MODEL PAPER
Government College University Faisalabad

BSc part-1

Paper A: MECHANICS Examination 2017 Total Marks; 35

Time allowed: 3.0 h passing marks 33%

Note: Attempt any **FIVE** questions from the following. All questions carry equal marks.

Q. No.1:

(a) Prove that, $\vec{A}\cdot(\vec{A}\times\vec{C}) = 0.$ **(3 Marks)**

(b) If, $\vec{A} = x^2z\hat{\imath} - 2y^3z^2\hat{\jmath} + xy^2z\hat{k}$, Then find Divergence of $\vec{A}$ at a point **(3,-2,1).** **(4 Marks)**

Q. No.2:

(a) Define non-constant forces and explain its different types with suitable examples. **(4 Marks)**

(b) The position of a particle of mass ***2.17 kg*** travelling in a straight line is given by;

$$x = 0.179\, t^4 - 2.08\, t^2 + 17.1$$

Find the velocity, acceleration and force on the particle at time ***t= 7.18 sec***. **(3 Marks)**

Q. No.3:

(a) For Banked curve, prove that; $\mathbf{Tan}\,\theta = v^2/Rg.$ **(4 Marks)**

(b) A child places a picnic basket on the outer rim of a merry-go-round that has a radius of **4.6 m** and revolves once every **24sec**. How large must the coefficient of static friction be for the basket to stay on the merry-go-round? **(2 Marks)**

(c) Why is it that racing drivers actually speed up when traversing a curve? **(1 Mark)**

Q. No.4:

(a) What is the kinetic energy of a body? Explain work energy theorem by showing, **(5 Marks)**

$$W_{net} = \tfrac{1}{2} mv_f^2 - \tfrac{1}{2} mv_i^2$$

(b) Does work energy theorem hold if friction acts on an object? Explain your answer. **(2 Marks)**

Q. No.5:

(a) A solid Hoop of mass (M) and radius (R) starts from rest and rolls without slipping down on an inclined plane of length (L) and height (h). Find its acceleration, speed of its centre of mass and the force of static friction needed for rolling of this hoop. **(4 Marks)**

(b) A top is spinning at **28.6 rev/s** about an axis making an angle of **34°** with the vertical, its mass is **492 gm** and its rotational inertia is **5.12 × 10⁻⁴ kg.m²**. The centre of mass is **3.88** cm from the pivot point. The spin is clock wise as seen from above. Find the magnitude in **(rev/s)**of the angular velocity of precession. **(2 Marks)**

(c) Why we don't ordinarily notice the gravitational force between objects around us? **(1 Mark)**

Q. No.6:

(a) State & prove Kepler's Law of Periods. **(3 Marks)**

(b) If the force of gravity acts on all bodies in proportion to their masses, why does a heavy body not fall correspondingly faster than a lighter body? **(2 Marks)**

(c) The escape velocity for the moon is **2.38 km/s**. If the radius of moon is $\mathbf{1.74 \times 10^6}$ **m**, then calculate the mass of the moon. **(2 Marks)**

Q. No.7:

(a) Explain briefly stress, strain, tension and compression. **(4 Marks)**

(b) A structural steel rod has a radius of **8.6mm** and length of **79cm**. A force of $\mathbf{5.9 \times 10^4}$ **N** stretches it axially. What is the stress in the rod? Find also elongation of the rod under this load. **(3 Marks)**

Q. No.8:

(a) Discuss relativity of time (Time Dilation) in detail based on Einstein's special theory of relativity. **(3 Marks)**

(b) Calculate the K.E of an electron moving with a velocity of 0.98c in the laboratory system. **(3 Marks)**

(c) If the speed of a photon is "c" in one frame of reference, can it would be found at rest in any other frame? Comment. **(1 Mark)**

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BSc part-1

Paper B : Waves & Oscillations, Optics and Thermodynamics

Examination 2017 Total Marks: 35

Time allowed: 3.0 h passing marks 33%

Note: Attempt any five questions. All question carry equal marks.

