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SB-3441

M. Sc. (Part - I) Examination

March / April - 2011

Electronics

(Quantum Mechanics, Mathematical & Computational Methods)

Time : Hours] [Total Marks : **52**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **M. SC. (PART - 1)**

Name of the Subject :

☛ **ELECTRONICS**

☛ Subject Code No. : **3 4 4 1** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Answers to the two sections must be written in separate answer books..

(3) Figures to right hand side of each question indicate full marks.

(4) Assume the data if necessary.

SECTION - I

1 (a) Discuss the experimental necessity of Dirac's approach to relativistic equation. **2**

(b) What are Clebsh Gordan coefficients ? **2**

(c) Prove that $(AB)^+ = B^+ A^+$ **2**

(d) Find $[X, P^n]$ **2**

2 (a) Derive Schrödinger equation for a free particle in one dimension. **5**

(b) Show that variational method gives an upper bound on ground state energy of system. **4**

OR

2 (a) Deduce the Klein Gordon wave equation for free relativistic particle. Discuss its solutions. **5**

(b) Obtain the matrices J_z and J^2 for j = 1/2 using eigen value equations of J^2 and J_z. **4**

3 (a) Prove that perturbation removes the degeneracy. 5

(b) Obtain the Schrödinger equation for a charge particle q under the influence of uniform electric field. 4

OR

3 (a) Discuss in detail Kroring-Penney model. 5

(b) Show that S_+ and S_- flip the spin from down to up and up to down respectively. 4

SECTION - II

4 (a) What are hyperbolic, parabolic and elliptic differential equations ? Write the characteristic conditions of the partial differential equations of them. 2

(b) State and prove Parsevel's theorem in one dimensional case and explain its significance. 2

(c) Prove the recurrance relation : 3

$J_{n-1}(x) - J_{n+1}(x) = 2J_n'(x)$

(d) What is conformal transformation ? 1

5 (a) Discuss the method of separation variables to solve partial differential equation. Use this method to solve Laplace equation $(\nabla^2\phi = 0)$ in cartesian coordinates. 5

(b) Find the Laplace transform of cos 5t. 4

OR

5 (a) What are legendre polynomials ? Show that 4

$P_{2m+1}(-x) = -P_{2m+1}(x)$

(b) Explain the significance of spherical harmonics and discuss the general properties of harmonic function. 5

6 (a) State and explain central limit theorem. 2

(b) State Poission distribution function and discuss its properties. 3

(c) Fit a Poission distribution to the set of observations. 4

Death	0	1	2	3	4
Frequency	122	60	15	2	1

OR

6 (a) Explain the Jacobi method for solution of eigen value problems. 3

(b) Explain the principal of least square. 2

(c) Given 4

$\frac{dy}{dx} - x - y = 0$ and $y(0) = 1$

Find y (0.2) using fourth order Rung-Kutta method.