

6. a) Solve $\frac{\partial^3 z}{\partial x^2 \partial y} + 18xy^2 + \sin(2x - y) = 0$ by direct integration. 6 L2
- b) Solve the following non-linear partial differential equations 7 L2
- i) $zpq = p + q$ ii) $p^2 + q^2 = x + y$
- c) Derive one dimensional heat flow equation of the form $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. 7 L3
7. a) Evaluate $\int_{-c}^c \int_{-b}^b \int_{-a}^a (x^2 + y^2 + z^2) dx dy dz$. 6 L2
- b) Prove that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. 7 L3
- c) Using double integrals find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. 7 L3
8. a) Prove that $\int_0^{\frac{\pi}{2}} \sqrt{\sin \theta} d\theta \cdot \int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin \theta}} = \pi$. 6 L2
- b) Evaluate $\iint_D (x^2 + y^2) dx dy$ where D is the region bounded by $y = x$ and $\frac{y^2}{1-x^2} = 4x$. 7 L2
- c) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 dy dx$ by changing the order of integration. 7 L3
9. a) Find $L\left\{\frac{\sin^2 t}{t}\right\}$. 6 L1
- b) Find $L\{f(t)\}$ if $f(t) = \begin{cases} t, & 0 < t < \pi \\ \pi - t, & \pi < t < 2\pi \end{cases}$ and $f(t+2\pi) = f(t)$. 7 L2
- c) Express $f(t) = \begin{cases} t^2, & 0 < t \leq 2 \\ 4, & 2 < t \leq 4 \\ 0, & t > 4 \end{cases}$ in terms of unit step function and hence find its Laplace transform. 7 L2
10. a) Find the inverse Laplace transform of $\frac{1}{s^2(s+1)^2}$ by using the convolution theorem. 6 L1
- b) Find the inverse Laplace transform of i) $\log\left[\frac{s^2+1}{s(s+1)}\right]$ ii) $\frac{3(s^2-2)^2}{2s^5}$. 7 L2
- c) Solve $x''(t) + x(t) = 6 \cos 2t$, $x(0) = 3$, $x'(0) = 1$ by the Laplace transform method. 7 L2
- BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome 7 L2

NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Make up/Supplementary Examinations – September 2021

20MA201 – ENGINEERING MATHEMATICS - II

Duration: 3 Hours

Max. Marks: 100

Note: Answer any **Five full** questions.

Marks BT* CO* PO*

a) Solve $(x^3 + \cos y + \frac{1}{x})dy = (\frac{y}{x^2} - 3yx^2)dx$.

6 L*2 1 1

b) Solve $\frac{dx}{dy} = \frac{(\tan^{-1} y) - x}{1 + y^2}$.

7 L3 1 2

c) The law for the decay of radio active materials states that disintegration at any instant is proportional to the amount of material present. If 30% of the radio active substance disappeared in 10 days, find how long will it take for 90% of it to disappear.

7 L2 1 1

a) Find the general and singular solutions of the equation $y = xp + \frac{a}{p}$.

6 L2 1 1

b) Obtain the orthogonal trajectories of the family of curves $r^n = a \sin n\theta$.

7 L2 1 1

c) Solve $p^3 + 2xp^2 - y^2p^2 - 2xy^2p = 0$.

7 L3 1 2

a) Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 1 - e^x + 5x^2$.

6 L2 2 1

b) Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$.

7 L2 2 2

c) Solve $(D^2 + 5D + 6)y = 2e^x + 3e^{3x} + 7$

7 L2 2 2

a) Solve $(D^2 - 2D + 4)y = e^x \cos x$.

6 L2 2 1

b) Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ by using the method of Variation of parameters.

7 L2 2 2

c) Solve $y'' + 4y' + 4y = 3 \sin x$.

7 L2 2 2

a) Form the partial differential equation by eliminating the arbitrary functions and arbitrary constants from the equations

i) $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$ ii) $z = f(x^2 + y^2)$

6 L2 3 2

b) Solve $x^2 \frac{\partial u}{\partial x} + y^2 \frac{\partial u}{\partial y} = 0$ by the method of separation of variables.

7 L2 3 2

c) Derive one dimensional wave equation in the form $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$.

7 L2 3 2