*R20 Regulation* *Subject code:* 3B2AA

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

# B.Tech II Semester Regular Examinations, September 2021

## ORDINARY DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

*(Common to CE,CSE, IT, CSE(AI&ML) & CSE(DS))*

*Maximum Marks: 70* Date:09.09.2021 Duration: 3 hours

**Note: 1.This question paper contains two parts A and B.**
**2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.**
**3. Part B consists of 5 Units. Answer any one full question from each unit.**
**4. Each question carries 10 marks and may have a, b, c, d as sub questions.**

## Part-A

**All the following questions carry equal marks** **(10x2M=20 Marks)**

1 Find integrating factor $\frac{dy}{dx} + 2xy = e^{-x^2}$

2 State the Newton's Law of cooling

3 Solve $(D^3 - 4D^2)y = 0$

4 Solve $\frac{1}{D^2}x^4$

5 Solve $x^2y'' - 2xy' + 2y = 0$

6 Define Simultaneous differential equation of first order

7 Find magnitude of the gradient function $f(x, y, z) = xyz^3$at the point (1, 0, 2)

8 Show that the vector$(-x^2 + yz)\bar{i} + (4y - z^2x)\bar{j} + (2xz - 4z)\bar{k}$ is solenoidal

9 Define line and surface integrals

10 State Stokes theorem

## Part-B

Answer All the following questions. **(10M X 5=50Marks)**

11 a) Solve $x\frac{dy}{dx} + 2xy = 10x^3$ (5M)

b) A body is originally 80°$C$at and cools down to 60°$C$in 20 minutes. If the temperature of the air is 40°$C$, find the temperature of the body after 40 minutes. (5M)

OR

12 a) Solve $\frac{dy}{dx} + \frac{y}{x} = y^2x\sin x$ (5M)

b) If 30% of radioactive substance disappeared in 10 days, how long it will take for 90% of it to disappear? (5M)

13 a) Solve $(D^2 - 2D + 2)y = \sin x + e^{2x}$ (5M)

b) Find PI of $(D^2 + 5D + 6)y = 1 + 2x + x^2$ (5M)

OR

14 a) Solve $(D^2 - 1)y = e^x\cos 2x$ (5M)

b) Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ by using method of variations of parameters. (5M)

15 Solve $(x+a)^2\frac{d^2y}{dx^2}-4(x+a)\frac{dy}{dx}+6y=x$ (10M)

OR

16 Solve $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+4y=x^2\, sinlog\, x$ (10M)

17 a) If $\bar{v}=2xy\bar{i}-(2y^2-x^2)\bar{j}$Find curl of $\bar{v}$ (5M)
b) Find directional derivative of $\varphi=x^4+y^4+z^4$ at the point A (1, -2, 1) in the direction of AB where $B is (2,6,-1)$ (5M)

OR

18 a) Find the equation of tangent plane and normal line to the surface $x^2+y^2+z^2=30$at the point (1, -2, 5) (5M)
b) Find the scalar potential function of an irrotational field $x\bar{i}+y\bar{j}+z\bar{k}$ (5M)

19 Verify the Stokes theorem for the function integrated around the square bin the plane$z=0$ whose sides are along the lines $x=0, x=a, y=0, y=a$ (10M)

OR

20 Verify the divergence theorem for $(x^2-yz)\bar{i}+(y^2-zx)\bar{j}+(z^2-xy)\bar{k}$ taken over the rectangular parallelepiped $0\le x\le a, 0\le y\le b, 0\le z\le c$ (10M)