R20 Regulation *Subject code: 3B2AI*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech II Semester Supplementary Examinations, September 2023

DIFFERENTIAL EQUATIONS &VECTOR CALCULUS

(ME)

Maximum Marks: 70 Date:14.09.2023 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 State Newton's law of cooling.

2 Check whether the D.E. is exact or not $(y^2 - x^2)dx + 2xydy = 0$.

3 Solve $(D^2+D+1)Y=0$

4 Solve $(D^3+3D^2+3D+1)Y = e^x$.

5 Form the PDE from $z = a + b(x+y)$

6 Form the PDE by eliminating the arbitrary functions from $z = f(x^2+y^2)$

7 Define curl of a vector point function

8 Find a unit normal vector to the given surface $x^2y + 2xz = 4$ at the point (2,-2,3).

9 State stoke's theorem.

10 State Greens theorem in a plane.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 An object whose temperature is 75^0c cools in an atmosphere of constant temperature 25^0c at the rate $k\theta$,θ being the excess temperature of the body over the temperature, if after 10 minutes the temperature of the object falls to 65^0c,find its temperature after 20 minutes, find the time required to cool down to 55^0c. [10]

OR

12 A Bacterial culture growing exponentially, increases from 100 to 400 grams in 10 hours. How much was present after 3 hours. [10]

13 $\text{Solve}(D^3 + 2D^2 + D)y = e^{2x} + \sin 2x$ [10]

OR

14 $Solve(D^2 + 2D - 3)y = x^2e^{-3x}$ [10]

15 Form a PDE by eliminating the arbitrary functions $z = f(x) + e^{y} g(x)$ [10]

OR

16 Solve $p \tan x + q \tan y = \tan z$ [10]

17 Prove that the vector $(x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational and find its scalar potential. [10]

OR

18 Find the angle between the surface $xy^2z = 3x + z^2$ and $3x^2 - y^2 + 2z = 1$ at $(1,-2,1)$ [10]

19

Use Greens theorem for $\int_c (3x^2 - 8y^2)dx + (4y - 6xy)\ dy$ where 'c' is the region bounded by x=0, y=0, and x+y=1.

OR

20 Verify Green's Theorem for $\int_c [(xy + y^2)\ dx + x^2\ dy]$, where c is bounded by $y = x$ and $y = x^2$ [10]