

## CBCS Scheme

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15MAT21

Second Semester B.E. Degree Examination, June/July 2017

## Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Solve :  $\frac{d^2y}{dx^2} - 4y = \cosh(2x-1) + 3^x$ . (05 Marks)
- b. Solve :  $(D^2 - 4D + 3)y = e^{2x} \cdot \cos 3x$ . (05 Marks)
- c. Apply the method of undetermined coefficients to solve  $y'' - 3y' + 2y = x^2 + e^x$ . (06 Marks)

OR

- 2 a. Solve :  $(D^4 - 1)y = 0$ . (05 Marks)
- b. Solve :  $(D^2 - 4D + 4)y = 8(e^{2x} + \sin 2x)$ . (05 Marks)
- c. By the method of variation of parameters solve  $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ . (06 Marks)

Module-2

- 3 a. Solve :  $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$ . (05 Marks)
- b. Solve :  $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$ . (05 Marks)
- c. Solve  $(px - y)(py + x) = 2p$  by reducing it into the Clairaut's form by taking the substitution  $X = x^2$ ,  $Y = y^2$ . (06 Marks)

OR

- 4 a. Solve :  $(1 + x^2)y'' + (1 + x)y' + y = \sin \{ \log(1 + x)^2 \}$ . (05 Marks)
- b. Obtain the general solution and the singular solution of the equation  $p^2 + 4x^5p - 12x^4y = 0$ . (05 Marks)
- c. Show that the equation  $xp^2 + px - py + 1 - y = 0$  is a Clairaut's equation. Hence obtain the general solution and the singular solution. (06 Marks)

Module-3

- 5 a. Form a partial differential equation by eliminating  $\phi$  and  $\psi$  from the relation  $z = x\phi(y) + y\psi(x)$ . (05 Marks)
- b. Solve  $\frac{\partial^2 z}{\partial x^2} - a^2 z = 0$  under the conditions  $z = 0$  when  $x = 0$  and  $\frac{\partial z}{\partial x} = a \sin y$  when  $x = 0$ . (05 Marks)
- c. Derive an expression for the one dimensional heat equation. (06 Marks)

OR

- 6 a. Form a partial differential equation by eliminating  $\phi$  from  $\phi(x + y + z, xy + z^2) = 0$ . (05 Marks)
- b. Solve  $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$  given that  $\frac{\partial z}{\partial y} = -2 \sin y$ , when  $x = 0$  and  $z = 0$  when  $y$  is an odd multiple of  $\frac{\pi}{2}$ . (05 Marks)

- c. Use the method of separation of variables to solve the wave equation  $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$ . (06 Marks)

**Module-4**

- 7 a. By changing the order of integration, evaluate  $\int_0^a \int_y^a \frac{xdxdy}{x^2 + y^2}$ . (05 Marks)
- b. Evaluate  $\int_{-c}^c \int_{-b}^b \int_{-a}^a (x^2 + y^2 + z^2) dx dy dz$ . (05 Marks)
- c. Prove that  $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$  using definition of  $\Gamma(n)$ . (06 Marks)

**OR**

- 8 a. Evaluate  $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$  by changing into polar coordinates. (05 Marks)
- b. Evaluate  $\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} \frac{dz dy dx}{\sqrt{a^2-x^2-y^2-z^2}}$ . (05 Marks)
- c. Show that  $\int_0^{\frac{\pi}{2}} \sqrt{\sin \theta} d\theta \cdot \int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin \theta}} = \pi$ . (06 Marks)

**Module-5**

- 9 a. Find the Laplace transform of,  $2^t + \frac{\cos 2t - \cos 3t}{t} + t \sin t$ . (05 Marks)
- b. A periodic function of period  $2a$  is defined by,  $f(t) = \begin{cases} E & \text{for } 0 \leq t \leq a \\ -E & \text{for } a < t \leq 2a \end{cases}$  where  $E$  is a constant. Show that  $L\{f(t)\} = \frac{E}{S} \text{Tanh}\left(\frac{aS}{2}\right)$ . (05 Marks)
- c. Find  $L^{-1}\left\{\log\left[\frac{s^2+1}{s(s+1)}\right]\right\}$ . (06 Marks)

**OR**

- 10 a. Express  $f(t) = \begin{cases} \sin t, & 0 < t \leq \frac{\pi}{2} \\ \cos t, & t > \frac{\pi}{2} \end{cases}$  in terms of unit step function and hence find its laplace transform. (05 Marks)
- b. By using the convolution theorem find  $L^{-1}\left\{\frac{1}{(s^2+a^2)^2}\right\}$ . (05 Marks)
- c. By using Laplace transforms, solve  $\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^{2t}$ ,  $x(0) = 0$ ,  $\frac{dx}{dt}(0) = -1$ . (06 Marks)

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