6. a) Evaluate $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y}\, dy\, dx$ by changing the order of integration.

b) Find the area included between the Cardioids $r = a(1 + \cos\theta)$ and $r = a(1 - \cos\theta)$.

c) Find the volume common to the cylinders $x^2 + y^2 = a^2$ and $x^2 + z^2 = a^2$.

**Unit – IV**

7. a) Find (i) $L[t^2 \sin t]$ (ii) $L\left[\frac{1-e^{-t}}{t}\right]$

b) Express $f(t)=\begin{cases} \cos t, & 0 < t \le \pi \\ 1 & , \pi < t \le 2\pi \\ \sin t & t > 2\pi \end{cases}$ *interms of* Heaviside (unit step) function and also find its Laplace transform.

c) If f(t) is a periodic function with period T so that f (t + T)=f(t) for all values of t, prove

$$L\{f(t)\} = \frac{\int_0^T e^{-st} f(t)\,dt}{1-e^{-sT}}$$

8. a) Find (i) $L^{-1}\left[\log\left(1-\frac{a^2}{s^2}\right)\right]$ $(ii) L^{-1}\left[e^{-2\pi s}\frac{s}{s^2+4}\right]$

b) Find $L^{-1}\left[\frac{1}{(s-1)(s^2+1)}\right]$ using convolution theorem.

c) Using Laplace transform technique solve $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+3y=e^{-t}$ with $y(0)=1=y'(0)$

**Unit – V**

9. a) Find the PDE of the family of all spheres whose centres lie on the plane z=0 & have constant radius 'r'.

b) Solve $u_{xt} = e^{-t}\cos x$, given that u=0 when t=0 and $\frac{\partial u}{\partial t} = 0$ at $x = 0$. Also show $u \to \sin x$ as $t \to \infty$.

c) Derive one dimensional wave equation.

10. a) Form the PDE for $f\left(\frac{xy}{z}, z\right) = 0$

b) Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$.

c) Solve $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y} = 2(x+y)u$, by the method of separation of variables.

BT* Bloom's Taxonomy, L* Level

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# NMAM INSTITUTE OF TECHNOLOGY, NITTE

*(An Autonomous Institution affiliated to VTU, Belagavi)*

**Second Semester B.E. (Credit System) Degree Examinations**

April – May 2017

**16MA201 – ENGINEERING MATHEMATICS - II**

Duration: 3 Hours  Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit**.*

## Unit – I

1. a) Solve $ye^{xy}dx + (xe^{xy} + 2y)dy = 0$ 6

   b) Obtain the orthogonal trajectories of the family of curves $r = \dfrac{2a}{1+\cos\theta}$. 7

   c) A body originally at $80^0$C cools down to $60^0$C in 20 min. The temperature of air is $40^0$C. What will be the temperature of the body after 40 min from the original position? 7

2. a) Find the general and singular solution of $P = \log(Px - y)$. 6

   b) Obtain the general solution of the equation $xp^4 - 2yp^3 + 12x^3 = 0$. 7

   c) If 30% of the radio active substance disappeared in 10 days; find how long will it take for 90% of it to disappear. 7

## Unit – II

3. a) Solve $(D-3)^2 y = e^{3x} + e^{5x}$ 6

   b) Using the method of variation of parameters solve:
   $\dfrac{d^2y}{dx^2} - 6\dfrac{dy}{dx} + 9y = \dfrac{e^{3x}}{x^2}$ 7

   c) Solve : $\dfrac{x^2 d^2y}{dx^2} + x\dfrac{dy}{dx} + 9y = 3x^2 + \sin(3\log x)$ 7

4. a) Solve $(D^2 - 2D + 1)y = xe^x \sin x$. 6

   b) Solve by the method of undetermined coefficients $(D^2 - 2D)y = e^x \sin x$ 7

   c) A spring is such that it would be stretched by 19.6 cms by a 4.9 kg weight. Let the weight be attached to the spring and pulled down 15 cms below the equilibrium position. If the weight is started with an upward velocity of 9.8 cms per second, describe the motion. No damping or impressed force is present. 7

## Unit – III

5. a) Evaluate $\displaystyle\int_0^1 \frac{x^\alpha - 1}{\log x}dx,\ \alpha \ge 0$ using differentiation under the integral sign. 6

   b) Prove that $\beta(m,n) = \dfrac{\Gamma m\,\Gamma n}{\Gamma(m+n)}$. 7

   c) Evaluate $\displaystyle\int_0^\infty \frac{dx}{1+x^4}$ in terms of Gamma function. 7

P.T.O.

