May 2015

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 questions from Group-A & B, as directed.

1. Pick up the correct answer from the given alternatives: 1x10

i) A car moving with a speed of 50 km/hr can be stopped by brakes after at least 6m. If the same car is moving at a speed of 100 km/hr, the minimum stopping distance is – (a) 12 m, (b) 18 m, (c) 24 m, (d) 6m.

ii) A man weighs 80 kg. He stands on a weighing scale in the lift, which is moving upwards with a uniform acceleration of $5m/s^2$. What would be the reading on the scale? ($g= 10m/s^2$) – (a) Zero, (b) 400N, (c) 800N, (d) 1200N.

iii) If the radius of the circular path of particle going around the circle is doubled without changing its frequency of rotation, the centripetal force on it is – (a) unchanged, (b) doubled, (c) halved, (d) quadrupled.

iv) A light and a heavy body have equal linear momentum. Which has greater kinetic energy? – (a) Light body, (b) heavy body, (c) both have equal kinetic energy, (d) none of these.

v) The length of a conductor is doubled and its radius is halved, its specific resistance is – (a) unchanged, (b) halved, (c) doubled, (d) quadrupled.

vi) The electric current in a lamp decreases by 5%. The power decreases by – (a) 5%, (b) 10%, (c) 15%, (d) 20%.

vii) Lenz's Law is based on which conservation law? – (a) Charge, (b) mass, (c) momentum, (d) energy.

viii) The magnetic field at any point due to an infinitely long straight current carrying wire is directly proportional to – (a) distance of the point from the wire, (b) diameter of the wire, (c) resistance of the wire, (d) the magnitude of the current in the wire.

ix) A P-type Semiconductor is – (a) negatively charged, (b) positively charged, (c) neutral, (d) none of these.

x) The characteristic X-ray depends on – (a) nature of the target material, (b) velocity of electron, (c) number of electrons striking the target, (d) none of these.

Group-A

Answer any three questions.

2. a) A train is moving along straight rails. Draw velocity – time graph of the train in the following cases – (i) When the train is moving with constant velocity, (ii) When the train is moving with constant retardation.

b) A particle travels 25 cm and 33 cm during fifth and seventh second of its motion. What will be the velocity of the particle after 9 second of motion?

c) What is linear momentum of a body? 2+2+1

3. a) Write the relation between torque and angular momentum.
   b) A machine gun has a mass 5 kg. It fires 50 gram bullets at the rate of 30 bullets per minute at speed of 400 m/s. What force is required to keep the gun in position?
   c) Define moment of inertia of a rigid body about a given axis. Is the moment of inertia a scalar quantity? 1+2+2

4. a) Find the expression of Kinetic energy of a body of mass M moving with velocity V.
   b) State work-energy principle.
   c) The power of a water pump is 2 Kilo watt. How much time will it take to lift a mass of 200kg of water to a height of 40 metre? 1+2+2

5. a) What is super conductivity?
   b) A wire of resistance 4Ω is bent in the form of a circle. What is the effective resistance between the ends of the diameter?
   c) Explain how you can convert a galvanometer into an Ammeter. 1+2+2

6. a) State Joule's law in current electricity.
   b) Show graphically how the thermo-e.m.f. changes with temperature at the hot junction keeping the other junction at 0°C. Define neutral temperature and temperature of inversion. 2+(1+1+1)

Group-B

Answer any two questions.

7. a) What is the magnitude of force on a current carrying conductor placed in a magnetic field?
   b) State Fleming's left hand rule.
   c) The magnetic flux linked with a coil is varying according to the relation $\varphi = 4\cos(100\pi t)$, where φ & t is measured in Weber and second respectively. Find the expression for induced alternating voltage in the coil. Also calculate the frequency of the alternating voltage. 1+1+(2+1)

8. a) State Faraday's law of electromagnetic induction.
   b) Why is 220 volt A.C more dangerous than 220 D.C?
   c) A glass rod of length l moves with velocity V perpendicular to a uniform magnetic field B. What is the induced e.m.f. in the rod? 2+2+1

9. a) Explain with circuit diagram the action of a full wave bridge rectifier.
   b) Draw the characteristic curve of a p-n junction diode in the forward and reverse bias.
   c) What are the minority carriers in n type semiconductor? 3+1+1

10. a) Write two properties of LASER?
    b) What is hologram?
    c) An X-ray tube operates at a potential difference V. What is the minimum wave length of X-rays? Mention two important uses of X-rays. 2+1+(1+1)