

C.U.SHAH UNIVERSITY

WADHWAN CITY

University (Winter) Examination -2013

Course Name :M.Sc(Physics) Sem-I

Subject Name : -Mathematical Physics

Duration :- 3:00 Hours

Date : 16/12/2013

Instructions:-

- (1) Attempt all Questions of both sections in same answer book / Supplementary.
 (2) Use of Programmable calculator & any other electronic instrument is prohibited.
 (3) Instructions written on main answer Book are strictly to be obeyed.
 (4) Draw neat diagrams & figures (If necessary) at right places.
 (5) Assume suitable & Perfect data if needed.

SECTION – I**Q-1 Do as Directed.(All Questions are compulsory) (07)**

- a) Give the solution of $L \{t^2 \sin at\}$. (02)
 b) What do you mean by Piece-wise continuous function? (02)
 c) Give the equation of Legendre's differential equation. (01)
 d) Give Differential Equation of Hermite polynomial. (01)
 e) Give the Bessel's differential Equation. (01)

Q-2 Answer the following in detail.

- a) Radium decays to radon which decays to polonium. If at $t=0$, a sample is pure radium, how much radon does it contain at time "t"? (05)
 b) Prove that Legendre's polynomials are the set of orthogonal function in the interval (-1,1) (05)
 c) Prove that: $P_n(-1) = (-1)^n P_n(1)$ (04)

OR**Q-2 Answer the following in detail.**

- a) Explain Rodrigue's formula of Legendre's Polynomials. (05)
 b) Recurrence formula for Hermite polynomials. (05)
 c) Solve the following ordinary differential equation $x^2 \frac{dy}{dx} - 2xy = \frac{1}{x}$. (04)

Q-3 Answer the following in detail.

- a) Prove that : $\int_0^\infty \frac{a}{a^2+n^2} \cos nx dx = \frac{\pi}{2} e^{-ax} = \int_0^\infty \frac{n}{a^2+n^2} \sin nx dx$ (07)
 b) Explain Recurrence relation for $P_n(\mu)$. (07)

OR**Q-3 Answer the following in detail.**

- a) Explain Generating function of Hermite polynomials. (07)
 b) Give the solution of second order linear differential equation with Variable co-efficient (07)



SECTION – II

Q-4 Do as Directed.(All Questions are compulsory)

- a) What are the different types of transforms? List atleast four of them (02)
- b) Find the Laplace transform of $F(t)=t$ (02)
- c) Define Fourier sine and cosine transforms. (02)
- d) Write Mathematical form of Fourier series. (01)

Q-5 Answer the following in detail.

- a) Discuss application of Fourier transform in science. (05)
- b) Explain Laplace transform of Derivatives. (05)
- c) Find Laplace transform of $4e^{5t}-4\cos 3t+3\sin 4t$ apply in the linearity property. (04)

OR

Q-5 Answer the following in detail.

- a) Explain integral formula of Laguerre's polynomial (05)
- b) Find the Laplace transforms of the following functions. (05)
 - (i) $F(t)=e^{kt}$ (ii) $F(t)=\cos kt$
- c) Solve that: $L^{-1}\left\{\frac{s+1}{s^2+6s+25}\right\}$ (04)

Q-6 Answer the following in detail.

- a) State and prove some simple properties of Laplace transform. (07)
- b) Recurrence formula for Laguerre's polynomial. (07)

OR

Q-6 Answer the following in detail.

- a) Explain inverse Laplace transforms. (07)
- b) (i) Find Fourier transformation of given function: $F(x) = e^{-|x|}$. (07)
(ii) Find the Fourier sine transformation of $F(t) = e^{-t}$.

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