USN | | | | | | | | | | 14MAT21

Second Semester B.E. Degree Examination, June/July 2018
Engineering Mathematics – II

Time: 3 hrs. Max. Marks:100

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

Module – 1

1 a. Solve: $\frac{d^2y}{dt^2} - 4\frac{dy}{dt} + 13y = e^{3t}\cosh 2t + 2^t$. **(06 Marks)**

b. Solve : $y'' - 4y' + 4y = 8\cos 2x$. **(07 Marks)**

c. Solve : $y'' + 4y = x^2 + e^{-x}$ by the method of undetermined coefficients. **(07 Marks)**

OR

2 a. Solve : $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. **(06 Marks)**

b. Solve : $y'' + 4y' - 12y = e^{2x} - 3\sin 2x$. **(07 Marks)**

c. Solve by the method of variation of parameters $y'' + 2y' + 2y = e^{-x}\sec^3 x$. **(07 Marks)**

Module – 2

3 a. Solve : $\frac{dx}{dt} + 2y = -\sin t$, $\frac{dy}{dt} - 2x = \cos t$. **(06 Marks)**

b. Solve : $x^4\frac{d^3y}{dx^3} + 2x^3\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} + xy = \sin(\log x)$. **(07 Marks)**

c. Solve : $xy\left(\frac{dy}{dx}\right)^2 - (x^2 + y^2)\frac{dy}{dx} + xy = 0$, using solvable for P. **(07 Marks)**

OR

4 a. Solve : $\frac{dy}{dx} + y = z + e^x$, $\frac{dz}{dx} + z = y + e^x$. **(06 Marks)**

b. Solve : $(3x+2)^2 y'' + 3(3x+2)y' - 36y = 8x^2 + 4x + 1$. **(07 Marks)**

c. Show that the equation, $xp^2 + px - py + 1 - y = 0$ is Clairaut's equation. Hence obtain the general and singular solution. **(07 Marks)**

Module – 3

5 a. Form the partial differential equation by eliminating the arbitrary function in $\phi(x + y + z,\ x^2 + y^2 - z^2) = 0$ **(06 Marks)**

b. Derive one dimensional wave equation in the form, $\frac{\partial^2 u}{\partial t^2} = C^2\frac{\partial^2 u}{\partial x^2}$. **(07 Marks)**

c. Evaluate : $\int_0^1\int_0^{\sqrt{1-x^2}}\int_0^{\sqrt{1-x^2-y^2}} xyz\,dz\,dy\,dx$. **(07 Marks)**

OR

6 a. Solve $\frac{\partial^2 u}{\partial x \partial t} = e^{-t}\cos x$ given that $u = 0$ when $t = 0$ and $\frac{\partial u}{\partial t} = 0$ at $x = 0$. Also show that $u \to \sin x$ as $t \to \infty$. **(06 Marks)**

b. Derive one dimensional heat equation in the form, $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$. **(07 Marks)**

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

Module – 4

7 a. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by double integration. **(06 Marks)**

b. Show that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(07 Marks)**

c. Express the vector $\vec{A} = z\hat{i} - 2x\hat{j} + y\hat{k}$ in cylindrical coordinates. **(07 Marks)**

OR

8 a. Find the volume generated by the revolution of the cardioide $r = a(1+\cos\theta)$ about the initial line. **(06 Marks)**

b. Show that $\int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}} \times \int_0^{\pi/2} \sqrt{\sin\theta}\, d\theta = \pi$ **(07 Marks)**

c. Show that spherical polar coordinate system is orthogonal. **(07 Marks)**

Module – 5

9 a. Find the Laplace transform of $2^t + \frac{\cos 2t - \cos 3t}{t} + t\sin t$. **(06 Marks)**

b. If $f(t) = \begin{cases} t, & 0 \le t \le a \\ 2a - t, & a \le t \le 2a, \end{cases}$ $f(t+2a) = f(t)$

then (i) Sketch the graph of f(t) as a periodic function.

(ii) Show that $L\{f(t)\} = \frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$ **(07 Marks)**

c. Solve $y''' + 2y'' - y' - 2y = 0$ given $y(0) = y'(0) = 0$ and $y''(0) = 6$ by using Laplace transform method. **(07 Marks)**

OR

10 a. Find the Laplace transform of $t^2 e^{-3t} \sin 2t$. **(06 Marks)**

b. Express the following function interms of Heaviside unit step function and hence find its Laplace transform:

$$f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \cos 2t, & \pi < t < 2\pi \\ \cos 3t, & t > 2\pi \end{cases}$$ **(07 Marks)**

c. Using convolution theorem obtain the inverse Laplace transform of:

$\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}$. **(07 Marks)**

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