QCA : 18/I

PHYSICS : Paper-I

2014

INSTRUCTIONS

(i) Attempt ONLY 2 questions.

(ii) Attempt ONLY 1 question in each Section.

(iii) Sections 6 to 8 are compulsory.

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two sections and printed both in KANNADA and in ENGLISH.

Candidate has to attempt FIVE questions in all.

Question No. 1 and 5 are compulsory, and out of the remaining, THREE are to be attempted choosing at least ONE question from each Section.

The number of marks carried by a question/part is indicated against it.

Answer must be written in the medium authorized in the Admission Certificate which must be stated clearly on the cover of this Question-cum-Answer (QCA) Booklet in the space provided. No marks will be given for answers written in a medium other than the authorized one.

Word limit in questions, wherever specified, should be adhered to.

Attempts of questions shall be counted in chronological order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.
1. (a) State Kepler’s laws of planetary motion and arrive at the Kepler’s second law from Newton’s law of gravitation.

(b) An artificial geo stationary satellite is moving around the Earth. Calculate the height of the satellite. Given \( g = 9.8 \text{ms}^{-2} \) and radius \( R = 6.37 \times 10^6 \text{m} \) of the earth.

2. (a) What is rigid body? Define angular momentum and torque of a rotating body. In the case of top show that precession angular velocity is inversely proportional to spin angular velocity.

(b) Describe the Michelson-Morley experiment with a diagram and explain the physical significance of negative result.

3. (a) What is Carnot cycle? Arrive at the expression for the efficiency of a Carnot cycle.

(b) Derive maxwell's thermodynamics relations and hence deduce Clausius-Clapeyron equation.
4. (a) State and explain Zeroth, First, Second and Third law of thermodynamics.

(b) Explain the principle and working of production of low temperature by the method of Adiabatic Demagnetization.
5. (a) Derive the expression for fringe width from Young’s double slit experiment. Show that fringe width remains same for both bright and dark fringes.

(b) What is polarization? Explain the different methods of obtaining polarization from unpolarized light.

6. Differentiate between simple harmonic motion and oscillatory motion. Derive a general differential equation of motion of a simple harmonic oscillator and obtain its various solutions.

7. Discuss in detail the phenomenon of diffraction at a straight edge. From a study of fringes, describe how the wavelength of light is determined.

8. Specify broadly the components of LASER. Analyse the lasing action involved. Present thoroughly, the construction and the mode of working of a solid state ruby laser.
INSTRUCTIONS

(i) All answers must be typed in 12 Point Times New Roman.
(ii) All questions must be attempted.
(iii) There are 8 questions divided into two sections and printed both in KANNADA and in ENGLISH.

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two sections and printed both in KANNADA and in ENGLISH.

Candidate has to attempt FIVE questions in all.

Question No. 1 and 5 are compulsory and out of the remaining, THREE are to be attempted choosing at least ONE question from each Section.

The number of marks carried by a question/part is indicated against it.

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Word limit in questions, wherever specified, should be adhered to.

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Section-A

1. (a) Obtain an expression for the electric intensity at a far-off axial point of an electric dipole. Hence arrive at the electric potential at that point.

(b) Two concentric spheres of radii $r_1$ and $r_2$ (with $r_1 < r_2$) carry charges $q_1$ and $q_2$, respectively. Calculate the charge $q_3$ on the outer sphere for which potential on the inner sphere is zero.

Discuss the variation of potential at point between the spheres.

2. Compare and contrast the application of Biot-savart’s law for magnetic field and the Coulomb’s law for electrostatic field.

Discuss the variation of magnetic field along the axis of a current carrying circular coil.

3. (a) Discuss Bohr’s Theory of hydrogen atom and arrive at an expression for energy of electrons in Bohr orbits.

(b) Discuss the origin of different spectral series in hydrogen atom spectrum.
4. (a) Discuss the Quantum Theory of Raman Effect.
(b) Distinguish between Raman Spectrum and Fluorescence Spectrum.
(c) Discuss the applications of Raman Effect.
(d) Describe the experimental method of study of Raman Effect in liquids.

5. (a) Explain Stern-Gerlach experiment with a neat sketch and necessary theory.
(b) Solve Schrodinger’s wave equation for the ground state of particle like Deuteron. How is the quadrupole moment of the Deuteron explained?

6. (a) Explain the theory of Aston’s mass spectrograph. How has it is been used to detect isotopes. What are the limitations of it?
(b) What are elementary particles? What are the broad categories into which elementary particles are classified?
7. (a) Zener diode is a type of diode used for voltage regulation. It has a constant voltage region where it blocks the current flow. Describe the mechanism of breakdown in zener diode and distinguish between avalanche breakdown and zener breakdown.

(b) Define and calculate average value, rms value, efficiency, ripple factor, peak inverse voltage and voltage regulation of a full wave rectifier. Show that the ripple factor for full wave rectifier is 0.48.

8. (a) Draw transistor as an and emitter follower circuit. Justify that it is a common collector amplifier circuit.

(b) What is a p-n junction diode? Explain the V-I characteristics of a p-n junction diode.