B.TECH SEM – IV (2007 COURSE) (CIVIL ENGG.) :
WINTER - 2017
SUBJECT: ENGINEERING MATHEMATICS-III

Day: Monday **Time:** 02.30 PM TO 05.30 PM
Date: 20/11/2017 **W-2017-2400** **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) Answers to both the sections should be written in the **SEPARATE** answer book.
3) Draw neat and labeled diagram **WHEREVER** necessary.
4) Figures to the right indicate **FULL** marks.
5) Assume suitable data if necessary.

SECTION-I

Q.1 **a)** $Solve: \frac{dx}{3z-4y} = \frac{dy}{4x-2z} = \frac{dz}{2y-3x}$ **(04)**

b) Solve the following system of equations by LU-decomposition. **(05)**

$2x+3y+z=9$

$x+2y+3z=6$

$3x+y+2z=8$

c) Solve by method of variation of parameters: **(05)**

$(D^2-1)y = e^{-x}\sin(e^{-x}) + \cos(e^{-x})$

Q.2 Solve **(ANY THREE):** **(13)**

a) $(D^2+1)y = \sin x . \sin 2x$

b) $(D^4+2D^2+1)y = x^2 \cos x$

c) $(D^2-2D+1)y = xe^x \sin x$

d) $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 4y = \cos(\log x) + x\sin(\log x)$

e) $(3x+2)^2\frac{d^2y}{dx^2} + 3(3x+2)\frac{dy}{dx} - 36y = 3x^2+4x+1$

Q.3 **a)** A horizontal strut of length l is clamped horizontally at one end and carries a vertical load W at the other end. If the horizontal thrust be P, prove the deflection at the free end is $\frac{W}{nP}(tan\, nl - nl), where\, n^2 = P/EI$ **(07)**

b) The initial temperature distribution of a rod of length 1 meter, whose ends are maintained at 0^0C, is given as follows: **(06)**

$$u(x,0) = \begin{cases} 0, & 0 \le x \le \frac{1}{2} \\ (1-x), & \frac{1}{2} \le x \le 1 \end{cases}$$

Find the temperature distribution u(x, t) if the equation satisfied is $\frac{\partial u}{\partial t} = a^2\frac{\partial^2 u}{\partial x^2}$

P.T.O.

Q.4 a) Using Runge - kutta method of fourth order, to $solve \frac{dy}{dx}=\frac{1}{x+y}, x_0=0, y_0=1$ to find y at x = 0.4, taking h = 0.2. **(07)**

b) Solve the following system of equations by Gauss Seidel method. **(06)**

$10x_1 - 5x_2 - 2x_3 = 3$

$4x_1 - 10x_2 + 3x_3 = -3$

$x_1 + 6x_2 + 10x_3 = -3$

SECTION-II

Q.5 a) A problem in statistics is given to three students A, B, C whose chances of solving it are $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ respectively, what is the probability that the problem can be solved? **(05)**

b) For the curve x = cost + t sint, y = sint- t cost, find the tangential and normal components of acceleration at any time t. **(05)**

c) Find the work done in moving particle once round the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1, z=0$ under the field of force given by $\overline{F}=(2x-y+z)\hat{i}+(x+y-z^2)\hat{j}+(3x-2y+4z)\hat{k}$. Is the field conservative? **(04)**

Q.6 a) Calculate the coefficient of correlation between the marks obtained by 8 students in Maths and stats, from the following table. **(05)**

Student	A	B	C	D	E	F	G	H
Maths	25	30	32	35	37	40	42	45
Stats	8	10	15	17	20	22	24	25

b) Out of 2000 families with 4 children each, how many would you expect to have **(04)**

i) At least a boy ii) Two boys iii) No girls

c) Find the probability that at most 5 defective fuses will be found in a box of 200 fuses if 2% of such fuses are defective. **(04)**

Q.7 a) Find the directional derivative of $\phi = e^{2x}\cos yz$ at (0,0,0) in the direction of the tangent to the curve x = a sint, y = a cost, z = at $at\, t=\frac{\pi}{4}$ **(05)**

b) Show that (**ANY TWO**): **(08)**

i) $\nabla\left(\frac{\overline{a}.\overline{r}}{r^n}\right)=\frac{\overline{a}}{r^n}-\frac{n(\overline{a}.\overline{r})}{r^{n+2}}\overline{r}$

ii) $\nabla^2[\nabla.(\overline{r}/r^2)]=2/r^4$

iii) $\nabla^2 f(r)=\frac{d^2 f}{dr^2}+\frac{2}{r}\frac{df}{dr}$

Q.8 a) Verify stokes theorem for $\overline{F}=(y-z+2)\hat{i}+(yz+4)\hat{j}-xz\hat{k}$ over the surface of a cube $x=0, y=0, z=0, x=2, z=2$ above the XOY plane (open at bottom). **(07)**

b) Evaluate $\iint_s 2x^2y\,dydz - y^2dzdx + 4xz^2\,dxdy$ over the curved surface of the cylinder $y^2+z^2=9, bounded\ by\ x=0\ and\ x=2$. **(06)**

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