## Unit – IV

7. a) If f(t) is a periodic function with period T so that f(t+T)=f(t) for all values of t, prove that $L\{f(t)\} = \frac{1}{1-e^{-ST}}\int_0^T e^{-st} f(t)dt$

b) Obtain $L\left\{\frac{\cos 2t - \cos 3t}{t} + e^{-2t}(2\cos 3t - 3\sin 3t)\right\}$

c) Express in terms of unit step function and hence find Laplace transform of

$$f(t) = \begin{cases} t^2, & 0 < t < 2 \\ 4t & 2 < t < 4 \\ 8 & t > 4 \end{cases}$$

8. a) Obtain $L^{-1}\left\{\frac{3s+7}{s^2-2s-3} + \frac{s+23}{s^2+4s+13} + \log\left(\frac{s+a}{s+b}\right)\right\}$

b) Apply Laplace transform method to determine the solution of

$$y''(t) + 5y'(t) + 6y(t) = 5e^{2t}, where\ y(0) = 2, y'(0) = 1$$

c) Using Convolution theorem, evaluate $L^{-1}\left\{\frac{1}{s(s^2+a^2)}\right\}$

## Unit – V

9. a) Formulate a partial differential equation $z = f(y-2x) + g(2y-x)$

b) Determine the solution of $(x^2-y^2-z^2)\,p + 2xyq = 2xz$ by Lagrange's method.

c) Solve $\frac{\partial^2 z}{\partial x \partial y} + 9x^2y^2 = \cos(2x-y)$ given that z=0, when y=0 and $\frac{\partial z}{\partial y} = 0$ when x=0

10. a) Solve $\frac{\partial^2 z}{\partial y^2} = z$ given y=0, z=$e^x$ & $\frac{\partial z}{\partial y} = e^{-x}$

b) Using the method of separation of variable solve $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}$ given $u(0,y) = 8e^{-3y}$.

c) Derive the equation of one dimensional heat equation.

BT* Bloom's Taxonomy, L* Level

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# NMAM INSTITUTE OF TECHNOLOGY, NITTE

*(An Autonomous Institution affiliated to VTU, Belagavi)*

**Second Semester B.E. (Credit System) Degree Examinations**

**Make up / Supplementary Examinations - July 2017** 10004

**16MA201 – ENGINEERING MATHEMATICS – II**

ration: 3 Hours

Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit**.*

## Unit – I

| | | Marks | BT* |
|---|---|---|---|
| a) | Solve $ye^{xy}\,dx+(xe^{xy}+2y)dy=0$. | 6 | L*3 |
| b) | If a body originally is at 80ºC cools down to 60ºC in 20 min, the temperature of air being 40ºC. Find the temperature of the body after 40mm from the original. | 7 | L2 |
| c) | Obtain the orthogonal trajectories of the family of the curves $r^n = a^n \cos n\theta$ | 7 | L5 |
| a) | Solve $p^2 + p(x+y) + xy = 0$ | 6 | L3 |
| b) | Solve $(x^2+y^2+x)dx+xydy=0$ | 7 | L3 |
| c) | Obtain the general and singular solution of $xp^3 - yp^2 + 1 = 0$ | 7 | L5 |

## Unit – II

| | | | |
|---|---|---|---|
| a) | Solve $(D^3 - 6D^2+11D - 6)y=e^{-2x}+e^{-3x}$. | 6 | L3 |
| b) | Solve $\frac{d^2y}{dx^2} - \frac{2dy}{dx} + 5y = e^{2x}\sin x$ | 7 | L3 |
| c) | Solve by the method of variation of parameters $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ | 7 | L3 |
| a) | Solve $\left(D^2+2D+2\right)y=1+3x+x^2$ | 6 | L3 |
| b) | Solve $(D^2 + 2)\, y = x^2 e^{3x} + \cos 2x$ | 7 | L3 |
| c) | Solve by the method of undetermined multipliers $(D^2 - D - 2)\, y = 1 - 2x - 9e^{-x}$ | 7 | L3 |

## Unit – III

| | | | |
|---|---|---|---|
| a) | Prove that $\beta(m,n)=\frac{\mu(m)\mu(n)}{\mu(m+n)}$ | 6 | L3 |
| b) | Prove That $\int_0^1 \frac{x^2}{\sqrt{1-x^4}}dx \times \int_0^1 \frac{1}{\sqrt{1+x^4}}dx = \frac{\pi}{4\sqrt{2}}$ | 7 | L3 |
| c) | Evaluate $\int_0^2 (4-x^2)^{\frac{3}{2}} dx$ by using beta and gamma functions. | 7 | L4 |
| a) | Evaluate $\int_0^{\infty}\int_x^{\infty} \frac{e^{-y}}{y}\, dy\, dx$ by changing the order of integration | 6 | L4 |
| b) | Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dz\, dy\, dx}{\sqrt{1-x^2-y^2-z^2}}$ | 7 | L4 |
| c) | Find the area bounded by the parabola $y=x^2$ and the line $y=x$. | 7 | L3 |

P.T.O.