B.TECH SEM – IV (2007 COURSE) (CIVIL ENGG.) : SUMMER - 2018

SUBJECT: ENGINEERING MATHEMATICS-III

Day : **Saturday**
Date : **02/06/2018**

S-2018-2605

Time : **10.00 AM TO 01.00 PM**
Max. Marks: 80

N. B. :

1) **Q. No. 1** and **Q. No.5** are **COMPULSORY**. Out of the remaining attempt **ANY TWO** questions form section – **I** and Section – **II**.
2) Figures to the right indicate **FULL** marks.
3) Answers to both the section should be written in **SEPARATE** answer books.
4) Assume suitable data, if necessary.

SECTION-I

Q.1 **a)** Solve by method of variation of parameters: **(05)**
$\left(D^2+a^2\right)y=\tan ax$

b) Solve: $\dfrac{dx}{x^2+y^2}=\dfrac{dy}{2xy}=\dfrac{dz}{(x+y)^3 z^2}$ **(05)**

c) Solve by Gauss Elimination method: **(04)**
$2x+y+z=10$
$3x+2y+3z=18$
$x+4y+9z=16$

Q.2 Solve **Any Three** of the following: **(13)**

i) $\left(D^2-D-6\right)y=e^x\cosh 2x$

ii) $\left(D^2-2D+5\right)y=x^2$

iii) $\left(D^2+D+1\right)y=x\sin x$

iv) $x^3\dfrac{d^2y}{dx^2}+3x^2\dfrac{dy}{dx}+xy=\sin(\log x)$

v) $(1+x)^2\dfrac{d^2y}{dx^2}+(1+x)\dfrac{dy}{dx}+y=4\cos\left(\log(1+x)\right)$

Q.3 **a)** The differential equation satisfied by a beam uniformly loaded with one end fixed and the second subjected to a tensile force P is given by **(07)**

$EI\dfrac{d^2y}{dx^2}=Py-\dfrac{1}{2}Wx^2$

Show that the elastic curve for the beam under conditions $y=0,\ \dfrac{dy}{dx}=0$ at $x=0$ is given by $y=\dfrac{W}{Pn^2}(1-\cosh nx)+\dfrac{Wx^2}{2P}$, where $n^2=\dfrac{P}{EI}$

b) The equation for the conduction of heat along a bar of length l is $\dfrac{\partial\theta}{\partial t}=k\dfrac{\partial^2\theta}{\partial x^2}$, neglecting radiation. Find an expression for θ if the ends of the bar are maintained at zero temperature and if initially the temperature is T at the centre of the bar and falls uniformly to zero at its ends. **(06)**

P.T.O.

Q.4 **a)** Use fourth order Runge Kutta method to find y at $x = 0.1$ given that **(06)**
$\frac{dy}{dx} = 3e^x + 2y,\ \ y(0) = 0$ and $h = 0.1$

b) Solve by Jacobi's iteration method, the equations **(07)**
$20x + y - 2z = 17$
$3x + 20y - z = -18$
$2x - 3y + 20z = 25$

SECTION - II

Q.5 **a)** Two cards are drawn from a well shuffled pack of 52 cards. Find the probability that they are both kings, if **(05)**
i) the first card drawn is replaced.
ii) the first card drawn is not replaced.

b) For the curve $x = t^3 + 1,\ y = t^2,\ z = t,$ find the magnitude of tangential and normal components of acceleration for a particle moving on the curve at $t = 1$. **(05)**

c) Find the work done in moving a particle from $(0, 1, -1)$ *to* $\left(\frac{\pi}{2}, -1, 2\right)$ in a force field $\overline{F} = \left(y^2 \cos x + z^3\right)\hat{i} + \left(2y \sin x - 4\right)\hat{j} + \left(3xz^2 + 2\right)\hat{k}$. Is the field conservative? **(04)**

Q.6 **a)** Calculate the lines of regressions for following data: **(08)**

x:	40	70	50	60	80	50	90	40	60	60
y:	2.5	6.0	4.5	5.0	4.5	2.0	5.5	3.0	4.5	3.0

& estimate y for $x = 55$ *and* x *for* $y = 3.5$.

b) An unbiased coin is thrown 10 times. Find the probability of getting exactly 6 heads, at least 6 heads. **(05)**

Q.7 **a)** For a solenoidal vector field $\overline{E}$, show that **(05)**
$curl\,curl\,curl\,curl\,\overline{E} = \nabla^4 \overline{E}$

b) Prove that: **(08)**
i) $\nabla^2\left[\nabla \cdot \left(\frac{\overline{r}}{r^2}\right)\right] = \frac{2}{r^4}$
ii) $\nabla \times \left(\frac{\overline{a} \times \overline{r}}{r^3}\right) = -\frac{\overline{a}}{r^3} + \frac{3(\overline{a}.\overline{r})}{r^5}\overline{r}$

Q.8 **a)** Evaluate the surface integral $\iint_s \overline{r}.\overline{n}\,ds,\ \overline{r} = x\hat{i} + y\hat{j} + z\hat{k}$ over the part of the spherical surface S of the sphere $x^2 + y^2 + z^2 = a^2$ that lies within the vertical cylinder $x^2 + y^2 = ax$ **(06)**

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

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