ACHARYA INSTITUTE OF TECHNOLOGY
Bangalore - 560090

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14MAT21

Second Semester B.E. Degree Examination, June/July 2017
Engineering Mathematics – II

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least ONE question from each part.***

Module-1

1 a. Solve $(D^2 + 4D + 5)y = -2\cosh x$. **(06 Marks)**

b. Solve $\dfrac{d^4y}{dx^4} + m^4y = 0$. **(07 Marks)**

c. Solve, by using method of variation of parameters, $y'' + 4y = \text{Tan } 2x$. **(07 Marks)**

2 a. Solve $y''' - 6y'' + 11y - 6y = 1 + x + \sin x$. **(06 Marks)**

b. Solve, by using method of undermined coefficients, $y'' - 3y' + 2y = 4x^2$. **(07 Marks)**

c. Solve, by using method of variation of parameters, $(D^2 + 2D + 1) = e^{-x}\log x$. **(07 Marks)**

Module-2

3 a. Solve, $x^3y''' + 2x^2y'' + 2y = 10\left(x + \frac{1}{x}\right)$. **(06 Marks)**

b. Solve, $x^2p^2 + xy\,p - 6y^2 = 0$ for p. **(07 Marks)**

c. Solve, $(px - y)(py + x) = 2p$ by substituting $X = x^2$, $Y = y^2$ and also find its singular solution. **(07 Marks)**

4 a. Solve $(2x + 3)^2y'' - 2(2x + 3)y' - 12y = 6x$. **(06 Marks)**

b. Solve $y = 2px + y^2p^3$. **(07 Marks)**

c. Solve the following simultaneous linear equations :
$(D + 4)x + 3y = t$ and $2x + (D + 5)y = e^t$. **(07 Marks)**

Module-3

5 a. Form a partial differential equation by eliminating arbitrary function, f from the relation :
$z = f\left(\frac{xy}{z}\right)$. **(06 Marks)**

b. Change the order of integration in $I = \int_{y=0}^{a}\int_{x=y}^{a} \frac{x}{x^2 + y^2}\,dxdy$ and hence evaluate the same. **(07 Marks)**

c. Solve the one dimensional wave equation $\dfrac{\partial^2 y}{\partial t^2} = a^2\dfrac{\partial^2 y}{\partial x^2}$ by variable separable method. **(07 Marks)**

6 a. Solve $\frac{\partial^2 z}{\partial y^2} = z$, given that $z = e^x$, $\frac{\partial z}{\partial y} = e^{-x}$ at $y = 0$. **(06 Marks)**

b. Change into polar co-ordinates and evaluate : $I = \int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dydx$. **(07 Marks)**

c. Evaluate : $I = \int_{x=1}^{3} \int_{y=\frac{1}{x}}^{1} \int_{z=0}^{\sqrt{x}} xyz\, dzdydx$. **(07 Marks)**

Module-4

7 a. By using double integral, find the area bounded by the co-ordinate axes and the line $x + y = 2$. **(06 Marks)**

b. State and prove the relation between Beta and Gamma functions. **(07 Marks)**

c. Find the spherical polar co-ordinate system defined by $x = r \sin\theta \cos\phi$, $y = r \sin\theta \sin\phi$, $z = r\cos\theta$ and also prove that spherical polar co-ordinate system is orthogonal. **(07 Marks)**

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

b. Evaluate : $\int_0^a x^4 \sqrt{a^2 - x^2}\, dx$ by using Beta and Gamma functions. **(07 Marks)**

c. Derive expression for div $\overline{A}$ in orthogonal curvilinear coordinates. **(07 Marks)**

Module-5

9 a. Find : $L(e^{-t} \sin 6t + t \cos 3t)$. **(06 Marks)**

b. Find : $L^{-1}\left\{\frac{s-1}{s(s^2 - 2s + 5)}\right\}$. **(07 Marks)**

c. Solve, by using Laplace transforms, $y''' + 2y'' - y' - 2y = 0$, where $y = 1$, $\frac{dy}{dt} = 2 = \frac{d^2y}{dt^2}$ at $t = 0$. **(07 Marks)**

10 a. Evaluate : $\int_0^\infty te^{-3t} \cos 2t\; dt$, by using Laplace transforms. **(06 Marks)**

b. If $f(t) = \begin{cases} E \sin \omega t, & 0 < t < \frac{\pi}{\omega} \\ 0, & \frac{\pi}{\omega} < t < \frac{2\pi}{\omega} \end{cases}$ is periodic function then find $L(f(t))$. **(07 Marks)**

c. Find: $L^{-1}\left(\frac{s}{(s-1)(s^2+4)}\right)$ using convolution theorem. **(07 Marks)**

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