Briefly discuss resolving power of a microscope and telescope.
5. What are Polaroids? Write some of its uses.
6. What is meant by plane polarized light?
7. State and explain Brewster's law.
8. State Huygen's principle and prove the (i) laws of reflection and (ii) law of refraction on the basis of wave theory.
9. What is meant by interference of light? Discuss young's double slit experiment to demonstrate interference of light.
10. Derive the conditions for constructive and destructive interference.
11. What is meant by coherent sources of light.

OPTICS

GUESS QUESTIONS-2007

1. Explain the phenomenon of total internal reflection .What are the conditions for the total internal reflection ?
2. Find relation between critical angle and refractive index of medium.
3. Explain the (a) Optical fibres (b) Totally reflecting glass prism
4. Prove $-\frac{\mu_1}{u} + \frac{\mu_2}{v} = \frac{\mu_2 - \mu_1}{R}$. When refraction occurs from rarer to denser medium at a (i) concave (ii) convex spherical refracting surface. All have usual meaning. Write the sign conventions used what happen to the focal length of convex lens when it is immersed in water.
5. Derive lens maker's formula for a thin a convex lens.
6. Obtain an express for focal length of a combination of thin lenses in contact.
7. Discuss the phenomenon of refraction through a prism. Prove that $\delta=(\mu-1) A$, where the symbols have their usual meaning.
8. Prove prism formula $\mu = \frac{(\delta_m + A) / 2}{A/2}$
9. Draw a labelled diagram of a compound microscope .Deduce an expression for its magnifying power. How can the magnifying power be increased?
10. Draw a labelled diagram of an astronomical telescope. .Deduce an expression for its magnifying power when the final image is (a) at infinity (b) at least distance of distinct vision.
11. Describe a simple microscope or a magnifying glass. Derive an expression for its magnifying power
12. Describe the reflecting type telescope (a) Cassegrainian type telescope (b) Newtonian type telescope. What are its advantages?
13. Explain (a) Danger signals are red .(b) The sun looks reddish at time of sun rise and sun set (c) the colour of sky is blue.
14. The image of a candle is formed by a convex lens on the screen. If the lower half of the lens is painted black to make it completely opaque, will the full size image be obtained?
15. To a fish under water viewing obliquely a fisherman standing on the bank of a lake, does the man look taller or shorter than what he actually is?
16. A lens shown in fig. is made of two different materials. A point object is placed on the principal axis of the lens. How many images will be obtained.



17. How does focal length of a lens change when red light is replaced by the blue light ?
18. An equiconvex lens of focal length 15 cm is cut into two equal halves in thickness. What is the focal length of each half ?
19. For same angle of incidence the angles of refraction in medium P,Q , and R are 35° ,

25° , 15° respectively. In which medium will the velocity of light be minimum?

20. Draw a graph to show the variation of the angle of deviation ' δ ' with angle of incidence ' i ' for a monochromatic ray of light passing through a glass of refracting angle ' A '.

PRINCIPLES OF COMMUNICATION

Guess Questions-2007

1. Why is modulation necessary at all ? (Or) Why is modulation required for sending messages?
2. Long distance radio broadcasts use short wave bands. Why ?
3. It is necessary to use satellites for long distance T.V. transmission Why?
4. What is a carrier wave ? Why high frequency carrier waves are employed for transmission.
5. Compare and contrast the frequency and amplitude modulation ?
6. Explain what is meant by demodulation. Give block diagrams of tuned radio A.
7. What are sky waves and space waves ? Discuss their propagation.
8. What is remote sensing? . Mention some of its applications .
9. Distinguish between analog and digital communications.
10. Explain the "green house effect" of earth's atmosphere .
11. What is ground wave ? Why short wave communication over long distance is not via ground wave ?.
12. Explain that microwaves are better carriers of signals than radio waves ?
13. Deduce an expression for the distance from which the T.V signals can directly be received from a T.V tower of height h .
14. State at least four characteristics and uses of lasers .
15. Define the following terms :
(a) Amplitude modulation (b) frequency modulation (c) Fax (d) Demodulation
(e) passive satellite (f) active satellite. (g) Cladding (h) population Inversion
Inversion (i) Pulse modulation

