Total No. of Questions – [08]

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G.R. No.	

Paper Code - U218-111 (BE-FS)

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S. Y. B. TECH. (CIVIL ENGINEERING) (SEMESTER - II)

COURSE NAME: Engineering Mathematics III

COURSE CODE:CVUA21171

(PATTERN 2017)

Time: [**2 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data whereever required**

Q.1 A

Solve by variation of parameters $(D^2 + 4)y = \sec 2x$ [6]

OR

B

Solve $x^3 \frac{d^2y}{dx^2} + 3x^2 \frac{dy}{dx} + xy = \sin(\log x)$ [6]

Q.2 A Solve the following system of equations by Gauss-Seidel method:

$10x_1+x_2+x_3=12$

$2x_1+10x_2+x_3=13$

$2x_1+2x_2+10x_3=14$ [6]

OR

B

Using fourth order Runge-Kutta method ,solve $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ for x=0.2 correct to four decimal places .Initial conditions are x=0 , y=1 , $\frac{dy}{dx}=0$ [6]

Q.3 A Calculate the first four moments about the mean of the given distribution . Also find β_1 and β_2.

x	2.0	2.5	3.0	3.5	4.0	4.5	5.0
f	5	38	65	92	70	40	10

[6]

OR

B Find the regression line for the following data :

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

And estimate y for x=14.5 and x for y=29.5. [6]

Q.4 A Prove that $\frac{\bar{a}\times\bar{r}}{r^n}$ is solenoidal [4]

OR

B Show that $\overline{F} = (ye^{xy}\cos z)\bar{i} + (xe^{xy}\cos z)\bar{j} - (e^{xy}\sin z)\bar{k}$ is irrotational .Find the scalar φ such that $\nabla\varphi = \overline{F}$ [4]

Q.5 A Verify Greens theorem for $\overline{F} = x^2\bar{i} + xy\bar{j}$ over the over the region R enclosed by $y=x^2$ and the line y=x . [6]

B Prove that $\iint_S (\varphi\nabla\psi - \psi\nabla\varphi)\bullet ds = \iiint_V (\varphi\nabla^2\psi - \psi\nabla^2\varphi)dv$ [4]

C Evaluate

$\iint_S (\nabla x\overline{F})\bullet \overline{ds}$ for $\overline{F} = y\bar{i} + z\bar{j} + x\bar{k}.$ where s is the surface of the paraboloid $z = 1 - x^2 - y^2$, $z \geq 0$ [4]

OR

Q.6 A Find the work done in moving a particle once round the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$

Z=0 under the field of force [6]

$\overline{F} = (2x - y + z)\bar{i} + (x + y - z^2)\bar{j} + (3x - 2y + 4z)\bar{k}$ is the field is conservative.

B Evaluate $\iint_S (x^3\bar{i} + y^3\bar{j} + z^3\bar{k})\bullet \overline{ds}$ where S is the surface of the sphere $x^2+y^2+z^2=16$. [4]

C Evaluate : $\iint_S \left(\nabla \times \overline{F}\right)\bullet \overline{ds}$, where $\overline{F} = (x^3 - y^3)\bar{i} - xyz\bar{j} + y^3\bar{k}$

and S is the surface $x^2+4y^2+z^2-2x=4$ above the plane x=0 [4]

Q.7 A Solve $\frac{\partial v}{\partial t} = k\frac{\partial^2 v}{\partial x^2}$ if i) $v \neq \infty$ as $t \to \infty$, ii) $\left(\frac{\partial v}{\partial t}\right)_{x=0} = 0$ for all t [6]

iii) v(L,t)=0 for all t. iv) $v(x,0)=v_0$.

B A string is stretched and fastened to two points L apart .Motion is started by displaying the string in the form $u = a\sin\frac{\pi x}{L}$ from which it is released at t=0. Write the conditions in mathematical form. [4]

c In above question 7) B) find the displacement u(x,t) from one end [4]

OR

Q.8 A

Solve the equation $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$ with conditions

i) $v=0$ when $y \to \infty$
ii) $v=0$ when $x=0$ and for all y
iii) $v=0$ when $x=1$ and for all y
$v=x(1-x)$ when $y=0$ and for $0 < x < 1$ [6]

B

The equation for conduction of heat along a bar of length L is $\frac{\partial \theta}{\partial t} = k\frac{\partial^2 \theta}{\partial x^2}$

neglecting radiation . If the ends of the bar are maintained at zero temperature and if initially the temperature is T at the center of the bar and falls uniformly to zero at its ends. Write the conditions in mathematical form. [4]

C In above question 8)B) Find an expression for temperature θ [4]