BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - IV CIVIL :SUMMER- 2022
SUBJECT : ENGINEERING MATHEMATICS - III

Day : Tuesday
Date : 14-06-2022

S-12677-2022

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable calculator is allowed.

Q.1 Solve : $(D^4+2D^2+1)y = x^2\cos x$. **(10)**

OR

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

Q.2 A cantilever beam of length l and weighing ω *lb/unit* is subjected to a horizontal compressive force p applied at the free end. Taking the origin at the free end and y-axis upwards, establish differential equation of the beam and hence find the maximum deflection. **(10)**

OR

Solve the differential equation $\frac{\partial u}{\partial t} = \alpha^2\frac{\partial^2 u}{\partial x^2}$ for the conduction of heat along a rod without radiation, subject to the following conditions:

i) u is not infinite for t $\to \infty$.

ii) $\frac{\partial u}{\partial x} = 0$ for $x = 0$ and $x = l$.

iii) $u = lx - x^2$ for $t = 0$, between $x = 0$ and $x = l$.

Q.3 Solve by Gauss Seidel iteration method. **(10)**

$10x - 2y - z - t = 3$
$-2x + 10y - z - t = 15$
$-x - y + 10z - 2t = 27$
$-x - y - 2z + 10t = -9$

OR

Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$ with $y(0) = 1$ at $x = 0.2, 0.4$.

Q.4 The following are scores of two batsmen A and B in a series of inning: **(10)**

A :	12	115	6	73	7	19	119	36	84	29
B :	47	12	16	42	4	51	37	48	13	0

Who is the better score getter and who is more consistent?

P.T.O.

OR

Three urns contains 6 red, 4 black; 4 red, 6 black and 5 red, 5 black balls respectively. One of the urns is selected at random and a ball is drawn from it. If the ball drawn is white, find the probability that it is drawn from the first urn.

Q.5 Find the directional derivative of $\phi = xy^2 + yz^2$ at the point (1, -1, 1) : **(10)**

i) along the vector $\hat{i} + 2\hat{j} + 2\hat{k}$

ii) towards the point (2, 1, -1)

iii) along the direction normal to the surface $x^2 + y^2 + z^2 = 9$ at (1,2,2).

OR

Show that **i)** $\nabla^2 f(r) = \frac{d^2 f}{dr^2} + \frac{2}{r}\frac{df}{dr}$.

ii) $\nabla^4 e^r = e^r + \frac{4}{r} e^r$.

Q.6 Find the work done is moving particle form (0, 1, -1) to $\left(\frac{\pi}{2}, -1, 2\right)$ in a force field $F = (y^2 \cos x + z^3)\hat{i} + (2y\sin x - 4)\hat{j} + (3xz^2 + 2)\hat{k}$. Is the field conservative? **(10)**

OR

Verify the divergence theorem for $\overline{F} = (x + y^2)\hat{i} - 2x\hat{j} + 2yz\hat{k}$ and the volume of a tetrahedron bounded by co-ordinate planes and the plane $2x + y + 2z = 6$.

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