

USN



14MAT21

Second Semester B.E. Degree Examination, June/July 2015

Engineering Mathematics - II

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, selecting ONE full question from each Part.

PART — A

1 a. Solve $4 \frac{d^4 u}{dx^4} - 4 \frac{d^3 u}{dx^3} - 23 \frac{d^2 u}{dx^2} + 12 \frac{du}{dx} + 36y = 0$. (06 Marks)

b. Solve $\frac{d^2 y}{dx^2} + 6 \frac{dy}{dx} + 11y = e^x + 1$ using inverse differential operator method. (07 Marks)

c. Solve $(D^2 - 2D)y = e^x \sin x$ using method of undetermined coefficients. (07 Marks)

2 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. (07 Marks)

b. Solve $(D^2 + 4)y = x^2 + e^x$ using inverse differential operator method. (07 Marks)

c. Solve $(1D^2 - 2D + 2)y = e^x \tan x$ using method of variation of parameters. (07 Marks)

PART — B

3 a. Solve $\frac{dx}{dt} - 7x + y = 0$, $\frac{dy}{dt} - 5y = 0$. (06 Marks)

b. Solve $x \frac{dy}{dx} + 4x \frac{dy}{dx} = e^x$. (07 Marks)

c. Solve $y = 2px + p$ by solving for x. (07 Marks)

4 a. Solve $(1 + 4x^2) \frac{d^2 y}{dx^2} + (1 + x) \frac{dy}{dx} + y = 2 \sin(\log(1 + x))$. (06 Marks)

b. Solve $\frac{dy}{dx} - \frac{y}{x} = \frac{x^2 - y^2}{y}$ by solving for P. (07 Marks)

c. Solve $(px - y)(py + x) = a^2 p$ by reducing to Clairaut's form. (07 Marks)

PART — C

5 a. From the function $f(x^2 + y^2, z - xy) = 0$ form the partial differential equation. (06 Marks)

b. Derive one dimensional wave equation as $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$. (07 Marks)

c. Evaluate $\int_0^1 \int_{x^2}^{2-x} xy dy dx$ by changing the order of integration. (07 Marks)

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- 6 a. Solve $\frac{\partial^2 u}{\partial x^2} = \sin x \sin y$ for which $\frac{\partial u}{\partial y} = -2 \sin y$ when $x = 0$ and $u = 0$ when y is an odd multiple of $\frac{\pi}{2}$. (06 Marks)

- b. Derive one dimensional heat equation as $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. (07 Marks)

- c. Evaluate $\int_{-1}^1 \int_0^1 \int_{x-z}^1 (x+y+z) dy dx dz$ (07 Marks)

PART —D

- 7 a. Find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ using double integral. (06 Marks)

- b. Evaluate $\int_0^{\pi/2} \frac{dx}{\sin x}$ using beta and gamma functions. (07 Marks)

- c. Express the vector $Zi - 2xj + yk$ in cylindrical coordinates. (07 Marks)

- 8 a. Find the volume of the solid bounded by the planes $x = 0$, $y = 0$, $x + y + z = 1$ and $z = 0$ using triple integral. (06 Marks)

- b. Evaluate $\int_0^{\pi/2} \frac{dx}{\sin x}$ using beta and gamma functions. (07 Marks)

- c. Express the vector field $2xi - zj$ in spherical polar coordinate system. (07 Marks)

PART —E

- a. Find the Laplace transform of $e^{-t} \sin 3t$ and $e^{-at} - e^{-bt}$. (06 Marks)

- b. Express $f(t)$ in terms of unit step function and find its Laplace transform given that $f(t) = \begin{cases} t^2, & 0 \leq t < 2 \\ 4t, & 2 \leq t < 4 \\ 0, & t > 4 \end{cases}$. (07 Marks)

- c. Find $\mathcal{L}^{-1} \left\{ \frac{1}{(s^2 + 1)^2} \right\}$ using convolution theorem. (07 Marks)

- 10-k. a. A periodic function $f(t)$ with period 2 is defined by $f(t) = \begin{cases} t, & 0 \leq t < 1 \\ 2 - t, & 1 \leq t < 2 \end{cases}$ find $\mathcal{L}\{f(t)\}$. (06 Marks)

- b. Find $\mathcal{L}^{-1} \left\{ \frac{5s-2}{3s^2+4s+8} \right\}$. (07 Marks)

- c. Solve using Laplace transform method $\frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} + y = te$ with $y(0) = 1$, $y'(0) = -2$. (07 Marks)