ACHARYA INSTITUTE OF TECHNOLOGY
Bangalore - 560090

USN | | | | | | | | | | | 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.***

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.

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 $\int_0^1\int_0^{\sqrt{1-y^2}} x^3y\,dxdy$. **(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 $\int_0^4\int_0^{2\sqrt{z}}\int_0^{\sqrt{4z-x^2}} dydxdz$. **(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,

$\beta(m,n) = \int_0^1 \frac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}} dx$. **(07 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) $e^{3t}t^4$ (ii) $\sin t \sin 2t \sin 3t$ **(06 Marks)**

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

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

$L\{f(t)\} = \frac{EW}{(s^2 + w^2)\left(1 - e^{\frac{-\pi s}{W}}\right)}$. **(07 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 $f(t) = \begin{cases} t^2 & 1 < t \le 2 \\ 4t & t > 2 \end{cases}$

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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