B.Tech Sem – IV (2007 Course) (Mechanical Engg.)/ (Producation Engg.) : WINTER - 2018

SUBJECT: ENGINEERING MATHEMATICS-III

Day : Tuesday Date : 13/11/2018	**W-2018-2768**	Time : 02.30 PM TO 05.30 PM Max. Marks: 80

N. B. :

1) **Q. No.1** and **Q. No.5** are **COMPULSORY.** Out of remaining questions attempt **ANY TWO** questions from each section.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the sections should be written in the **SEPARATE** answer books.
4) Use of non-programmable **CALCULATOR** is allowed.
5) Assume suitable data, if necessary.

SECTION-I

Q.1 a) Solve: $\frac{dx}{y+z}=\frac{dy}{-(x+z)}=\frac{dz}{x-y}$. **(04)**

b) An emf Esinpt is applied at t=0 to a circuit containing condenser C and inductance L in series. The current x satisfies the equation $L\frac{dx}{dt}+\frac{1}{C}\int xdt = E\sin pt$,where $x=-\frac{dq}{dt}$.If $p^2=\frac{1}{LC}$ and initially the current x and charge q are zero, find the current. **(05)**

c) Obtain Laplace Transform of: $f(t)=\begin{cases}0, & 0<t<2\pi, \\ \sin t, & t>2\pi\end{cases}$ **(05)**

Q.2 Solve **ANY THREE** of the following: **(13)**

a) $(D^2+a^2)y=\sec ax$ (by method of variation of parameters).

b) $(D^2-1)y=\frac{2}{1+e^x}$.

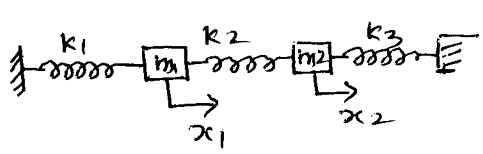
c) $(D^3-2D+4)y=3x^2-5x+2$.

d) $(x^2D^2+xD+1)y=\cos(\log x)+x\sin(\log x)$.

e) $(D^2-4)y=x\sinh 2x$.

Q.3 a) A tightly stretched string with fixed end points x=0 and x=l is initially in position given by $y(x,0)=y_0\sin^3(\frac{\pi x}{l})$.If it is released from the rest, find the displacement y at any distance x from one end at any time. **(06)**

b) For the system in figure, if $m_1=1, m_2=3, k_1=1, k_2=3, k_3=3$ assuming that there is no frinction, find the natural frequencies of the system and corresponding normal modes of vibrations, using matrix method. **(07)**



P.T.O.

Q.4 a) Find Fourier transform of: $f(x) = e^{-\frac{x^2}{2}}$ **(07)**

b) Find inverse Laplace transform of: **(06)**

i) $\tan^{-1}(\frac{1}{s})$.

ii) $\frac{s^2}{(s+1)^2}$.

SECTION-II

Q.5 a) A problem on mathematics is given to the three students A, B and C, whose chances of solving are $\frac{1}{2}, \frac{3}{4} \& \frac{1}{4}$ respectively. What is the probability that the problem will be solved? **(04)**

b) Find the directional derivative of $\phi = e^{2x} \cos yz$ at (0,0,0) in the direction of tangent to the curve $x = a\sin t, y = a\cos t, z = at$ at $t = \frac{\pi}{4}$. **(05)**

c) Evaluate: $\oint_C (\cos y\,\hat{i} + x(1-\sin y)\,\hat{j}).d\bar{r}$ for a closed curve which is given by $x^2 + y^2 = 1, z = 0$. **(05)**

Q.6 a) Find the lines of regression for the following data: **(08)**

x	10	14	19	26	30	34	39
y	12	16	18	26	29	35	38

And estimate y for x=14.5 and x for y=29.5

b) In certain examination test, 2000 students appeared in a subject of statistics. Average marks obtained were 50% with standard deviation 5%.How many students are expected to obtain more than 60% of marks, supposing that marks are distributed normally? (Given: z=2, A=0.4772). **(05)**

Q.7 a) Show that the vector field given by $\bar{F} = (y^2 \cos x + xz^2)\hat{i} + 2y\sin x\,\hat{j} + 2xz\,\hat{k}$ is conservative and find scalar ϕ such that $\bar{F} = \nabla\phi$ **(05)**

b) Prove that: **(08)**

i) $\nabla^4(\log r) = \frac{4}{r^4}$

ii) $\nabla \cdot [r\nabla(\frac{1}{r^n})] = \frac{n(n-2)}{r^{n+1}}$

Q.8 a) Evaluate: $\iint_S \nabla \times \bar{F} \cdot d\bar{s}$ for $\bar{F} = (x^2 + y - 4)\hat{i} + 3xy\,\hat{j} + (2xz + z^2)\hat{k}$ and S is the surface of paraboloid $z = 4 - (x^2 + y^2)$ above the plane z=0. **(06)**

b) For $\bar{F} = x^2\hat{i} + xy\hat{j}$, where C is the boundary of the rectangle x=0, y=0,x=a ,y=b, verify Stokes theorem. **(07)**

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