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14MAT21

**Second Semester B.E. Degree Examination, Dec.2016/Jan.2017**  
**Engineering Mathematics – II**

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting ONE full question from each module.**

Module – 1

- 1 a. Solve  $\frac{d^4y}{dx^4} + 5\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} - 4\frac{dy}{dx} - 8y = 0$ . (06 Marks)
- b. Solve  $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{-x} + \sin 2x$ . (07 Marks)
- c. Solve by the method of undetermined coefficient,  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 4y = 2x^2 + 3e^{-x}$ . (07 Marks)
- 2 a. Solve  $4\frac{d^4y}{dx^4} - 8\frac{d^3y}{dx^3} - 7\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = 0$  (06 Marks)
- b. Solve  $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 1 + 3x + x^2$ . (07 Marks)
- c. Solve by the method of variation of parameter  $y'' + a^2y = \sec ax$ . (07 Marks)

Module – 2

- 3 a. Solve  $x^2\frac{d^2y}{dx^2} + 5x\frac{dy}{dx} + 13y = \log x + x^2$ . (06 Marks)
- b. Solve  $x^2p^2 + 3xyp + 2y^2 = 0$ . (07 Marks)
- c. Find the general and singular solution of,  $(x^2 - 1)p^2 - 2xyp + y^2 - 1 = 0$ . (07 Marks)
- 4 a. Solve the system of equations,  
 $\frac{dx}{dt} = 3x - 4y, \frac{dy}{dt} = x - y$ . (06 Marks)
- b. Solve  $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin \log(1+x)$ . (07 Marks)
- c. Solve  $y = 2px - yp^2$  (07 Marks)

Module – 3

- 5 a. Form a partial differential equation by eliminating arbitrary function,  
 $f(x + y + z, x^2 + y^2 + z^2) = 0$  (06 Marks)
- b. Derive one dimensional wave equation. (07 Marks)
- c. Evaluate  $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y dx dy$ . (07 Marks)
- 6 a. Form a P.D.E by eliminating arbitrary constants,  
 $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$  (06 Marks)
- b. Evaluate  $\int_0^4 \int_0^{2\sqrt{z}} \int_0^{\sqrt{4z-x^2}} dy dx dz$ . (07 Marks)

- c. Solve one dimensional heat equation by separation of variables. Given  $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ . (07 Marks)

**Module – 4**

- 7 a. For  $m > 0, n > 0$  show that  $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ . (06 Marks)

b. Prove that  $\int_0^1 \frac{x^2}{\sqrt{1-x^4}} dx \cdot \int_0^1 \frac{1}{\sqrt{1+x^4}} dx = \frac{\pi}{4\sqrt{2}}$ . (07 Marks)

- c. Prove that cylindrical co-ordinate system is orthogonal. (07 Marks)

- 8 a. Find the volume of the sphere,  $x^2 + y^2 + z^2 = a^2$  using triple integral. (06 Marks)

- b. For  $m$  and  $n$  positive prove that,

$$\beta(m, n) = \int_0^1 \frac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}} dx. \quad (07 \text{ Marks})$$

- c. Express the vector  $\vec{f} = 2y\hat{i} - z\hat{j} + 3x\hat{k}$  in cylindrical co-ordinates. (07 Marks)

**Module – 5**

- 9 a. Find the Laplace transform of, (i)  $e^{3t^4}$  (ii)  $\sin t \sin 2t \sin 3t$  (06 Marks)

- b. A periodic function of period  $\frac{2\pi}{W}$  is defined by,

$$f(t) = \begin{cases} E \sin \omega t & \text{for } 0 \leq t \leq \frac{\pi}{W} \\ 0 & \text{for } \frac{\pi}{W} \leq t \leq \frac{2\pi}{W} \end{cases} \quad \text{where } E \text{ and } W \text{ are positive constants. Show that}$$

$$L\{f(t)\} = \frac{EW}{(s^2 + w^2) \left(1 - e^{-\frac{\pi s}{W}}\right)}. \quad (07 \text{ Marks})$$

- c. Find the inverse Laplace transform,  $\frac{1}{s(s+1)(s+2)}$ . (07 Marks)

- 10 a. Find  $L\left(\frac{\cos 2t - \cos 3t}{t}\right)$ . (06 Marks)

b. Express  $f(t) = \begin{cases} t^2 & 1 < t \leq 2 \\ 4t & t > 2 \end{cases}$

in terms of unit step function and hence find  $L[f(t)]$ . (07 Marks)

- c. Solve using Laplace transform method,  $y'' + 2y' - 3y = \sin t, y(0) = y'(0) = 0$  (07 Marks)

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