B.Tech. SEM -IV (Chemical) 2014 Course (CBCS) : SUMMER - 2019

SUBJECT: ENGINEERING MATHEMATICS-III

Day: Thursday
Date: 23/05/2019

Time: 10.00 AM TO 01.00 PM
Max. Marks: 60

S-2019-2591

N.B:

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use non programmable **CALCULATOR** allowed.
4) Assume suitable data if necessary.

Q.1 **a)** Solve: $\frac{d^2y}{dx^2}-7\frac{dy}{dx}+6y=e^{4x}$. **(05)**

b) Solve: $\frac{dx}{2x}=\frac{dy}{-y}=\frac{dz}{4xy^2-2z}$. **(05)**

OR

a) Solve: $\left(D^2-2D+2\right)y=e^x\tan x$ by the method of variation of parameters. **(05)**

b) Solve: $u=r\frac{d}{dr}\left[r\frac{du}{dr}\right]+ar^3$. **(05)**

Q.2 A string is stretched and fastened to two points L apart. Motion is started by displacing the string in the form $u=a\ \sin\frac{\pi x}{L}$ from which it is released at time $t=0$. Find the displacement $u(x,t)$ from one end. **(10)**

OR

A rectangular plate with insulated surface is 10 cm wide and so long to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature of the short edge $y=0$ is given by, **(10)**

$$u=\begin{cases}20x, & 0\le x\le 5\\ 0, & 5\le x\le 10\end{cases}$$

and the two long edges $x=0, x=10$ as well as the other short edge are kept at 0^0C, then find the steady state temperature distribution at any point (x, y) .

Q.3 **a)** Using Fourier integral representation, show that **(05)**

$$\int_0^\infty \frac{\lambda^3\sin\lambda x}{\lambda^4+4}d\lambda=\frac{\pi}{2}e^{-x}\cos x,\ where\ x>0$$

b) Find the Fourier cosine transform of **(05)**

$$f(x)=\begin{cases}1, & 0\le x\le 1\\ 0, & x>1\end{cases}$$

OR

Find the Fourier cosine transform of $f(x)=\frac{1}{1+x^2}$. **(10)**

P.T.O.

Q.4 **a)** Evaluate by using Laplace transform $\int_0^\infty e^{3t}\frac{\sinh t}{t}dt$. **(05)**

b) Using partial fractions, find the inverse Laplace transform of $\frac{1}{(s+2)(s^2+2s+2)}$. **(05)**

OR

a) Solve the following differential equation by using Laplace transform. **(05)**
$y''+y=t,\ \ y(0)=1,\ \ y'(0)=-2.$.

b) Use the convolution theorem to find inverse Laplace transform of the function $\frac{1}{s(s^2+a^2)}$. **(05)**

Q.5 **a)** For the curve $x=\cos t+t\sin t, \mathrm{y}=\sin t-t\cos t$, find the tangential and normal components of acceleration at any time t. **(05)**

b) Find directional derivative of $\phi=x^2yz+4xz^2$ at the point (1, -2, -1) in the direction of vector $2\vec{i}-\vec{j}-2\vec{k}$. **(05)**

OR

a) Prove that $\vec{F}=(2xy+z^3)\vec{i}+x^2\vec{j}+3xz^2\vec{k}$ is irrotational force field. Hence find corresponding scalar potential. **(05)**

b) Show that $\nabla^2\left[\frac{\overline{a}.\overline{b}}{r}\right]=0$. **(05)**

Q.6 Verify Green's Lemma in the plane for $\oint_C (3x^2-8y^2)dx+(4y-6xy)\,dy$ where C is the boundary defined $x=0,\ y=0,\ x+y=1$. **(05)**

OR

Verify Divergence theorem for $\overline{F}=4xz\,\vec{i}-y^2\vec{j}+yz\,\vec{k}$ and S, the surface of the cube bounded by the planes $x=0, x=2, y=0,\ y=2, z=0, z=2$. **(10)**

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