R20 Regulation *Subject code:3B2AI*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B. Tech II Semester Supplementary Examinations, January 2026

DIFFERENTIAL EQUATIONS & VECTOR CALCULUS
(ME)

Maximum Marks: 70 Date: 08.01.2026 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 10 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	Solve the P.I of $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{2x}$	2M	2	L1
5	Solve p q=1	2M	3	L1
6	Solve $z = p\,x + q\,y + p\,q$	2M	3	L1
7	Find the greatest value of the directional derivative of the function $f = x^2 y z^3$ at (2,1,-1)	2M	4	L1
8	Find ∇A at (2,-1,2) if $A = 3xyz^2\bar{\imath} + 2xy^3 - x^2yz\,\bar{k}$	2M	4	L1
9	If $\bar{F} = (4xy - 3x^2z^2)\bar{\imath} + 2x^2\bar{\jmath} - 2x^3z\bar{k}$, then find grad f	2M	5	L1
10	If $\bar{F} = xy\bar{\imath} - z\bar{\jmath} + x^2\bar{k}$ and c is the curve $x = t^2, y = 2t, z = t^3$ from $t = 0$ to $t = 1$, evaluate $\int_C F.dr$	2M	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
11	Solve $2\frac{dy}{dx} - y\sec x = y^3 \tan x$	10M	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 $(D^2 - 2D)y = e^x \sin x$	10M	2	L2
	OR			

14	Solve $D^2(D^2+4)y = 96x^2 + sin2x$	10M	2	L2
15	Find the general solution of (i) p x + q y = z (ii) y^2 z p + x^2 z q = y^2 x	5M 5M	3	L2
	OR			
16	Solve (i) $p^2 + q^2$ = n p q (ii)p – x^2 = q + 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) Prove that if $\bar{r}$ is the position vector of any point in space, then $r^n.\bar{r}$is irrotational b) Find the angle between the surface xy^2z = 3x+z^2 and $3x^2 - y^2 + 2z = 1$ at (1,-2,1)	5M 5M	4	L2
19	If $\bar{F} = 4xz\bar{\imath} - y^2\bar{\jmath} + yz\bar{k}$, evaluate $\int \bar{F}.\bar{n}\ ds$ where S is the surface of the cube bounded by $x = 0, x = a, y = 0, y = a, z = 0, z = a$	10M	5	L2
	OR			
20	Verify Green's Theorem for $\int_c [(xy + y^2)\ dx + x^2\ dy]$, where c is bounded by $y = x$ and $y = x^2$	10M	5	L2