

I B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018
MATHEMATICS-I

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is Compulsory
3. Answer any **FOUR** Questions from **Part-B**

PART -A

1. a) State Newton's law of cooling. (2M)
- b) Test whether the functions $e^x \cos x$ and $e^x \sin x$ are linearly independent or not. (2M)
- c) Write the Laplace transform of y'' , given that $y(0)=1$ and $y'(0)=1$. (2M)
- d) Verify whether $u = 2x - y, v = x - 2y$ are functionally dependent. (2M)
- e) Find the general solution of $3p^2 = q$. (2M)
- f) Find the general solution of $(D^2 - 4DD' + 4D'^2) = 0$. (2M)
- g) Find Laplace transform of $t \cos at$. (2M)

PART -B

2. a) Solve $3e^x \tan y dx + (1 - e^x) \sec^2 y dy = 0$. (7M)
- b) Find the equation of the system of orthogonal trajectories of the parabolas (7M)
 $r = \frac{2a}{1 + \cos \theta}$, where a is the parameter.
3. a) Solve $(D^2 - 3D + 2)y = \cos 3x$. (7M)
- b) Solve $(D^2 - 5D + 6)y = e^x \sin x$. (7M)
4. a) Find $L [t^3 e^{2t} \sin t]$. (7M)
- b) $y'' - 3y' + 2y = 4t + e^{3t}$ when $y(0) = 1$ and $y'(0) = -1$. (7M)
5. a) If $x + y + z = u, y + z = uv, z = uvw$, then evaluate $\frac{\partial(x, y, z)}{\partial(u, v, w)}$. (7M)
- b) Find the volume of the largest rectangular parallelepiped that can be inscribed in (7M)
the ellipsoid $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{25} = 1$.
6. a) Form a partial differential equation by eliminating the arbitrary functions f and g (7M)
from $z = xf(ax + by) + g(ax + by)$.
- b) Solve $z^2(p^2 + q^2) = x^2 + y^2$. (7M)



7. a) Solve $(4D^2 + 12DD' + 9D'^2)z = e^{3x-2y}$. (7M)

b) Classify the nature of the partial differential equation (7M)

$$x^2 \frac{\partial^2 u}{\partial x^2} + (1 - y^2) \frac{\partial^2 u}{\partial y^2} = 0, \quad -\infty < x < \infty, \quad -1 < y < 1.$$



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PART - A

1. a) Write the differential equation for L-R circuit, explain the terms involved in it and write the solution of the differential equation. (2M)
- b) Test whether the functions e^x and xe^x are linearly independent or not. (2M)
- c) Write the second shifting theorem of Laplace transforms. (2M)
- d) If $u = \frac{y}{x}, v = xy$, then find $J\left(\frac{u,v}{x,y}\right)$. (2M)
- e) Find the general solution of $p^2 + q^2 = 1$. (2M)
- f) Find the general solution of $(D^2 + DD' - 2D'^2) = 0$. (2M)
- g) Find L $[\sin 2t \sin 3t]$. (2M)

PART - B

2. a) Solve $\frac{dy}{dx} + \frac{y}{x} \log y = \frac{y}{x^2} (\log y)^2$. (7M)
- b) Find the orthogonal trajectories of the following family of curves: $r^n = a^n \sin n\theta$. (7M)
3. a) Solve $(D^2 - p^2)y = \text{Sinh } px$. (7M)
- b) Solve $(D^2 - 6D + 13)y = 8e^{3x} \sin 2x$. (7M)
4. a) Find L $[(t+3)^3 e^{2t}]$ (7M)
- b) Solve $(D^2 + 2D + 1)y = 3te^{-t}$ given that $y(0) = 4, y'(0) = 2$. (7M)
5. a) Prove that $u = \frac{x^2 - y^2}{x^2 + y^2}, v = \frac{2xy}{x^2 + y^2}$ are functionally dependent and find the relation between them. (7M)
- b) Find the maximum and minimum values $x + y + z$ subject to $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$. (7M)
6. a) Form a partial differential equation by eliminating the arbitrary function $z = f(x^2 + y^2 + z^2)$. (7M)
- b) Solve $x^2(z - y)p + y^2(x - z)q = z^2(y - x)$. (7M)
7. a) Solve $(D^3 + D^2D' - DD' - D'^3)z = 3\sin(x + y)$. (7M)
- b) Classify the nature of the partial differential equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = \sin(x + y)$. (7M)



