Dr. R.K Vals

National Institute of Technology Hamirpur (HP)

End Semester Examination

[Class: B.Tech. (2nd Semester) Title of the Course: Engineering Mathematics-II Course Code: MA-121

Time: 3 Hours

O No 3

Note : Attempt all questions.

Maximum Marks: 50

Roll No .:.

Ordinary Differential Equations

Q.No.1.: Solve the following differential equations

(a)	(1+xy)ydx+(1-xy)xdy=0.	(2.5

(b)
$$(px + y)^2 = py^2$$
. (2.5)

Q.No.2.: Course Outcomes: CO1, CO2, CO3, CO4. Solve the following simultaneous differential equations:

 $\frac{dx}{dt} + 5x - 2y = t, \ \frac{dy}{dt} + 2x + y = 0,$

being given x = y = 0, when t = 0.

Course Outcomes: CO1, CO2, CO3, CO4.

Partial Differential Equations

Q.110.0	Solve the following Lagrange's linear partial differential equation:	(5)
	$(x^2 - y^2 - z^2)p + 2xyq = 2xz$.	

Course Outcomes: CO1, CO2, CO3, , CO4.

Q.No.4.: Solve the following non-homogeneous linear partial differential equations:

$$D^{2} - DD' + D' - 1 z = \cos(x + 2y)$$
.

Course Outcomes: CO1, CO2, CO3, CO4.

Transforms Theory

(Laplace Transforms, Fourier Transforms and $\,\mathbb{Z}$ -Transforms)

Q.No.5.: (a) Find the Laplace transforms of

(i) $t\cos at$, (ii) $t^3 e^{-3t}$, (iii) $te^{-t}\sin 3t$.

(b) Solve, by the method of Laplace transforms, the differential equation

$$(D^3 - 3D^2 + 3D - 1)y = t^2 e^t$$

given that y (0) =1, y'= (0) = 0, y'' (0) = -2.

Course Outcomes: CO1, CO2, CO3.

(3)

(5)

(5)

(5)

Q.No.6.: (a) If F(s) is the complex Fourier transform of f(x), then find $F{f(ax)}$, $a \neq 0$.

(b) If $F_s(s)$ is Fourier sine transforms of f(x), then show that

$$F_{s}\left\{f(x)\sin ax\right\} = \frac{1}{2}\left[F_{c}(s-a) - F_{c}(s+a)\right].$$

Course Outcomes: CO1, CO2, CO3, CO4.

Q.No.7.: Solve (by Fourier transform) the following partial differential equation (4) $\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}, \text{ if } u(0, t) = 0, \quad u(x,0) = e^{-x} (x > 0) \text{ and } u(x, t) \text{ is bounded, where}$ x > 0, t > 0.

Course Outcomes: CO1, CO2, CO3.

(i) Find $\mathbb{Z}\{n\}$,

Q.No.8.:

(ii) Prove that
$$\mathbb{Z}\left\{r^{n}\cos n\theta\right\} = \frac{z(z-r\cos\theta)}{z^{2}-2zr\cos\theta+r^{2}}$$
, (2)

(iii) Find
$$\mathbb{Z}\left\{e^{-at}\right\}$$
, (1)

(iv) Prove that
$$\mathbb{Z}\left\{e^{-at}\cos bt\right\} = \frac{ze^{aT}\left\{ze^{aT} - \cos bT\right\}}{z^2e^{2aT} - 2ze^{aT}\cos bT + 1}$$
. (2)
Course Outcomes: CO1, CO2, CO3, CO4.

Probability and Statistics

- Q.No.9.: In sampling a large number of parts manufactured by a machine, the mean (4) number of defectives in a sample of 20 is 2. Out of 1000 such samples, how many would be expected to contain at least 3 defective parts?
 Course Outcomes: CO1, CO3, CO4.
- **Q.No.10.:** In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S. D. of 60 hours. Estimate the number of bulbs likely to burn for
 - (a) more than 2150 hours,

(b) less than 1960 hours and

(c) more than 1920 hours but less than 2160 hours.

Given: Area against z = 1.33 in the table = 0.4082.

Area against z = 1.83 in the table = 0.4664.

Area against z = 2.00 in the table = 0.4772. Course Outcomes: C01, CO3, CO4, C05. (2+2)

(1)

(4)