

I B. Tech I Semester Regular/Supplementary Examinations, Nov/Dec - 2017

MATHEMATICS-I

Time: 3 hours

(Comm. to All Branches)

Max. Marks: 70

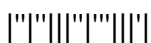
- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. Answer **ALL** the question in **Part-A**
 3. Answer any **FOUR** Questions from **Part-B**

PART - A

1. a) State Newton's Law of cooling. (2M)
- b) Solve the D.E $(D^2 - 8D + 9)y = 0$ (2M)
- c) Show that the function $f(t) = t^2$ is of exponential order 3. (2M)
- d) Find Inverse Laplace transform of $\frac{s-1}{s^2+5^2}$ (2M)
- e) Find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ if $u = \frac{x^3 y^3}{x^3 + y^3}$ (2M)
- f) From the partial differential equation by eliminating arbitrary constants from $z = ax + by + ab$ (2M)
- g) Classify the nature of $2 \frac{\partial^2 u}{\partial x^2} + 3 \frac{\partial^2 u}{\partial y^2} = 0$ the partial differential equations. (2M)

PART - B

2. a) Find the charge and current in RC circuit if $R = 20$ ohms, $c = 0.01$ farad, and $E(t) = 20 \sin 2t$ with $q(0) = 0$. (7M)
- b) If 30% of radioactive substance disappears in 10 days, how long will it take for 90% of it to disappear? (7M)
3. a) At the end of three successive seconds, the distance of a point moving with simple harmonic motion from its mean position, measured in the same direction are 1, 5, 5. Then find the complete oscillation. (7M)
- b) Solve the D.E $(D^2 + 9)y = \operatorname{cosec} 3x$ by the method of variation of parameters. (7M)
4. a) Show that $\int_0^\infty \frac{\sin 2t + \sin 3t}{te^t} dt = \frac{3\pi}{4}$. (7M)
- b) Find $L^{-1} \left\{ \frac{1}{s^2(s^2+1)^2} \right\}$ using convolution theorem. (7M)
5. a) Find the extreme values of $f(x, y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 7$. (7M)
- b) Expand $f(x) = \log \sin x$ about $x = 3$ using Taylor's series expansion. (7M)
6. a) Solve the $(x + 2z)p + (4z - y)q = 2x + y$ partial differential equation. (7M)
- b) Show that the complete integral of $z = px + qy - 2p - 3q$ represents all possible planes through the point $(2, 3, 0)$. (7M)
7. a) Solve the PDE $(D^2 - 3D - D^1 + 3D^1)z = xy + e^{x+2y}$. (7M)
- b) Solve the PDE $(D^2 - DD^1)z = \sin x \cos 2y$. (7M)



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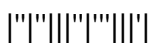
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1. a) Solve the D.E $(x^2 + y^2)dx + 2xy dy = 0$ (2M)
- b) Find the P.I of $(D^2 - 5D + 6)y = e^{4x}$ (2M)
- c) Evaluate $\int_0^{\infty} e^{-5t} \delta(t - 2) dt$. (2M)
- d) Find inverse Laplace transform of $\frac{1}{s} \sin \frac{1}{s}$. (2M)
- e) Find $\frac{\partial^3 f}{\partial x \partial y \partial z}$ for $f(x,y,z) = e^{xyz}$ (2M)
- f) Form the partial differential equation by eliminating arbitrary constants from $z = ax + by + \sqrt{a^2 + b^2}$. (2M)
- g) Find the P.I of $(D^2 - D^2)z = \cos(x + y)$. (2M)

PART -B

2. a) Find orthogonal trajectories of the Family of circles $x^2 + y^2 + 2fy + 1 = 0$, f being the parameter. (7M)
- b) Solve the D.E $y(x^4 y^4 + x^2 y^2 + xy)dx + x(x^4 y^4 - x^2 y^2 + xy)dy = 0$ (7M)
3. a) Solve the D.E $(D^2 + 9)y = \sec 3x$ by method of variation of parameters. (7M)
- b) Solve the D.E $(D^2 - 3D + 2)y = \sin(e^{-x})$ (7M)
4. a) Show that $\int_0^{\infty} e^{-2t} \frac{\sin ht}{t} dt = \frac{1}{2} \log 3$ (7M)
- b) Solve the D.E $y'' - 6y' + 9y = t^2 e^{3t}$ if $y(0) = 2, y'(0) = 6$ using Laplace transforms method. (7M)



5. a) if $x = \sqrt{vw}$, $y = \sqrt{wu}$, $z = \sqrt{uv}$, $x = r \sin \theta \cos \phi$, $y = r \sin \theta \sin \phi$, $w = r \cos \theta$ (7M)

then find $J\left(\frac{x, y, z}{r, \theta, \phi}\right)$.

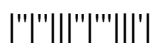
b) Expand $f(x, y) = xy^2 + \cos(xy)$ in powers of $(x - 1)(y - \frac{\pi}{2})$. (7M)

6. a) Solve the PDE $\left(\frac{p}{2} + x\right)^2 + \left(\frac{q}{2} + y\right)^2 = 1$. (7M)

b) Solve the $yp - xq = -xe^{x^2+y^2}$ partial differential equation. (7M)

7. a) Solve the PDE $(D^2 - DD^1 + D^1 - 1)z = \sin(x + 2y)$ (7M)

b) Solve the PDE $(D^2 - 2DD^1)z = e^{2x} + x^3y$ (7M)



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2. Answer **ALL** the question in **Part-A**

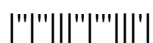
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PART -A

