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IV Semester B.Sc. Degree Examination, July/August- 2024

MATHEMATICS

Partial Differential Equations and Integral Transforms  
(NEP Scheme)



Time : 2 ½ Hours

Maximum Marks : 60

**Instructions to Candidates:**

Answer **All** the questions.

**I.** Answer any **SIX** of the following.

(6×2=12)

1. Form the partial differential equation by eliminating arbitrary constants  $z = ax + by + ab$ .

2. Solve:  $pq = 1$ .

3. Solve:  $(D^2 - DD' - 2D'^2)z = 0$

4. Find the particular integral of  $(D^2 - DD' - 2D'^2)z = e^{x+2y}$

5. Find the Laplace transform of  $e^{4t}\sin 5t$ .

6. Find  $L^{-1}\left\{\frac{s-3}{(s-3)^2+16}\right\}$ .

7. Write the formula for half range Fourier Cosine series over the interval  $(0, l)$ .

8. Write formula for Fourier Cosine transforms.

**II.** Answer any **THREE** of the following.

(3×4=12)

9. Form the partial differential equation by eliminating arbitrary function from  $\phi(x^2 + y^2 + z^2, z^2 - 2xy) = 0$ .

10. Solve:  $x^2p + y^2q = z^2$ .

[P.T.O.]



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11. Solve:  $p^2 + q^2 = x + y$ .
12. Solve:  $z^2(p^2 + q^2 + 1) = 1$ .
13. Solve:  $p(1 + q^2) + (b - z)q = 0$  by Charpit's method.

III. Answer any **THREE** of the following.

(3×4=12)

14. Solve:  $(D^2 - 2DD' - D'^2)z = e^{4x+2y}$ .
15. Solve:  $(D + D')(D + D' - 2)z = \cos(x + 2y)$ .
16. Reduce the equation  $\frac{\partial^2 z}{\partial x^2} = x^2 \left( \frac{\partial^2 z}{\partial y^2} \right)$  to a Canonical form.
17. Solve the wave equation  $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$  under the condition  $u = 0$  when  $x = 0$  and  $x = \pi$ ,  $\frac{\partial u}{\partial t} = 0$ . When  $t = 0$  and  $u(x, 0) = x$ ;  $0 < x < \pi$ .
18. An insulated rod of length 'l' has its ends A and B maintained at  $0^\circ\text{C}$  and  $100^\circ\text{C}$  respectively until steady state condition prevails. If B is suddenly reduced to  $0^\circ\text{C}$  and maintained at  $0^\circ\text{C}$  find the temperature at a distance x from A at time 't'.

IV. Answer any **THREE** of the following.

(3×4=12)

19. Find
  - i)  $L[\sin 5t \cos 2t]$
  - ii)  $L[e^{2t} \cos 3t]$
20. If  $f(t) = t^2$ ,  $0 < t < 2$  and  $f$  is periodic of period 2 then find  $L[f(t)]$ .
21. Find the Laplace transform of  $t^2 \cos at$ .
22. Verify the convolution theorem for the function  $f(t) = t$ ;  $g(t) = \cos t$ .
23. Find inverse Laplace transform of  $\frac{1}{s(s+1)(s+2)}$ .



V. Answer any **THREE** of the following.

(3×4=12)

24. Obtain the Fourier series for  $f(x) = |x|$  in  $(-\pi, \pi)$ .

25. Obtain the Fourier series of the function in  $(0, 2\pi)$  defined by

$$f(x) = \begin{cases} x; & 0 \leq x < \pi \\ 2\pi - x; & \pi \leq x \leq 2\pi \end{cases}$$

26. Obtain Fourier half range sine series of  $f(x) = (x - 1)^2$  in  $(0, 1)$ .

27. Express  $f(x) = \begin{cases} 1, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$  as a Fourier integral expansion.

28. Find the Fourier sine transform of  $f(x) = e^{-ax}$ ,  $a > 0$ .

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