14MAT21

USN

Second Semester B.E. Degree Examination, Dec.2017/Jan.2018
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 initial value problem $\frac{d^2x}{dt^2}+4\frac{dx}{dt}+29x=0$ given $x(0)=0$, $\frac{dx}{dt}(0)=15$. **(06 Marks)**

b. Solve the differential equation,
$\frac{d^2y}{dx^2}-6\frac{dy}{dx}+25y=e^{2x}+\sin x+x$. **(07 Marks)**

c. Solve $y''-4y'+3y=20\cos x$ using method of undetermined coefficients. **(07 Marks)**

2 a. Solve $(D^2+4)y=x^2+\cos 2x+2^{-x}$. **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2}+y=\sec x$ by using the method of variation of parameters. **(07 Marks)**

c. Solve $(D^2-1)y=(1+x^2)e^x$. **(07 Marks)**

Module – 2

3 a. Solve simultaneous differential equations,
$\frac{dx}{dt}+5x-2y=t$; $\frac{dy}{dt}+2x+y=0$. **(06 Marks)**

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

c. Solve $p^2+p(x+y)+xy=0$. **(07 Marks)**

4 a. Solve $y+px=x^4p^2$. **(06 Marks)**

b. Obtain the solution of differential equation, $(1+x)^2\frac{d^2y}{dx^2}+(1+x)\frac{dy}{dx}+y=2\sin(\log(1+x))$. **(07 Marks)**

c. Solve $y=xp+\sqrt{4+p^2}$ for general and singular solutions. **(07 Marks)**

Module – 3

5 a. Form the partial differential equation by eliminating arbitrary functions,
$xyz=f(x^2+y^2+z^2)$ **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2}=a^2z$ given that if $x=0$, $\frac{\partial z}{\partial x}=a\sin y$ and $\frac{\partial z}{\partial y}=0$. **(07 Marks)**

c. Evaluate by changing the order of integration $\int_0^a\int_0^{2\sqrt{ax}}x^2\,dy\,dx$. **(07 Marks)**

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

6 a. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dz\,dy\,dx$. (06 Marks)

b. Solve PDE by direct integration method. $\frac{\partial^2 z}{\partial x \partial t} = e^{-t}\cos x$ given $z = 0$ when $t = 0$ and $\frac{\partial z}{\partial t} = 0$ when $x = 0$. (07 Marks)

c. Obtain solution of one dimensional wave equation, $\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$ by the method of separation of variables. (07 Marks)

Module – 4

7 a. Find the area between parabolas $y^2 = 4ax$ and $x^2 = 4ay$. (06 Marks)

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

c. Prove that cylindrical coordinates system is orthogonal. (07 Marks)

8 a. Evaluate $\int_0^1 x^6 (1 - x^2)^{\frac{1}{2}} dx$. (06 Marks)

b. Express the vector $zi - 2xj + yk$ in cylindrical co-ordinates. (07 Marks)

c. Find the volume bounded by the surface $z^2 = a^2 - x^2$ and the planes x = 0, y = 0, z = 0 and y = b. (07 Marks)

Module – 5

9 a. Find Laplace transform of,

(i) $te^{-t}\sin(4t)$ (ii) $\frac{\cos at - \cos bt}{t}$. (06 Marks)

b. Find inverse Laplace transform of $\frac{5s+3}{(s-1)(s^2+2s+5)}$. (07 Marks)

c. Express the function, $f(t) = \begin{cases} \pi - t & 0 < t < \pi \\ \sin t & t > \pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. (07 Marks)

10 a. Find inverse Laplace transform of the following using convolution theorem $L^{-1}\left[\frac{s}{(s-1)(s^2+4)}\right]$. (06 Marks)

b. Given $f(t) = \begin{cases} E & 0 < t < \frac{a}{2} \\ -E & \frac{a}{2} < t < a \end{cases}$ where f(t+a) = f(t). Show that $L\{f(t)\} = \frac{E}{S}\tanh\left(\frac{aS}{2}\right)$. (07 Marks)

c. Using Laplace transform method, solve $\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 9y = 12t^2 e^{-3t}$. (07 Marks)

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