(Please write your Exam Roll No.) *Exam Roll No.* 664

END TERM EXAMINATION

FIRST SEMESTER [BCA] NOVEMBER-DECEMBER 2018

Paper Code: BCA-109 *Subject: Physics*

Time: 3 Hours *Maximum Marks: 75*

Note: Attempt any five questions including Q.no.1 which is compulsory. Select one question from each unit.

Q1 Attempt all parts of following: (2.5x10)

(a) State Lemi's theorem and elaborate it with one example.

(b) What is the inertial reference frame? Explain with example.

(c) Write the properties of friction. Why is coefficient of kinetic friction always less than coefficient of static friction?

(d) Suppose a particle moves along x-axis, decide whether the K.E. of particle increase, decrease or remain same if velocity changes –

(i) from -3 m/sec to -2 m/sec (ii) from -2 m/sec to 2 m/sec.

(e) Show that in 1-D elastic collision, the relative velocity of the particle is unchanged in magnitude but is reversed in direction.

(f) State Gauss's law in electrostatics and show that $\Delta \cdot \vec{E} = \rho/\varepsilon_0$, where ρ is charge density.

(g) State Kirchhoff's rule and explain it.

(h) Give the postulates of Bohr's Model.

(i) Write the name of current carriers in semiconductor materials. What is the effect of temperature in intrinsic semiconductors?

(j) Give the working and applications of LED.

UNIT-I

Q2 (a) Discuss the equilibrium of concurrent forces with examples. A resultant force of 20 N gives a body of mass m an acceleration of 8.0 m/sec², and a body of mass M an acceleration of 24 m/sec². What acceleration will this force cause two masses to acquire if fastened together? (8)

(b) Explain the need for automobile seat belts in terms of Newton's first law. A horizontal cable pulls a 200 kg cart along a horizontal track. The tension in the cable is 500 N. Starting from rest, (a) how long will it take the cart to reach a speed of 8 m/sec? (b) How far will it have gone? (4.5)

Q3 (a) Explain microscopic basis of friction. Consider an automobile moving along a straight horizontal road with a speed v_0. The driver applies the brakes and brings the car to a halt without skidding. If the coefficient of static friction between tires and road is μ_s, what is the shortest distance in which the automobile can be stopped? (6)

(b) Why is roadbed is banked for transportation? Show that angle of banking is $\tan(\theta) = v^2/Rg$, where R is curvature of radius and v is velocity of object. A conical pendulum is formed by attaching a 53 gm pebble to a 1.4 m string. The pebble swings around in a circle of radius 25 cm. What is the speed of pebble? (6.5)

UNIT-II

Q4 (a) State and prove work energy theorem. What is the conservative force? The potential energy of a particle undergoing one dimensional motion along the x-axis is $U(x) = \frac{1}{4}cx^4$, c is 8 N/m³. Its total energy at x=0 is 2 Joule, and it is not subject to any non-conservative force. Find (a) the positions where its kinetic energy is zero. (b) the force at this position. (5)

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(b) Derive the expression of Gravitational potential energy to bring an object from infinity. How much electrical energy would be used by an elevator lifting a 75 Kg person through a height of 50 m if the elevator system has overall efficiency of 25%? Assume the mass of the empty elevator car is properly balanced by a counterweight. (7.5)

Q5 (a) What is completely inelastic collision? Express the kinetic energy of a particle in terms of its mass m and the magnitude of linear momentum P. A block of mass m_1=4 Kg and initial velocity $u_1 = 4\hat{i}$ m/sec makes a 1-D elastic collision with a block of mass m_2=3 Kg at $u_2 = 2\hat{i}$ m/sec. Find their final momentum. (5.5)

(b) Derive the expression of the centre of mass of two colliding bodies if the target is initially stationary. An electron collides elastically with Hydrogen atom initially at rest. What percentage of electron's initial kinetic energy is transformed to Hydrogen atom? (The mass of the Hydrogen atom is 1840 times the mass of electron). (7)

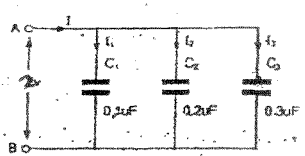
UNIT-III

Q6 (a) What is the source of frictional electricity? Give the properties of electric lines of force. A proton orbits with a speed 294 km/sec just outside a charged sphere of radius 1.13cm. Find the charge on the sphere. (m_p =1.27x10^{-27}Kg, ε_0=8.85x10^{-12} F/m). (8)

(b) Derive an expression for electric potential at the axis of ring due to a ring of uniform line charge. (4.5)

Q7 (a) What is Slide wire bridge? Explain working principle with a schematic diagram. Compare the slide wire bridge with Wheat stone bridge. (5)

(b) What is the effect of dielectric having inserted in parallel plate capacitor? Consider the following give circuit diagram. Answer the following questions. (7.5)



(a) Calculate the equivalent capacitance.
(b) Calculate total charges.
(c) Determine charges on individual capacitors

UNIT-IV

Q8 (a) What are the key failures of Thomson's atomic model? Write the conclusions of Rutherford's alpha scattering experiment. (7.5)

(b) Thought Silicon an Aluminium have the same atomic density and mass density, the difference in their electrical resistivity is very high. Why? What is meant by potential barrier across a p-n junction? (5)

Q9 (a) Indicate on an energy level diagram the conduction band and valence bands, donor and acceptor states. What are positions of Fermi levels for (a) an intrinsic semiconductor (b) a n-type semiconductor (c) a p-type semiconductor. (6)

(b) Discuss the working of a PNP transistor as an amplifier in common base configuration. Define the current gain in common base configuration. Derive the expressions for voltage gain and power gain. (6.5)