Code No: R161102 **R16** SET - 1

I B. Tech I Semester Supplementary Examinations, May - 2017
MATHEMATICS-I
(Common to all branches)

Time: 3 hours 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**

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PART –A

1. a) Find the orthogonal trajectory of the family of curves $xy = c$. (2M)

b) Solve $\frac{d^2y}{dx^2} + 8\frac{dy}{dx} + 16y = 0$. (2M)

c) Find the Laplace Transform of $\sin^3 at$. (2M)

d) Find the inverse Laplace Transform of $\frac{s+1}{s^2+2s+2}$. (2M)

e) Write Chain rules for Partial differentiation. (2M)

f) Form PDE from $z = ax + by + a^2 + b^2$. (2M)

g) Find the complementary function of $4\frac{\partial^2 z}{\partial x^2} + 12\frac{\partial^2 z}{\partial x \partial y} + 9\frac{\partial^2 z}{\partial y^2} = 0$. (2M)

PART –B

2. a) Solve $\frac{dy}{dx} + x\sin 2y = x^3 \cos^2 y$. (7M)

b) Find the orthogonal trajectory of the cardioids $r^2 = a^2 \sin 2\theta$. (7M)

3. a) Solve $\left(D^2+2\right)y = x^2e^{3x} + e^x \cos 2x$, *where* $D = \frac{d}{dx}$. (7M)

b) Solve the following D.E. by the method of variation of parameters: (7M)
$\frac{d^2y}{dx^2} + a^2y = \sec ax$.

4. a) Find the Laplace Transform of $\left\{\left(\sqrt{t} - \frac{1}{\sqrt{t}}\right)^3\right\}$. (4M)

b) Find $L^{-1}\left\{\frac{s}{s^4+s^2+1}\right\}$. (5M)

c) Solve the following differential equation by the transform method; (5M)
$\left(D^2+n^2\right)x = a\sin(nt+\alpha)$, $x = Dx = 0$ at $t = 0$ *where* $D = \frac{d}{dt}$.
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5. a) Determine whether the following functions are functionally dependent or not. If functionally dependent, find the functional relation between them: (7M)
$u = \frac{x}{y}, \quad v = \frac{x+y}{x-y}$.

b) Discuss the maxima and minima of $f(x, y) = x^3 y^2 (1 - x - y)$. (7M)

6. a) Obtain the partial differential equation by eliminating the arbitrary constants from the equation $z = \left(x^2 + a^2\right)\left(y^2 + b^2\right)$. (4M)

b) Solve the partial differential equation $\left(x^2 - y^2 - z^2\right) p + 2xyq = 2xz$. (5M)

c) Solve the PDE $zpq = p + q$. (5M)

7. a) Solve $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$. (7M)

b) Solve $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} - 6\frac{\partial^2 z}{\partial y^2} = \cos\left(2x + y\right)$. (7M)

Code No: R13102 **R13** SET - 1

I B. Tech I Semester Supplementary Examinations, May - 2017
MATHEMATICS-I
(Common to All Branches)

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 **THREE** Questions from **Part-B**

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PART –A

1. a) Explain the method of solving Bernoulli equation. (3M)
   b) Solve $(D^4 + 2D^2n^2 + n^4)y = 0$. (4M)
   c) State and prove change of scale property of Laplace transforms. (4M)
   d) Verify the chain rule for Jacobians if $x = u$, $y = u \tan v$, $z = w$. (4M)
   e) Form the partial differential equation by eliminating the arbitrary function f from $xy + yz + zx = f\left(\frac{z}{x+y}\right)$. (4M)
   f) State all possible solutions of Laplace's equation. (3M)

PART –B

2. a) The number N of bacteria in a culture grows at a rate proportional to N. The value of N was initially 100 and increased to 332 in one hour. What was the value of N after $1\frac{1}{2}$ hour? (9M)
   b) Solve $(x - y)dx - dy = 0, y(0) = 2$. (7M)

3. Solve $(D^2 - 4D + 4)y = x^2 \sin x + e^{2x} + 3$. (16M)

4. a) Evaluate $L\left\{\int_0^t e^{-t} \cos t \, dt\right\}$. (6M)
   b) Solve the differential equation using Laplace transforms (10M)
   $$\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x = e^{-t}; x(0) = 0, x'(0) = 1.$$

5. a) Find the minimum and maximum values of $\sin x + \sin y + \sin(x + y)$. (9M)
   b) If $u = \frac{1}{\sqrt{x^2+y^2+z^2}}, x^2 + y^2 + z^2 \neq 0$ then evaluate $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}$. (7M)

6. a) Solve $q^2y^2 = z(z - px)$. Also, find the general solution of $y^2zp + x^2zq = y^2x$. (10M)
   b) Solve $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$. (6M)

7. An infinitely long plane uniform plate is bounded by two parallel edges and an end at right angles to them. The breadth is π; this end is maintained at a temperature u_0 at all points and other edges are at zero temperature. Determine the temperature at any point of the plate in the steady-state. (16M)

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