Regulation R20 *Subject code: 3B2AI*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech II Semester Supplementary Examinations, January 2024

DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

(Mechanical Engineering)

Maximum Marks: 70 Date:19.01.2024 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. Each question carries 10 marks in PartB and may have a, b, c, d as sub questions.

Part-A

	All the following questions carry equal marks (10x2M=20 Marks)	CO	Bloom Tx
1	Define Linear differential equation.	CO1	L1
2	Check whether the differential equation $(x^2 + 2xy)\,dx + (y^2 + x^2)\,dy=0$ is exact or not.	CO1	L3
3	Solve $(D^2 + 9)\,y = 0$.	CO2	L3
4	Solve the P.I of $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{2x}$	CO2	L3
5	Solve p q=1	CO3	L3
6	Solve $z = p\,x + q\,y + p\,q$	CO3	L3
7	Define irrotational vector	CO4	L3
8	If $\bar{f}= (x+3y)\,\bar{\imath} + (y-2z)\,\bar{\jmath} + (x+pz)\,\bar{k}$ is solenoidal then find P.	CO4	L1
9	Evaluate $\int_c \bar{F}.d\bar{r}$ where $\bar{F} = x^2\bar{\imath} + y^2\bar{\jmath}$ and C is the curve $y = x^2$ in the xy - plane from (0,0) to (1,1)	CO5	L5
10	What is the Statement of Stokes theorem	CO5	L1

Part-B

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

11	A. Write the working rule of orthogonal trajectories in cartesian co-ordinates. B. Find the Orthogonal Trajectories of the family of curves $x^2 + y^2 = a^2$ [5+5]	CO1	L3
	OR		
12	In a chemical reaction a given substance is being converted into another at a rate proportional to the amount of substance unconverted. If (1/5)th of the original amount has been transformed in 4 minutes, how much time will be required to transform one half. [10]	CO1	L3
13	Solve by the method of variation of parameter $(D^2 - 2D)y = e^x \sin x$ [10]	CO2	L3
	OR		

14	Solve$(D^3 + 2D^2 + D)y = e^{2x} + x^2 + x + \sin 2x$ [10]	CO2	L3
15	Form a PDE by eliminating the arbitrary functions $z = f(x) + e^y g(x)$ Solve $p \tan x + q \tan y = \tan z$ [10]	CO3	L3
	OR		
16	Solve (i) $p^2 + q^2 = n\,p\,q$ (ii)$p - x^2 = q + y^2$ [5+5]	CO3	L3
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]	CO4	L3
	OR		
18	Find the directional derivative of the function $xy^2 + yz^2 + zx^2$ *along the tangent to the curve* $x = t, y = t^2, z = t^3$ at the point (1,1,1). [10]	CO4	L3
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. [10]	CO5	L3
	OR		
20	Verify stokes theorem for $F = y^2\,i + y\,j - 3\,x\,k$ and S is the upper half of the sphere $x^2 + y^2 + z^2 = a^2$ and $z \geq 0$. [10]	CO5	L4