June 2014

APPLIED PHYSICS

Time Allowed: 2 Hours   *Full Marks: 35*

Answer to Question No.1 is compulsory and to be answered first.
This answer is to be made in separate loose script(s) provided for the purpose.
Maximum time allowed is 45 minutes, after which the loose answer scripts will be collected and
fresh answer scripts for answering the remaining part of the question will be provided.
On early submission of answer scripts of Question No.1,
a student will get the remaining script earlier.
Answer <u>any five</u> questions from Group-A & B, as directed.

1. Answer all the questions: 1x10

  i)   The distance travelled by an object along a straight line in time t is given by $s = 3 - 4t + 5t^2$, the initial velocity of the object is (a) 3 unit, (b) – 3 unit, (c) 4 unit, (d) – 4 unit.

  ii)   A body is revolving with uniform speed 'v' in a circular of radius 'r'. The tangential acceleration is (a) v/r^2, (b) v^2/r, (c) v/r, (d) zero.

  iii)   If a body loses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest? (a)1 cm, (b) 2 cm, (c) 3 cm, (d) 4 cm.

  iv)   A light string passes over a smooth light pulley connects two blocks of masses m_1 and m_2 hanging vertically. If the acceleration of the system be g/8, then the ratio of the masses is (a) 8:1, (b) 9:7, (c) 4:3, (d) 5:3.

  v)   A body at rest may have (a) Energy, (b) Momentum, (c) Speed, (d) Velocity.

  vi)   When current is passed through a junction of two dissimilar metals, heat is evolved or absorbed at the junction. This process is called – (a) Seebeck effect, (b) Joule effect, (c) Peltier effect, (d) Thomson effect.

  vii)   When the current in a solenoid changes from 8A to 2A in 3×10^{-2} s, the emf induced in the coil is 2V. The self inductance of the coil in millihenry is (a) 1, (b) 5, (c) 20, (d) 10.

  viii)   The wavelength of most energetic x-rays emitted when a metal target is bombarded by 40 keV electrons is approximately (a) $300°A$, (b) $10°A$, (c) $4°A$, (d) $0.31°A$.

  ix)   In a junction diode the holes are due to: (a) protons, (b) extra electrons, (c) neutrons, (d) missing electrons.

  x)   When a forward bias is applied to p-n junction, it (a) raises the potential barrier, (b) reduces the majority carrier current to zero, (c) lowers the potential barrier, (d) widens the depletion layer.

Group-A
Answer <u>any three</u> questions.

2. a)   What do you mean by impulse of a force? Derive its relation with momentum.
    b)   A force of 12N produces an acceleration of 3 m/s² on a body and an acceleration 4 m/s² on another body of different mass. What will be the acceleration if the same force is applied on the combined mass?   2+3

3. a)   Which force is necessary for rotation of a body in a circular path with uniform angular velocity? Write its expression and explain the symbols used.
    b)   What is the rotational analog of mass?
    c)   Define angular momentum. What is its relation with torque?   2+1+2

4. a) Define work. What is a no-work force? Give an example.
   b) Show that the total energy of a freely falling body is constant.   2+3

5. a) State Ohm's law. Point out the limitations of this law.
   b) Define resistivity of a material. Obtain its SI unit.
   c) Write down the relation between the resistance of a conductor and temperature.   2+2+1

6. a) Define Watt-hour.
   b) An electric bulb is rated 60W at 220V, what is meant by the statement?
   c) Write the differences between Joule and Peltier effect.   1+2+2

Group-B
Answer any two questions.

7. a) State Biot-Savart's law related to the production of magnetic field due to a small current element.
   b) Define magnetic flux & flux density through a surface. Write their SI unit.
   c) Write the formula for dipole moment of a circular loop of radius 'r' carrying current 'i', having n number of turns in S.I. System.   1+3+1

8. a) What are self & mutual inductances? Write their SI units.
   b) State and explain the principle of generation of AC. What are rms and average value of an alternating emf?   1+1+2+1

9. a) Distinguish conductors, semiconductors and insulators in terms of energy band diagram.
   b) What are extrinsic semiconductors? What kind of impurity is chosen to make n-type and p-type semiconductors? Give examples.   2+1+1+1

10. a) What is LASER? Differentiate between ordinary light and laser.
    b) Define spontaneous and stimulated emission?
    c) What is population inversion?   1+1+2+1

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