Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Mathematics-II **Semester: II**
Program: B.Tech (APE-UP, APE-GAS, CHEMICAL, GSE, GIE, FSE) **Time 03 hrs.**
Course Code: MATH-1014 **Max. Marks: 100**

Instructions: All questions are compulsory.

SECTION A

S. No.		Marks	CO
Q 1	Solve $\left(D^2+4DD'-5D'^2\right)z=0.$	**4**	**CO4**
Q 2	Show that $x=0$ is a regular singular point of the equation $9x(1-x)\frac{d^2y}{dx^2}-12\frac{dy}{dx}+4y=0$	**4**	**CO3**
Q 3	Prove that $J_{1/2}(x)=\sqrt{\left(\frac{2}{\pi x}\right)}\sin x.$	**4**	**CO3**
Q 4	Solve $r\sin\theta\, d\theta+\left(r^3-2r^2\cos\theta+\cos\theta\right)dr=0.$	**4**	**CO2**
Q 5	Prove that $\frac{d}{dx}\left(x^{-n}J_n(x)\right)=-x^{-n}J_{n+1}(x)$	**4**	**CO3**
	SECTION B		
Q 6	Solve $\frac{\partial^2 z}{\partial x^2}-2\frac{\partial^2 z}{\partial x\partial y}+\frac{\partial^2 z}{\partial y^2}=\sin x.$	**8**	**CO4**
Q 7	Find the Laplace transform of $F(t)=\begin{cases}1, 0\le t<1\\ t, 1\le t<2\\ t^2, 2\le t<\infty.\end{cases}$	**8**	**CO1**
Q 8	Find the solution in series of the equation $\frac{d^2y}{dx^2}+xy=0.$	**8**	**CO3**
Q 9	Solve $\frac{\partial^2 z}{\partial x^2}+2\frac{\partial^2 z}{\partial x\partial y}+\frac{\partial^2 z}{\partial y^2}=e^{3x+2y}.$	**8**	**CO4**
	OR		

Q 9	Solve $\frac{\partial^3 z}{\partial x^3}-4\frac{\partial^3 z}{\partial x^2 \partial y}+4\frac{\partial^3 z}{\partial x \partial y^2}=4\sin(2x¿+y).¿$	**8**	**CO4**
Q 10	Solve $x^2\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+y=\frac{1}{(1-x)^2}.$	**8**	**CO2**
	OR		
Q10	Evaluate $\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=\frac{e^{-x}}{x+2}.$	**8**	**CO2**
	SECTION-C		
Q 11 A	Find the solution of the Bessel equation $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+(x^2-n^2)y=0.$	**10**	**CO3**
Q 11 B	Using the method of separation of variables, solve $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$ where $u(x,0)=6e^{-3x}.$	**10**	**CO4**
Q 12 A	Evaluate by method of variation of parameters: $\frac{d^2y}{dx^2}-2\frac{dy}{dx}=e^x\sin x.$	**10**	**CO2**
	OR		
Q 12 A	Solve $\sin^2 x\frac{d^2y}{dx^2}=2y$, given that $y=\cot x$ is a solution of it.	**10**	**CO2**
Q 12 B	A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form $y=A\sin\frac{\pi x}{l}$ from which it is released at time $t=0.$ Show that the displacement of any point at a distance x from the one end at time t is given by $y(x,t)=A\sin\frac{\pi x}{l}\cos\frac{\pi ct}{l}.$	**10**	**CO4**
	OR		
Q 12 B	Solve the wave equation $\frac{\partial^2 y}{\partial t^2}=c^2\frac{\partial^2 y}{\partial x^2}$ under the boundary conditions: $y=0$ when $x=0$ and $y=0$ when $x=l$	**10**	**CO4**

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SECTION A

S. No.		Marks	CO
Q 1	Find the complete solution of $\frac{\partial^3 z}{\partial x^3}-2\frac{\partial^3 z}{\partial x^2 \partial y}=0.$	4	CO4
Q 2	Prove that $J_{-1/2}(x)=\sqrt{\left(\frac{2}{\pi x}\right)}\cos x.$	4	CO3
Q 3	Show that $\frac{d}{dx}\left(x^n J_n(x)\right)=x^n J_{n-1}(x).$	4	CO3
Q 4	Solve $\frac{d^4 y}{dx^4}+m^4 y=0.$	4	CO2
Q 5	Show that $x=0$ is an ordinary point of $\left(1-x^2\right)\frac{d^2 y}{dx^2}-x\frac{dy}{dx}+4y=0.$	4	CO3

SECTION B

Q 6	Obtain the series solution for $x\frac{d^2 y}{dx^2}+\frac{dy}{dx}-xy=0.$	8	CO3
Q 7	Find the Inverse Laplace transform of $\frac{5s+3}{(s-1)(s^2+2s+5)}$	8	CO1
Q 8	Solve $\left(D^2-6DD'+9D'^2\right)z=12x^2+36xy.$	8	CO4
Q 9	Find solution of the following linear partial differential equation $2\frac{\partial^2 z}{\partial x^2}-5\frac{\partial^2 z}{\partial x \partial y}+2\frac{\partial^2 z}{\partial y^2}=5\sin(2x+y).$	8	CO4

OR

Q 9	Solve $\frac{\partial^2 z}{\partial x^2}+3\frac{\partial^2 z}{\partial x\,\partial y}+2\frac{\partial^2 z}{\partial y^2}=x+y.$	**8**	**CO4**
Q 10	Solve the differential equation $\left(D^2-4D+4\right)y=8x^2e^{2x}\sin 2x.$	**8**	**CO2**
	OR		
Q10	Solve $x^2\frac{d^2y}{dx^2}+4x\frac{dy}{dx}+2y=e^{x^x}.$	**8**	**CO2**
	SECTION-C		
Q 11 A	Find the solution of the Legendre's equation $\left(1-x^2\right)\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+n(n+1)y=0.$	**10**	**CO3**
Q 11 B	Solve $\frac{\partial^3 z}{\partial x^3}-2\frac{\partial^3 z}{\partial x^2\partial y}=2e^{2x}+3x^2y.$	**10**	**CO4**
Q 12 A	Obtain the solution of differential equation by changing the independent variable: $\frac{d^2y}{dx^2}+(3\sin x-\cot x)\frac{dy}{dx}-2y\sin^2 x=e^{-\cos x}\sin^2 x.$	**10**	**CO2**
	OR		
Q 12 A	Solve $\left(D^4+2D^2+1\right)y=x^2\cos x.$	**10**	**CO2**
Q 12 B	Find the complete solution of the wave equation $\frac{\partial^2 y}{\partial t^2}=c^2\frac{\partial^2 y}{\partial x^2}$ under the boundary conditions: $y=0$ when $x=0$ and $y=0$ when $x=l$	**10**	**CO4**
	OR		
Q 12 B	A tightly stretched string of length l with fixed ends is initially in equilibrium position. It is set vibrating by giving each point a velocity $v_0\sin^3\frac{\pi x}{l}$. Find the displacement $y(x,t)$.	**10**	**CO4**