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KAMALA INSTITUTE OF TECHNOLOGY & SCIENCE, SINGAPUR

23MA28BS102

I.B. Tech. II Supplementary Examinations, Jan./Feb.-2025
ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(COMMON TO ALL BRANCHES)

Time: 3 Hours

Max.Marks:60

Note: Question paper consists of Part-A & Part-B.

i) **Part-A** for 10M, ii) **Part-B** for 50marks

- Part A** is compulsory, consists of 10 sub questions from all units carrying equal marks.
- Part-B** consists of **10 questions** (numbered from 2 to 11) carrying **10marks** each. From each unit there are 2 questions and the students should answer one of them. Hence the student should answer **5 questions** from **Part-B**.

PART-A		(10Marks)	
Q.No	Questions	Marks	BTL
1.a)	Discuss whether the differential equation $(2x-y+1)dx + (2y-x-1)dy = 0$ is exact or not.	1	1
1.b)	State law of natural growth.	1	1
1.c)	Solve $y''-y'-2y = 0$	1	2
1.d)	Find Particular Integral of $(D^2 - 4D + 13)y = e^{2x}$	1	1
1.e)	Prove that $L[t] = \frac{1}{s^2}$	1	3
1.f)	Find the inverse Laplace transform for $1/(s+1)^2$	1	2
1.g)	If $\vec{f} = (x + 3y)\vec{i} + (y - 2z)\vec{j} + (x + \lambda z)\vec{k}$ is solenoidal, find the value of λ	1	2
1.h)	Write the formulas of Curl, Div, Gradient.	1	1
1.i)	State stokes theorem.	1	1
1.j)	Evaluate the line integral of the vector field $\vec{F} = x\vec{i} + y\vec{j}$ along the straight line segment from (0,0) to (1,1)	1	5
PART-B		(50Marks)	
Q.No.	Questions	Marks	BTL
2. a)	If the air is maintained at 20°C and the temperature of the body cools from 100°C to 80°C in 10 minutes, find the temperature of the body after 20 minutes and when the temperature will be 40°C	5M	1
b)	Solve $(3xy^2 - y^3)dx - (2x^2y - xy^2)dy = 0$	5M	3
OR			
3. a)	Prove that system of parabolas $y^2 = 4a(x+a)$ is self-orthogonal	5M	5
b)	Solve $\frac{dy}{dx} + y \cos x = y^3 \sin 2x$	5M	3
4. a)	Solve $(D^2 - 4D + 4)y = x^2 \sin x + e^{2x}$.	5M	3
b)	Using the method of variation of parameters solve $y'' + 4y = \tan 2x$	5M	3

OR			
5. a)	Solve the differential equation $(D^2 + 4D + 4)y = x^2 e^{-2x}$	5M	3
b)	Solve the differential equation $(D^2 + 1)y = x \cos x$	5M	3
6. a)	Find $L\left[\frac{\cos 4t \sin 2t}{t}\right]$	5M	3
b)	find the inverse Laplace transform of $\log\left(\frac{s+1}{s-1}\right)$	5M	3
OR			
7.	Using convolution theorem, find the inverse Laplace transform of $\frac{s}{(s^2+1)(s^2+4)}$	10M	3
8. a)	Prove that $\text{div}\left(\frac{\vec{r}}{r^3}\right) = 0$, where $\vec{r} = xi + yj + zk$.	5M	2
b)	Prove that $\vec{A} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ is irrotational and find the scalar potential f such that $\vec{A} = \nabla f$	5M	2
OR			
9. a)	Prove that $\nabla^2(r^n) = n(n+1)r^{n-2}$	5M	2
b)	If $\vec{F} = x^3i + x^2yj + xyz^2k$, find $\text{Curl } \vec{F}$	5M	3
10.	Use Green's theorem to evaluate $\oint (3x^2 - 8y^2)dx + (4y - 6xy)dy$ along the curve C: the boundary of the region defined by $x=0, y=0, x+y=1$.	10M	5
OR			
11.	If $\vec{F} = (x+y^2)\vec{i} - 2xz\vec{j} + 2yz\vec{k}$ evaluate $\iint_S \vec{F} \cdot \vec{n} \cdot dS$ where S is the surface on the plane $2x+y+2z=6$ in the first octant.	10M	5

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