UNIT – IV

8. (a) Solve : $(D^4 + 2D^2 + 1)y = x^2 \cos x$.

(b) Solve :

$$(3x+2)^2 \frac{d^2y}{dx^2} + (8x+6)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1$$

9. (a) Show that the frequency of free vibrations in a closed electrical circuit with inductance L and capacity C in series is $\frac{30}{\pi\sqrt{LC}}$ per minute.

(b) Solve : $\frac{d^2y}{dx^2} - y = e^{-x}\sin(e^{-x}) + \cos(e^{-x})$, by the method of variation of parameters.

Roll No. .....

3034

B. Tech. 3rd Semester (CSE) Examination – February, 2022

MATHEMATICS - III (Multivariable Calculus and Differential Equations)

Paper : BSC-MATH-203-G

Time : Three Hours] *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. 1 is ***compulsory***. All questions carry equal marks.

1. (a) If $f(x,y) = \frac{x-y}{x+y}, x \neq 0, y \neq 0,$ show that $\lim_{(x,y)\to(0,0)} f(x,y)$ does not exist.

(b) Show that $f(x,y) = \begin{cases} xy\frac{(x^2-y^2)}{(x^2+y^2)}; & (x,y) \neq (0,0) \\ 0; & \text{otherwise} \end{cases}$ is continuous at (0, 0).

(c) Evaluate the integral $\int_0^{\pi}\int_0^{\sin y} 3\,dx\,dy$.

(d) Solve $(6x^2y+4y^3)dy+(3x^2+6xy^2)dx=0$

(e) Find integrating factor for $(xy^3+y)dx+2(x^2y^2+x+y^4)dy=0$

(f) Solve $(D^2-4D+1)y=0$ where $D=\frac{d}{dt}$.

UNIT – I

2. (a) If $u=3(lx+my+nz)^2-(x^2+y^2+z^2)$ and $l^2+m^2+n^2=1$ prove that $\frac{\partial^2u}{\partial x^2}+\frac{\partial^2u}{\partial y^2}+\frac{\partial^2u}{\partial z^2}=0$.

(b) Evaluate $x^2\frac{\partial^2u}{\partial x^2}+2xy\frac{\partial^2u}{\partial x\,\partial y}+y^2\frac{\partial^2u}{\partial y^2}=?$,

where $u=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$.

3. (a) Examine for maxima and minima of $f(x,y)=xy(a-x-y)$.

(b) Find the maximum and minimum distance of the point (3, 4, 12) from $x^2+y^2+z^2=1$ using Lagrange's method of multipliers.

UNIT – II

4. (a) Solve $\int_0^{4a}\int_{x^2/4a}^{2\sqrt{ax}} dy\,dx$ by changing the order of integration.

(b) Evaluate the integral $\iint_R y\,dx\,dy$, where R is region bounded by $y^2=4x$ and $x^2=4y$.

5. (a) Evaluate :

$$\int_0^1\int_0^{\sqrt{1-x^2}}\int_0^{\sqrt{1-x^2-y^2}}\frac{1}{\sqrt{1-x^2-y^2-z^2}}\,dz\,dy\,dx$$

(b) Find the smaller of the areas bounded by the ellipse $4x^2+9y^2=36$ and the straight line $2x+3y=6$.

UNIT – III

6. (a) Solve :

$(xy^2\sin xy+y\cos xy)dx+(x^2y\sin xy-x\cos xy)dy=0$

(b) Solve : $(2x^3+4xy^3)dy+(x^2y+y^4)dx=0$

7. (a) Solve : $(xy^2-e^{1/x^3})dx-x^2y\,dy=0$

(b) Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$, where λ is a parameter.