R20 Regulation *Subject code:3B2AI*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech II Semester Supplementary Examinations, July 2025

DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

(ME)

Maximum Marks: 70 Date:09.07.2025 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)		Marks	CO	BTL
1	Define exact differential equation.	2M	1	L1
2	Write the statement of Newton's law of cooling	2M	1	L1
3	Solve $(D^3+3D^2+3D+1)y = 0$	2M	2	L1
4	Find the P.I. of $(D^2 + 9)y = cos3x$	2M	2	L1
5	Form the PDE from $z = a + b(x+y)$	2M	3	L1
6	Form the PDE by eliminating the arbitrary functions from $z = f(x^2+y^2)$	2M	3	L1
7	Find a unit normal vector to the given surface $x^2y + 2xz = 4$ at the point (2,-2,3).	2M	4	L1
8	If $\bar{f} = (x+3y)\,\bar{\imath} + (y-2z)\,\bar{\jmath} + (x+pz)\,\bar{k}$ is solenoidal then find P	2M	4	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)	2M	5	L1
10	What is the Statement of Stokes theorem	2M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
11	a) Write the working rule of orthogonal trajectories in cartesian co-ordinates b) Find the Orthogonal Trajectories of the family of curves $x^2 + y^2 = a^2$	5M 5M	1	L2
	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.	10M	1	L2
13	Solve by the method of variation of parameter $(D^2 - 2D)y = e^x sinx$	10M	2	L2
	OR			
14	Solve $(D^2 - 4D + 3)y = sin3xcos2x.$	10M	2	L2
15	a) Form the PDE by eliminating the arbitrary constants $z = ax^3+by^3$ b) Solve the PDE $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$	5M 5M	3	L2
	OR			

16	Solve (i) $p^2 + pq = z^2$ (ii) $p - q = x^2 + y^2$	5M 5M	3	L2
17	Prove that the vector $(x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational and find its scalar potential.	10M	4	L2
	OR			
18	a) Find the values of a and b so that the surface $ax^2 - byz = (a+2)x$ will be orthogonal to the surface $4x^2y + z^2 = 4$ at the point (-1,1,2) b)Prove that curl $(\bar{a} \, X \, \bar{b}) = \bar{a}$ div $\bar{b} - \bar{b}$ div $\bar{a} + (\bar{b}.\nabla)\,\bar{a}$ - $(\bar{a}.\nabla)\,\bar{b}$	5M 5M	4	L2
19	Evaluate (i) $\int_v \nabla.\bar{F}dv$ and (ii) $\int_v (\nabla \times \bar{F})dv$ where 'v' is the closed region bounded by x=0, y=0, z=0, 2x+2y+z=4 if $\bar{F} = (2x^2 - 3z)i - 2xyj - 4xk$	10M	5	L2
	OR			
20	Verify greens theorem in the plane for $\int_c (x^2 - xy^3)\,dx + (y^2$-2xy) dy where c is a square with vertices (0,0) ,(2,0) ,(2,2) ,(0,2)	10M	5	L2