BACHELOR OF TECHNOLOGY (C.B.C.S.) (2021-COURSE)
B. Tech. Sem - II Electronic & Communication : WINTER- 2022
SUBJECT : INTEGRAL TRANSFORMS & VECTOR CALCULUS

Day : Thursday — Time : 10:00 AM-01:00 PM

Date : 24-11-2022 — **W-24088-2022** — 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.
4) Assume suitable data if necessary.

Q.1 Solve : $\sin x \dfrac{dy}{dx} + 2y = \tan^3 \dfrac{x}{2}$. **[10]**

OR

Q.1 Solve : $x^2 y\,dx - \left(x^3 + y^3\right)dy = 0$. **[10]**

Q.2 The equation of electromotive force in terms of current i for an electrical circuit having resistance R and a condenser C, in series, is $E = Ri + \int \frac{i}{c}\,dt$. Find the current i at any time t, when $E = E_0 \sin wt$.

OR

Q.2 If the temperature of the body drops from 100^0C to 60^0C in one minute, when the temperature of surrounding is 20^0C, what will be the temperature of the body at the end of second minute? **[10]**

Q.3 Solve by method of variation of parameters: **[10]**

$$\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$$

OR

Q.3 Solve : $(2x+1)^2 \dfrac{d^2y}{dx^2} - 2(2x+1)\dfrac{dy}{dx} - 12y = 6x$. **[10]**

Q.4 Find Fourier sine transform of $\dfrac{e^{-ax}}{x}$ and hence evaluate $\displaystyle\int_0^\infty \tan^{-1}\frac{x}{a}\sin x\,dx$. **[10]**

OR

Q.4 Find Z– transform of : $f(k) = 4^k + 5^k \;(k \ge 0)$. **[10]**

Q.5 Find Laplace transform of: $\dfrac{d}{dt}\left(\dfrac{\sin t}{t}\right)$. **[10]**

OR

Q.5 Obtain inverse Laplace transform of: $\dfrac{s+1}{\left(s^2+2s+2\right)^2}$. **[10]**

Q.6 Find the directional derivative of :
$\phi = 4xz^3 - 3x^2y^2z$ at $(2,-1,2)$

a) in the direction $2\hat{i} - 3\hat{j} + 6\hat{k}$.

b) towards the point $\hat{i} + \hat{j} - \hat{k}$.

c) along the tangent to the curve $x = e^t\cos t,\ y = e^t\sin t,\ z = e^t$ at $t = 0$.

OR

Q.6 Verify Gauss divergence theorem for **[10]**
$\overline{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$ and S, the surface of cube bounded by planes $x=0,\ x=2,\ y=0,\ y=2,\ z=0,\ z=2$.

* * * *