

# CBCS Scheme

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15MAT21

## Second Semester B.E. Degree Examination, Dec.2016/Jan.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  $(D-2)^2 y = 8(e^{2x} + x + x^2)$  by inverse differential operator method. (06 Marks)
- b. Solve  $(D^2 - 4D + 3)y = e^x \cos 2x$ , by inverse differential operator method. (05 Marks)
- c. Solve by the method of variation of parameters  $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$ . (05 Marks)

**OR**

- 2 a. Solve  $(D^2 - 1)y = x \sin 3x$  by inverse differential operator method. (06 Marks)
- b. Solve  $(D^3 - 6D^2 + 11D - 6)y = e^{2x}$  by inverse differential operator method. (05 Marks)
- c. Solve  $(D^2 + 2D + 4)y = 2x^2 + 3e^{-x}$  by the method of undetermined coefficient. (05 Marks)

### Module-2

- 3 a. Solve  $x^3 y''' + 3x^2 y'' + xy' + 8y = 65 \cos(\log x)$ . (06 Marks)
- b. Solve  $xy p^2 + p(3x^2 - 2y^2) - 6xy = 0$ . (05 Marks)
- c. Solve the equation  $y^2(y - xp) = x^4 p^2$  by reducing into Clairaut's form, taking the substitution  $x = \frac{1}{x}$  and  $y = \frac{1}{y}$ . (05 Marks)

**OR**

- 4 a. Solve  $(2x + 3)^2 y'' - (2x + 3)y' - 12y = 6x$ . (06 Marks)
- b. Solve  $p^2 + 4x^5 p - 12x^4 y = 0$ . (05 Marks)
- c. Solve  $p^3 - 4xy p + 8y^2 = 0$ . (05 Marks)

### Module-3

- 5 a. Obtain the partial differential equation by eliminating the arbitrary function.  $Z = f(x + at) + g(x - at)$ . (06 Marks)
- b. Solve  $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$ , for which  $\frac{\partial z}{\partial y} = -2 \sin y$ , when  $x = 0$  and  $z = 0$ , when  $y$  is an odd multiple of  $\pi/2$ . (05 Marks)
- c. Find the solution of the wave equation  $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$  by the method of separation of variables. (05 Marks)

**OR**

- 6 a. Obtain the partial differential equation by eliminating the arbitrary function  $\ell x + my + nz = \phi(x^2 + y^2 + z^2)$ . (06 Marks)
- b. Solve  $\frac{\partial^2 z}{\partial y^2} = z$ , given that, when  $y = 0$ ,  $z = e^x$  and  $\frac{\partial z}{\partial y} = e^{-x}$ . (05 Marks)

- c. Derive one dimensional heat equation  $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ . (05 Marks)

**Module-4**

- 7 a. Evaluate  $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x+y+z) dy dx dz$ . (06 Marks)
- b. Evaluate  $\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} xy dy dx$  by changing the order of integration. (05 Marks)
- c. Evaluate  $\int_0^4 x^{3/2} (4-x)^{5/2} dx$  by using Beta and Gamma function. (05 Marks)

**OR**

- 8 a. Evaluate  $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$  by changing to polar co-ordinates. Hence show that  $\int_0^\infty e^{-x^2} dx = \sqrt{\pi}/2$ . (06 Marks)
- b. Find by double integration, the area lying inside the circle  $r = a \sin \theta$  and outside the cardioid  $r = a(1 - \cos \theta)$ . (05 Marks)
- c. Obtain the relation between beta and gamma function in the form  $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ . (05 Marks)

**Module-5**

- 9 a. Find i)  $L\{e^{-3t}(2 \cos 5t - 3 \sin 5t)\}$  ii)  $L\left\{\frac{\cos at - \cos bt}{t}\right\}$ . (06 Marks)
- b. If a periodic function of period  $2a$  is defined by  $f(t) = \begin{cases} t & \text{if } 0 \leq t \leq a \\ 2a - t & \text{if } a \leq t \leq 2a \end{cases}$  then show that  $L\{f(t)\} = \frac{1}{s^2} \tan h\left(\frac{as}{2}\right)$ . (05 Marks)
- c. Solve the equation by Laplace transform method.  $y''' + 2y'' - y' - 2y = 0$ . Given  $y(0) = y'(0) = 0, y''(0) = 6$ . (05 Marks)

**OR**

- 10 a. Find  $L^{-1}\left\{\frac{s+3}{s^2-4s+13}\right\}$ . (06 Marks)
- b. Find  $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$  by using Convolution theorem. (05 Marks)
- c. Express  $f(t) = \begin{cases} \sin t, & 0 \leq t < \pi \\ \sin 2t, & \pi \leq t < 2\pi \\ \sin 3t, & t \geq 2\pi \end{cases}$  in terms of unit step function and hence find its Laplace transforms. (05 Marks)

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