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PART -A

1. a) Write the differential equation for C-R circuit, explain the terms involved in it and write the solution of the differential equation. (2M)
- b) Test whether the functions $\sin x$ and $x \sin x$ are linearly independent or not. (2M)
- c) State convolution theorem in Laplace transforms. (2M)
- d) Find the stationary points of $f(x, y) = xy + (x - y)$. (2M)
- e) Find the general solution of $pq=l$. (2M)
- f) Find the general solution of $(D^2 + 7DD' + 12D'^2) = 0$. (2M)
- g) Find Laplace transform of $t^2 e^{-2t}$. (2M)

PART -B

2. a) Solve $(x + 2y^3) \frac{dy}{dx} = y$. (7M)
- b) Find the orthogonal trajectories of the family $r = 2a(\cos \theta + \sin \theta)$ (7M)
3. a) Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$. (7M)
- b) Solve $(D^2 - 2D + 1)y = xe^x \sin x$ (7M)
4. a) Find $L [t^2 \sin at]$. (7M)
- b) Solve $(D^2 + 6D + 9)y = \sin t$ given that $y(0) = 1, y'(0) = 0$. (7M)
5. a) If $u = \frac{yz}{x}, v = \frac{xz}{y}, w = \frac{xy}{z}$ find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$. (7M)
- b) Find the stationary points of $u(x, y) = \sin x \sin y \sin(x + y)$ where $0 < x < \pi, 0 < y < \pi$ and find the maximum u . (7M)
6. a) Form a partial differential equation by eliminating the arbitrary function f from $xyz = f(x^2 + y^2 + z^2)$. (7M)
- b) Solve $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$. (7M)
7. a) Solve $(D^3 - 4D^2D' + 4DD'^2)z = 6 \sin(3x + 6y)$. (7M)
- b) Classify the nature of the partial differential equation $\frac{\partial^2 u}{\partial x^2} + 2 \frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = 0$. (7M)

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PART -A

1. a) State law of natural growth or decay and write the corresponding differential equations and their solutions. (2M)
- b) Test whether the functions e^{2x} and e^{5x} are linearly independent or not. (2M)
- c) Find the Laplace transform of Heaviside's unit function. (2M)
- d) Expand $e^x \cos y$ near $(1, \frac{\lambda}{4})$ (2M)
- e) Find the general solution of $p+q=1$. (2M)
- f) Find the general solution of $(D^2 - 4DD'+4D'^2) = 0$. (2M)
- g) If $L\left(\frac{\sin t}{t}\right) = \tan^{-1} \frac{1}{s}$, find $L\left(\frac{\sin at}{t}\right)$. (2M)

PART -B

2. a) Solve $\cosh x \frac{dy}{dx} + y \sinh x = 2 \cosh^2 x \sinh x$. (7M)
- b) Find the orthogonal trajectories of $r^2 = a \sin 2\theta$. (7M)
3. a) Solve $(D^2 + 3D + 2)y = e^{-x} + \cos x$. (7M)
- b) Solve $(D^2 + 2D - 3)y = x^2 e^{-3x}$. (7M)
4. a) Find $L\left[e^{-3t} \int_0^t \frac{1 - \cos t}{t^2} dt\right]$ (7M)
- b) Solve $y''' - 3y'' + 3y' - y = t^2 e^t$ given that $y=1, y'=0, y''=-2$ at $t=0$. (7M)
5. a) Determine whether the functions $U = \frac{x}{y-z}, V = \frac{y}{z-x}, W = \frac{z}{x-y}$ are dependent. (7M)
If dependent find the relationship between them.
- b) Examine the function for extreme values $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$. (7M)
6. a) Form a partial differential equation by eliminating a and b from $\log(az-1) = x + ay + b$. (7M)
- b) Solve $px(z-2y^2) = (z-xy)(z-y^2-2x^3)$. (7M)
7. a) Solve $(D^2 - 4DD'+4D'^2)z = e^{2x+y}$. (7M)
- b) Classify the nature of the partial differential equation $\frac{\partial^2 u}{\partial x^2} + 4 \frac{\partial^2 u}{\partial x \partial y} + 4 \frac{\partial^2 u}{\partial y^2} - 2 \frac{\partial u}{\partial x} + 0 = 0$ (7M)

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