



RF-3467-68

M. Sc. - I Examination

April / May - 2010

Physics : Paper - II

(Quantum Mechanics & General Electronics)

Time : 3 Hours]

[Total Marks : 70

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Instructions :

(1)

नीचे दशावेक निशानीवाणी विगतो उत्तरवही पर अवश्य कपवी.
Fillup strictly the details of signs on your answer book.

Name of the Examination :
M. Sc. - 1

Name of the Subject :
PHYSICS - 2

Subject Code No. : 3 4 6 7 Section No. (1, 2,.....) : 1

Seat No. :
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Student's Signature

- (2) Answer to the two sections must be written in separate answer books.
- (3) Symbols used have their usual meaning.
- (4) Figures to the right indicate full marks.

(Quantum Mechanics)

1.(a)	Prove that plane wave function is the eigenfunction of linear momentum operator. Point out corresponding eigenvalue.	3
(b)	Evaluate the value of the commutator $[J_x, J_y]$.	2
(c)	Obtain operator form of L^2 in spherical polar co-ordinates.	3
(d)	Using Heisenberg's uncertainty principle estimate the ground state energy of Hydrogen atom.	3
2.(a)	Using operator method determine the energy eigenvalue spectrum of simple harmonic oscillator and interpret zeropoint energy.	5
(b)	Obtain matrix operators for J^2, J_z and J_x by considering basis vector $ lm\rangle$.	4
(c)	Define and discuss Clebsch-Gordan coefficients.	3

OR

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[Contd....

2.(a)	Establish commutation relations among the components of J.	4
(b)	Deduce differential and total scattering cross section for screened Coulomb potential.	3
(c)	Considering Pauli matrices prove the $(\sigma \cdot r)(\sigma \cdot p) = r \cdot p + i \sigma \cdot L$	5
3.(a)	Considering time independent non-degenerate perturbation theory obtain expressions for the first and second order corrections to the energy eigenvalue.	5
(b)	Explain how the ground state energy of the Helium atom could be estimated by using the variation method.	4
(c)	Prove that Dirac matrices are traceless 4X4 Hermitian matrices.	3
OR		
3.(a)	Show that perturbation removes the degeneracy. Give examples.	5
(b)	Obtain Klein-Gordon equation and state its limitations as well as applications.	4
(c)	Discuss quantization of field and its significance.	3

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(1)

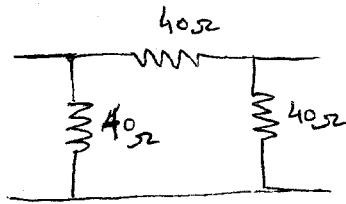
<p>नीचे दशांशों में निशानीवाणी विगतो उत्तरवही पर अवश्य लिखनी। Fillup strictly the details of signs on your answer book.</p> <p>Name of the Examination : <input style="width: 100%;" type="text" value="M. Sc. - 1"/></p> <p>Name of the Subject : <input style="width: 100%;" type="text" value="PHYSICS - 2"/></p> <p>Subject Code No. : <input style="width: 20px;" type="text" value="3"/> <input style="width: 20px;" type="text" value="4"/> <input style="width: 20px;" type="text" value="6"/> <input style="width: 20px;" type="text" value="8"/> Section No. (1, 2.....) : <input style="width: 20px;" type="text" value="2"/></p>	<p>Seat No. : <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/> <input style="width: 20px;" type="text"/></p> <div style="border: 1px solid black; border-radius: 15px; padding: 10px; text-align: center; margin-top: 10px;"> <p>Student's Signature</p> </div>
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GENERAL ELECTRONICS

- 4 (a) Draw the elementary circuit diagram of (i) T-network (ii) π -network (iii) bridge network and (iv) lattice network. [2]
- (b) List and briefly explain all the disadvantages of a fixed bias circuit. [3]
- (c) With the help of circuit diagram, derive an equation of the gain of an operational amplifier in inverting mode. [3]
- (d) What is digital comparator? Draw the truth table of a two bit digital comparator. [3]

- 5 (a) Explain Norton's theorem with suitable examples. [7]
 (b) Compute Z_{1oc} , Z_{2oc} , and Z_{1sc} for the following circuit, [5]



OR

- 5 (a) What is the difference between an active and a passive filter? Draw the circuit diagram of an operational amplifier based first order low pass active filter. Draw and explain its frequency response. [7]
 (b) Draw the circuit diagram of an operational amplifier based integrator. Show mathematically that the output of the circuit is proportional to the integration of its input. [5]
- 6 (a) Draw the internal block diagram of an IC-555 and explain its operation as an astable multivibrator. [7]
 (b) If the junction temperature of the transistor is found to be 72 °C when it dissipates 10 watt of power. Calculate thermal resistance of the transistor. [5]

OR

- 6 (a) Draw the circuit diagram and truth table of [7]
 (i) Clocked R-S flip flop and
 (ii) Clocked J-K flip flop.
 Why R-S flip flop can not be used to form a counter?
- (b) Simplify following relation using K-map method and implement. [5]
 (i) $Y = \overline{A + (A \cdot B)}$
 (ii) $Y = (A + B) \cdot (A + C)$