C.U.SHAH UNIVERSITY
Winter Examination-2015

Subject Name :Mathematical Physics

Subject Code :5SC01PHC1   **Branch : M. Sc. (Physics)**

Semester :1   Date : 30/11/2015   Time : 10:30 To 01:30   Marks :70

Instructions:
> (1) Use of Programmable calculator and any other electronic instrument is prohibited.
> (2) Instructions written on main answer book are strictly to be obeyed.
> (3) Draw neat diagrams and figures (if necessary) at right places.
> (4) Assume suitable data if needed.

SECTION – I

Q-1		**Attempt the Following questions**	**(07)**
	a.	What is ordinary differential equations (ODEs)?	01
	b.	What is partial differential equations (PDEs)?	01
	c.	Give example of first order ordinary differential equations (FODEs).	01
	d.	Give example of second order ordinary differential equations (SODEs).	01
	e.	Give the equation of Legendre's differential equation.	01
	f.	Write Bessel's differential equation.	01
	g.	What is Piece-wise continuous function?	01

Q-2		**Attempt all questions**	**(14)**
	a.	Prove that $Y = \frac{c}{x} + 2$ is a solution of the FOD equation $\frac{dy}{dx} = \frac{1}{x}(2 - y)$ in the interval (0, 2).	05
	b.	Prove that $y = (x + 1) - \frac{1}{3}e^x$ is a solution of the FOD equation $\frac{dy}{dx} = (y - x)$ with initial value y(0)=2/3.	05
	c.	Prove that $P_n(-1) = (-1)^n P_n(1)$.	04

OR

Q-2		**Attempt all questions**	**(14)**
	a.	Prove that $\frac{1}{D-M} R(x) = e^{mx} \int R(x)e^{-mx} dx$.	05
	b.	Solve $(D^2 + 3D + 2)y = e^{e^x}$.	05
	c.	Solve $y'' + 4y = e^{3x}$.	04

Q-3		**Attempt all questions**	**(14)**
	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'?	07
	b.	Prove that Legendre's polynomials are the set of orthogonal function in theinterval (-1,1).	07

| Q-3 | a. | Obtain the solution of Hermite differential equation. | 07 |
| | b. | Explain generating function of Legendre polynomial. | 07 |

SECTION – II

Q-4		**Attempt the Following questions**	(07)
	a.	Write name of the different types of transforms.	02
	b.	Define Inverse Laplace transformation.	02
	c.	Define Fourier sine and cosine transforms.	02
	d.	Write Mathematical expression of Lagurre's differential equation.	01

Q-5		**Attempt all questions**	(14)
	a.	Find the finite Fourier sine and cosine transform of $\frac{\partial^2 U}{\partial x^2}$, where U is a function of 'x' and 't' for $0 < x < l, t > 0$.	05
	b.	Explain Laplace transform of derivatives.	05
	c.	Find the Laplace transform of F (t) = t.	04

OR

Q-5		**Attempt all questions**	(14)
	a.	Explain integral formula of Laguerre's polynomial.	05
	b.	Give the solution of Lagurre'sdifferential equation.	05
	c.	Find the Laplace transform of F(t) where $F(t) = \begin{cases} cos\left(t - \frac{2\pi}{3}\right), t > \frac{2\pi}{3} \\ 0, \qquad\qquad t < \frac{2\pi}{3} \end{cases}$.	04

Q-6		**Attempt all questions**	(14)
	a.	Obtain recurrence formula for Languere's polynomial.	07
	b.	Find the Laplace transform of F(t)= t^n.	04
	c.	Find the Laplace transform of F(t)= 1.	03

OR

Q-6		**Attempt all Questions**	(14)
	a.	Explain in detail first and second translational (or shifting) properties of Laplace transform with example.	07
	b.	Find the Laplace transform of $4e^{5t} + 6t^3 - 4cos3t + 3sin4t$.	04
	c.	Find Fourier sine transform of $F(x) = x$ such that $0 < x < 2$.	03