Q. 1 (a) Show that the motion of mass-attached to a spring is simple harmonic motion 4

(b) A block–spring system oscillates with an amplitude of 3.50 cm. If the spring constant is 250 N/m and the mass of the block is 0.500 kg, determine (a) the mechanical energy of the system, (b) the maximum speed of the block, and (c) the maximum acceleration 3

Q. 2 (a) What happens to the period of a simple pendulum if the pendulum's length is doubled? What happens to the period if the mass of the suspended bob is doubled? 2

(b) Define resonance and give few examples of resonance 3

(c) can two pulses travelling in opposite directions on the same string reflect from each other? Explain. 2

Q. 3 (a) Derive the equation for wave speed 4

(b) Assume a wire has a mass of 4.00g and a length of 1.60m, and that a 3.00-kg object is suspended from it. A pulse requires 36.1ms to traverse the length of the wire. Calculate tension in wire 3

Q. 4 (a) Explain the Doppler Effect 4

(b) Standing at a crosswalk, you hear a frequency of 560Hz from the siren of an approaching ambulance. After

the ambulance passes, the observed frequency of the siren is 480Hz. Determine the ambulance's speed from these observations 3

Q. 5 (a) Discuss various energy transfer mechanisms in materials and also give one example for each energy transfer process. 4

(b) The temperature of a silver bar rises by 10.0°C when it absorbs 1.23 kJ of energy by heat. The mass of the bar is 525 g. Determine the specific heat of silver. 3

Q. 6 (a) Define 2nd law of thermodynamics also explain reversible and irreversible processes. 4

(b) A heat engine performs 200 J of work in each cycle and has an efficiency of 30.0%. For each cycle, how much energy is (a) taken in and (b) expelled by heat? 3

Q. 7 (a) What is Michelson interferometer, describe its construction and discuss its appilication in Michelson-Mosley Experiment. 5

(b) Could the Young two-slit interference experiment be performed with ganuna rays? If not, why not? If so, discuss differences in the experimental design compared to the experiment with visible light. 2

Q. 8 (a) Define Diffraction and explain Diffraction pattern with the help of Huygen,s principle. 4

(b) Monochromatic light is at normal incidence on a plane transmission grating. The first-order maxhnum in the interference pattern is at an angle of 8.94°. What is the angular position of the fourth-order maximum? 3

MODEL PAPER

Government College University Faisalabad

BSc part-II

Paper A: Electricity and Magnetism Examination 2017 Total Marks: 35

Time allowed: 3.0 h passing marks 33%

Note: Attempt five questions in all .All questions carry equal marks

1. a) Define an ELECTRIC DIPOLE and drive expression for (1)Torque acting on it (2) Its potential when placed in uniform electric field (4)

b.) Find the work required to turn an electric dipole end by end in uniform electric field E in terms of the magnitude P of dipole moment, the magnitude E of the field and initial angel Θ between P and E? (2)

c.) For what orientation of an electric dipole in a uniform electric field is the P.E. of the dipole (1)

I. The greatest

II. The least??

2. Write notes of any TWO of following? (3.5, 3.5)

I. Distribution of molecular speeds II. Capacitor with dielectric III. Ferromagnetism and hysteresis

IV. Electromagnetic wave spectrum

3. a) Discuss the growth of current on RC series circuit? (4)

b.)A resistor R=6.2MΩ and capacitor C=2.4μF are connected across the combination .what is the capacitive time constant of the circuit? (2)

c.) Explain why the resistance of the voltmeter should be very large as compared to the resistance across which p.d.is to be measured? (1)

4.a) Two long parallel wires carrying currents I_1 and I_2 separated by the distance d apart are lying in the magnetic field of each other .find the magnitude of magnetic force experience by each other. (4)

b.) A solenoid of certain diameter is 3.14m long .it has 5 layers of windings of 850 turns each and carries a current of 5A. What is B at its center? (2)

c.)Relate permittivity and permeability of free space with the velocity of electromagnetic radiation and hence calculate this velocity? (1)