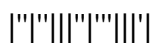
1. a) Write the Bernoulli's equation in 'y'. (2M)
- b) Find the P.I of $(D^2 + 1)y = x^2$. (2M)
- c) Find $L^{-1}\left\{\frac{1}{s-6} - \frac{2}{s^2+3} + \frac{3}{s^4}\right\}$ (2M)
- d) If $L^{-1}\left\{\frac{e^{-1/s}}{s^{1/2}}\right\} = \frac{\cos 2\sqrt{t}}{\sqrt{\pi t}}$ then find $L^{-1}\left\{\frac{e^{-a/s}}{s^{1/2}}\right\}$ (2M)
- e) Find $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ for $f(x, y) = \log\sqrt{x^2 + y^2}$. (2M)
- f) Form the partial differential equation by eliminating arbitrary constants from $z = ax + a^2y^2 + b$. (2M)
- g) Classify the nature of $x \frac{\partial^2 u}{\partial x^2} + y \frac{\partial^2 u}{\partial y^2} = 0$ if $xy > 0$ the partial differential equations. (2M)

PART -B

2. a) An RL circuit has an Emf given (in volts) by $4 \sin t$, a resistance of 100 ohms, an inductance of 4 henries with no initial current. Find the current at any time t. (7M)
- b) Find the orthogonal trajectory of $r = a(\sec\theta + \tan\theta)$. (7M)
3. a) Solve the D.E $(D^2 + D)y = \frac{1}{1 + e^x}$. (7M)
- b) Solve the D.E $(D^3 + 1)y = \cos(2x-1) + x^2 e^{-x}$. (7M)
4. a) Evaluate $\int_0^\infty \frac{\cos at - \cos bt}{t} dt$. (7M)
- b) Solve the D.E $y'' + 2y' + 5y = 8\sin t + 4 \cos t$, $y(0) = 1$ and $y\left(\frac{\pi}{4}\right) = \sqrt{2}$ Using Laplace transform method. (7M)



5. a) If $u = \frac{x^2 y^2}{x+y}$ then find (i) $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ (ii) $x \frac{\partial^2 u}{\partial x \partial y} + y \frac{\partial^2 u}{\partial y^2}$. (7M)
- b) Prove that $JJ^1 = 1$ if $u = \frac{yz}{x}, v = \frac{zx}{y}, w = \frac{xy}{z}$. (7M)
6. a) Solve the PDE $z^2(p^2 + q^2) = 1$. (7M)
- b) Solve the $\left(\frac{y-z}{yz}\right)p + \left(\frac{z-x}{zx}\right)q = \frac{x-y}{xy}$ partial differential equation. (7M)
7. a) Solve the PDE $(D^2 - 2DD^1 + D^{1^2})z = 2x \cos y$. (7M)
- b) Solve the PDE $(D^2 + 2DD^1 - 8D^{1^2})z = \sqrt{2x+3y}$. (7M)



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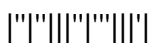
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PART - A

1. a) Write the equation to represent RC circuit. (2M)
- b) Solve the D.E $(D^4 + m^4)y = 0$. (2M)
- c) Find $L^{-1} \left\{ \frac{1}{(s^2+1)(s^2+9)} \right\}$. (2M)
- d) Find $L^{-1} \left\{ \frac{3}{\left(s - \frac{\pi}{2}\right)^4} \right\}$. (2M)
- e) Find $\lim_{\substack{x \rightarrow 1 \\ y \rightarrow 1}} \left(\frac{2xy}{x^2 + y^2 + 1} \right)$. (2M)
- f) Form the partial differential equation by eliminating arbitrary constants from $z = ax + by + a^2 + b^2$. (2M)
- g) Find the P.I of $(D^2 - D^{i^2})z = e^{x+y}$. (2M)

PART - B

2. a) Solve the D.E $(2xy^4 e^y + 2xy^3 + y)dx + (x^2 y^4 e^y - x^2 y^2 - 3x)dy = 0$ (7M)
- b) The temperature of a cup of coffee is 92°C , when freshly poured the room temperature being 24°C . In one minute it was cooled to 80°C . How long a period must elapse, before the temperature of the cup becomes 65°C . (7M)
3. a) Solve the D.E $(D^2 + 2D + 1)y = x \cdot \cos x$. (7M)
- b) Determine the charge on the capacitor at any time $t > 0$ in a series RLC circuit having an E.M.F $E(t) = 100 \sin 60 t$, a resistor of 2 ohms, an inductor of 0.1 henries and capacitor of $\frac{1}{260}$ farads, if the initial current in the inductor and charge on the capacitor are both zero. (7M)



4. a) Evaluate $L\left\{\int_0^{t/2} \frac{1-e^{-2x}}{x} dx\right\}$. (7M)
- b) Find inverse Laplace transform of $\frac{s}{s^4+s^2+1}$. (7M)
5. a) Find $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$ if $u = \cos ec^{-1}\left(\frac{\sqrt{x} + \sqrt{y}}{x^{1/3} + y^{1/3}}\right)^{1/2}$ (7M)
- b) Find the extreme values of following using Lagrange's multiplier method (7M)
 xy subject to $3x^2 + y^2 = 6$.
6. a) Find the general solutions of the partial differential equations (7M)
 $y(x-z)p + (z^2 - xz - x^2)q = y(2x-z)$. Hence obtain the particular solution
 which passes through the ellipse $z = 0, 2x^2 + 4y^2 = 1$.
- b) Solve the PDE $(1+y)p + (1+x)q = z$. (7M)
7. a) Solve the PDE $(D^2 + DD^1 - 6D^{1^2})z = x^2 \sin(x+y)$. (7M)
- b) Solve the PDE $(D^3 - D^{1^3})z = x^3 y^3$. (7M)

