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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN  
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]  
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

**Question Paper Code: 2014**

**B.E. / B.Tech DEGREE END-SEMESTER EXAMINATIONS – March/April 2023**

**First Semester**

**U19MA101 – CALCULUS**

**Common to All Branches**

**(Regulation 2019)**

Time: Three Hours

Maximum: 100 Marks

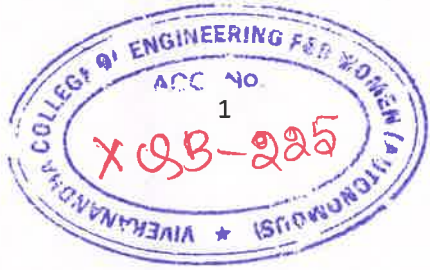
Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

**PART – A**

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Find $\frac{dy}{dx}$ when $y = \sqrt{1 + 3x}$	2	K3	CO1
2.	State the Rolle's theorem	2	K2	CO1
3.	State Euler's theorem.	2	K1	CO2
4.	Find the stationery points of $x^2 + y^2 + 6x + 12$ .	2	K3	CO2
5.	Find the value of $\int_0^{\frac{\pi}{2}} \cos^7 \theta \, d\theta$	2	K1	CO3
6.	If it is known that $\int_0^{10} f(x)dx = 17$ and $\int_0^8 f(x)dx = 12$ , find $\int_8^{10} f(x)dx$ .	2	K2	CO3
7.	Evaluate $\int_1^2 \int_0^3 x^2 y \, dx \, dy$ .	2	K2	CO4
8.	Change the order of integration $\int_0^1 \int_0^y f(x, y) \, dx \, dy$ .	2	K2	CO4
9.	Find the particular integral of $y'' - 3y' + 2y = e^x - e^{2x}$ .	2	K3	CO5
10.	Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = 0$ .	2	K2	CO5



PART – B

(5 x 16 = 80 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	<p>i. If <math>f(x) = \begin{cases} 2x - 2 &amp; \text{if } x &lt; -1 \\ ax + b &amp; \text{if } -1 \leq x &lt; 1 \\ 5x + 7 &amp; \text{if } x &gt; 1 \end{cases}</math> is continuous for all real x then find the value of a and b.</p> <p>ii. Find the absolute maximum and minimum values of the function <math>f(x) = x^3 - 3x^2 + 1, -\frac{1}{2} \leq x \leq 4</math>.</p> <p>(OR)</p>	8	K1	CO1
b)	<p>i. If <math>f(x) = \sqrt{x} g(x)</math>, where <math>g(4) = 2</math> and <math>g'(4) = 3</math>, find <math>f'(4)</math>.</p> <p>ii. A bottle of soda pop at room temperature <math>72^\circ\text{F}</math> is placed in a refrigerator where the temperature is <math>44^\circ\text{F}</math>. After half an hour the soda pop has cooled to <math>61^\circ\text{F}</math>. What is the temperature of the soda pop after another half hour?</p>	8	K1	CO1
12. a)	<p>i. If <math>u = f(x - y, y - z, z - x)</math>, show that <math>\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0</math>.</p> <p>ii. Find the value of the Jacobian <math>\frac{\partial(u,v)}{\partial(r,\theta)}</math>, where <math>u = x^2 - y^2, v = 2xy</math> and <math>x = r \cos\theta, y = r \sin\theta</math>.</p> <p>(OR)</p>	8	K2	CO2
b)	<p>i. Use Taylor's series, expand <math>e^x \log(1 + y)</math> in powers of x and y up to second degree.</p> <p>ii. Find the maximum and minimum values of the function <math>f(x, y) = x^3 + y^3 - 12x - 3y + 20</math>.</p>	8	K2	CO2
13. a)	<p>i. Evaluate the Riemann sum for <math>f(x) = x^3 - 6x</math> taking the sample points to be the right end points and <math>a = 0, b = 3</math>, and <math>n = 6</math>.</p> <p>ii. Use integration by parts to evaluate the integral <math>\int t^2 e^t dt</math>.</p> <p>(OR)</p>	8	K5	CO3
b)	<p>i. Evaluate <math>\int \frac{x}{x^2 + x + 1} dx</math></p> <p>ii. Use the reduction formula to show that <math>\int_0^{\frac{\pi}{2}} \sin^n x dx = \frac{n-1}{n} \int_0^{\frac{\pi}{2}} \sin^{n-2} x dx</math>.</p>	8	K5	CO3

14. a) i. Evaluate  $\iint_R xy dx dy$  over the positive quadrant of the circle  $x^2 + y^2 = a^2$  8 K2 CO4
- ii. Evaluate  $\int_0^a \int_x^1 \frac{x}{x^2+y^2} dx dy$  by changing the order of integration. 8 K2 CO4
- (OR)
- b) i. Find the area of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ . 8 K2 CO4
- ii. Find the volume of sphere  $x^2 + y^2 + z^2 = a^2$  8 K2 CO4
15. a) Solve: 16 K3 CO5
- $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = 2 \sin [\log(1+x)]$
- (OR)
- b) Solve  $(D^2+a^2)y = \tan ax$  by the method of variation of parameters. 16 K3 CO5
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