5.a) State Lenz's law. Show that Lenz law is in accordance with the law of conservation of energy? (4)

b.)The amerture of motor has 97 turns of area 190cm^2 and rotates in uniform magnetic field of 0.33T. A pd of 24V is applied. If no load is attached and friction is neglected. Find the rotational speed at equilibrium. (2)

c.) Is any emf induced in long solenoid by a bar magnet that moves inside it along the solenoid axis? (1)

6.a) Define current density? States ohms law and drive its microscopic form in terms of current density and electric field intensity? (4)

b.) A current of 5 A exists in 10Ω resistor for 5 min. how many electrons pass through any cross section of the resistor in this time? (2)

c.) Is the filament resistance lower or higher in a 500W light bulb than in a 100W bulb when both are designed to operate at 220V? (1)

7.a) State Gauss's law and apply it to find electric field near an infinite sheet of charge? (4)

b.) A point charge of 1.84μC is at the center of a cubical Gaussian surface 55am on edge. Find the flux passing through the surface. (2)

c.) A surface encloses two equal and opposite charges .what can you say about the electric flux for the surface (1)

8.a)Define and explain motional EMF and derive expression for it? (4)

b.) Earth magnetic field of magnitude 42μT points towards at 57 ° to the vertical. Calculate the flux through the horizontal surface of area 2.5m^2 (2)

c.) Can a charged particle at rest b set in motion by action of magnetic field?(1)

MODEL PAPER

Government College University Faisalabad

BSc part-II

Paper B: Modern physics and Electronics Examination 2017 Total Marks: 35

Time allowed: 3.0 h passing marks 33%

Note: Attempt any five questions. All question carry equal marks.

Q. No. 1(a) What is PN junction? Discuss its depletion region and direction of junction voltage. (4)

(b) The Fermi energy of copper is 7.0 eV. Is the corresponding Fermi speed 1600 km/s. (2)

(c) Pure silicon at room temperature has an electron number density in the conduction band of about $5\times10^{15}m^{-3}$ and an equal density of holes in the valence band. Suppose that one of every 10^{7} silicon atoms is replaced by a phosphorus atom. Which type will the doped semiconductor be, n or p? (1)

Q. No. 2(a) What is amplifier? Describe transistor as an amplifier for common emitter mode. (4)

(b) What is the effect of temperature on the electrical resistivity of semiconductor? (2)

(c) Draw the truth table of two inputs NAND gate. (1)

Q. No. 3(a) What is Compton effect? Describe its experimental arrangement and derive the relation for Compton's shift. (4)

(b) Find the maximum kinetic energy of electrons ejected from a certain material if the material's work function is 2.3 eV and the frequency of incident radiation is 3.0×10^{15} Hz. (3)

Q. No. 4 (a) Discuss De Broglie hypothesis about dual nature of radiations and matter. (5)

(b) What is the De Broglie wavelength of an electron with kinetic energy of 120 eV? (2)

Q. No. 5(a) What is LASER? Explain the working of He-Ne LASER. (3)

(b) Differentiate between excitation and ionization of an atom. (2)

(c) How fast must an electron move to have a kinetic energy equal to the photon energy of sodium light at wavelength 590 nm? (2)

Q. No. 6(a) Explain the terms (i) Wave function (ii) Probability density (5)

(b) An electron is confined to a one-dimensional, infinitely deep potential energy well of width **l** =100 pm. What is the smallest amount of energy the electron can have? (2)

Q. No. 7(a) What are X-rays? How K_α and K_β are produced? (5)

(b) Through what minimum potential difference must an electron in an x-ray tube be accelerated so that it can produce x rays with a wavelength of 0.100 nm? (2)

Q. No. 8 (a) Explain fusion reaction and thermonuclear fusion with examples. (5)

(b) If we split a nucleus into two smaller nuclei, with a release of energy, has the average binding energy per nucleon increased or decreased? (1)

(c) The half-life of a radioactive isotope is 140 days. How many days would it take for the decay rate of a sample of this isotope to fall to one-fourth of its initial value? (1)