UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2020

Programme: B.Sc. (Hons.) Physics and Chemistry	**Semester: III**
Course Name: Differential Equations	**Max. Marks: 100**
Course Code: MATH 1034	**Duration: 3 Hrs.**
No. of page/s: 02	

Section A

Attempt all the questions. This section contains 6 multiple-choice questions and one option is correct. Write the correct option. Each question carries 5 marks.

1.	All real solutions of the differential equation $\frac{d^2y}{dx^2}+2a\frac{dy}{dx}+by=\cos x$ (where a and b are real constants) are periodic if : A. $a=1$ and $b=0$ B. $a=0$ and $b=1$ C. $a=1$ and $b\neq 0$ D. $a=0$ and $b\neq 1$	**CO3**
2.	A particular solution of $4x^2\frac{d^2y}{dx^2}+8x\frac{dy}{dx}+y=\frac{4}{\sqrt{x}}$ is: A. $\frac{1}{2\sqrt{x}}$ B. $\frac{\log x}{2\sqrt{x}}$ C. $\frac{(\log x)^2}{2\sqrt{x}}$ D. $\frac{\{(\log x)\sqrt{x}\}}{2}$	**CO3**
3.	Let the general integral of the partial differential equation $(2xy-1)\frac{\partial z}{\partial x}+(z-2x^2)\frac{\partial z}{\partial y}=2(x-yz)$ be given by $F(u,v)=0$, where $F:\mathbb{R}^2\to\mathbb{R}$ is a continuously differentiable function. ($\mathbb{R}$ is the set of all real numbers and $\mathbb{R}^2=\{(x,y): x,y\in\mathbb{R}\}$). Which of the following is true? A. $u=x^2+y^2+z,\ v=xz+y$ B. $u=x^2+y^2-z,\ v=xz-y$ C. $u=x^2-y^2+z,\ v=yz+x$ D. $u=x^2+y^2-z,\ v=yz-x$	**CO5**
4.	The differential equation $(1-x^2)\frac{\partial^2 z}{\partial x^2}-2xy\frac{\partial^2 z}{\partial x\partial y}+(1-y^2)\frac{\partial^2 z}{\partial y^2}+x\frac{\partial z}{\partial x}+3x^2y\frac{\partial z}{\partial y}-2z=0$ is elliptic in the region: A. $x^2+y^2<0$ B. $x^2+y^2<1$ C. $x^2+y^2>0$ D. $x^2+y^2>1$	**CO1**

5.	The solution of $\frac{dy}{dt} - 3y = e^{2t},\ y(0) = 1$ is: A. $2e^{2t} + e^{3t}$ B. $2e^{3t} + e^{2t}$ C. $2e^{3t} - e^{2t}$ D. $2e^{2t} - e^{3t}$	**CO2**
6.	The particular integral of the differential equation $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 5^x - \log_e 2$ is: A. $\frac{1}{(\log_e 5+3)^2} - \frac{1}{9}\log_e 2$ B. $\frac{1}{(\log_e 5+3)^2} 5^x - \frac{1}{9}\log_e 2$ C. $\frac{1}{(\log_e 5+3)^2} 5^x + \frac{1}{9}\log_e 2$ D. $\frac{1}{(\log_e 5+3)^2} 5^x$	**CO3**

SECTION B

Attempt all the questions. This section contains descriptive type's questions. Each question carries 10 marks.

7.	Form the partial differential equation by eliminating h and k from the equation $(x-h)^2 + (y-k)^2 = \lambda^2$.	**CO1**
8.	According to Newton's law of cooling, the rate at which a substance cools in moving air is proportional to the difference between the temperature of the substance and that of the air. If the temperature of the air is 290 K and the substance cools from 370 K to 330 K in 10 minutes, find time when the temperature will be 295 K.	**CO2**
9.	Solve $(D^2 + 3D + 2)y = e^{2x}\sin x$.	**CO3**
10.	Find $f(z)$ such that $\left[\frac{(y^2+z^2-x^2)}{2x}\right]dx - ydy + f(z)dz = 0$ is integrable. Hence solve it.	**CO4**
11.	Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$.	**CO3**

SECTION C

This section contains descriptive type's question and it has internal choices. This question carries 20 marks.

12.	Find the complete integral of $2(z + px + qy) = yp^2)$ where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$. **OR** Solve $x(x^2 + 3y^2)\frac{\partial z}{\partial x} - y(3x^2 + y^2)\frac{\partial z}{\partial y} = 2z(y^2 - x^2)$.	**CO5**