DUAL NATURE OF MATTER AND RADIATIONS & ATOMIC NUCLEUS

GUESS QUESTION-2007

1. State laws of photoelectric emission. Establish Einstein photoelectric relation. Explain the laws of photoelectric emission on the basis of this relation.
2. Explain the terms: stopping potential and threshold frequency in photoelectric emission. Draw a graph showing the variation of stopping potential with frequency of incident light in relation to photoelectric effect.
3. Explain de Broglie dualistic nature of matter and derive de Broglie relationship for wavelength of matter waves. Find the de Broglie wavelength associated with an electron when accelerated. Under a potential difference of V volts.
4. Find a relation between cut off potential, frequency of the incident light threshold frequency.
5. Explain why wave theory of light could not explain the photoelectric effect?
6. How does (i) photoelectric current, and (ii) kinetic energy of the photoelectrons emitted in a photocell vary if the intensity of the incident radiation is doubled? Light of wavelength 400 nm is incident on the cathode of photocell, the stopping potential recorded is 6 V. If the wavelength of incident light is increased to 600 nm, calculate the new stopping potential
7. Define the terms: (i) work function, (ii) threshold frequency and (iii) stopping potential, with reference to photoelectric effect. Calculate the maximum kinetic energy of electrons emitted from a photosensitive surface of work function 3.2 eV, for the incident radiation of wavelength 300 nm.
8. State the dependence of work function on the kinetic energy of electrons emitted in a photocell. If the intensity of incident radiation is double, what changes occur in the stopping potential and the photoelectric current?
9. State how in a photocell the work function of the metal depends on the kinetic energy of the emitted electrons. If the frequency of the incident radiation is doubled what changes occur in the (i) stopping potential, and (ii) photoelectric current.
10. A source of light of frequency $\nu > \nu_0$ is placed at 2 m from the cathode of a photo cell. The stopping potential is found to be ν_0 . If the distance of the light source is halved, state with reason what changes occur in (i) stopping potential (ii) photoelectric current, and (iii) maximum velocity of photoelectrons emitted.
11. Explain the concept of nuclear forces. Discuss their important properties.
12. Explain the concept of nuclear binding energy. Draw a curve between mass number and binding energy.
13. What is meant by natural radioactivity? What types of radiations are emitted? Explain briefly the nature of these radiations
14. State and explain the laws of radioactive disintegration. Hence define disintegration constant and half life period.
15. What is meant by average life of a radioactive element? Derive an expression for it.
16. What is meant by nuclear fission and nuclear chain reaction? Outline the conditions necessary for nuclear chain reaction.
17. Describe Devison and Germer experiment to establish the wave nature of electron. Draw a labelled diagram of the apparatus.
18. Numerical based on radioactivity.
19. Numerical based on mass defect

SOLIDS AND SEMICONDUCTOR DEVICES

GUESS QUESTIONS-2007

1. Explain the formation of Energy bands in solids and hence define conduction band and valence band.
2. Distinguish between conductors (or metals), semiconductors and insulators on the basis of their energy bands.
3. What do you understand by term 'holes' in a semiconductors? Discuss how they move under the influence of an electric field?
4. What are the Intrinsic semiconductors? Explain how do they work?
5. What is doping? State the methods of doping.
6. Distinguish between (i) Intrinsic and Extrinsic semiconductor and (ii) n-type semiconductor and p-type semiconductor.
7. Distinguish between n-type and p-type semiconductors on the basis of energy band diagram.
8. What is p-n junction? How is a p-n junction made? How potential barrier is caused in it.
9. Discuss the characteristics of a p-n junction diode and define dynamic resistance of junction diode.
10. How p-n junction can be function as (a) Half wave rectifier (b) Full wave rectifier?
11. Discuss common emitter amplifier, using n-p-n transistor. Find its current gain, voltage gain and power gain.
12. Explain briefly the use of a junction transistor as an oscillator.
13. With the proper circuit diagram show the biasing of a n p n transistor. Explain the movement of charge carriers through different parts of this transistor. Hence show that $I_e = I_b + I_c$.
14. What is a transistor? Give symbols of p-n-p and n-p-n transistors. Explain action of a transistor.
15. How are OR gate, AND gate NOT gate, realized? Explain.
16. Describe (i) NAND gate, (ii) NOR gate and (iii) XOR gate.
17. Give the logic symbol, truth table and Boolean expression for AND gate?
18. Give the logic, truth table and Boolean expression for OR gate. How is it realized in practice?
19. Give the logic symbol and truth table for NOT gate.
20. The output of a 2-inputs NAND gate is fed to a NOT gate. Write down the truth table for the output of the combination for all possible inputs of A and B.