

Dec 22/Jan 23 to Dec 22/Jan 23.

I Sem to III Sem

58

XOB-22

Reg.No.:



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

**Question Paper Code: 2008**

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – DEC.2022 / JAN.2023

First Semester

**U15MA101 – CALCULUS**

(Common to All Branches)

(Regulation 2015)

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.	State the Taylor's theorem.	2	K1	CO1
2.	Use the indeterminate value theorem, check whether there is a root of the equation $x^4 + x - 3 = 0$ in (1, 2)	2	K2	CO1
3.	Find the value of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}$ if $u = \log(x^2 + y^2 + z^2)$ .	2	K2	CO2
4.	Find $\frac{du}{dx}$ if $u = \sin(x^2 + y^2)$	2	K1	CO2
5.	Evaluate $\int_1^5 \frac{\sqrt{x-1}}{x} dx$ .	2	K5	CO3
6.	State comparison test for Improper integral.	2	K1	CO3
7.	Change the order of integration of $\int_0^1 \int_0^x dy dx$ .	2	K3	CO4
8.	Evaluate $\int_0^1 \int_0^2 \int_0^3 xyz dx dy dz$ .	2	K5	CO4
9.	Find particular integral of $(D^2 + 4D + 4)y = 3^x$	2	K2	CO5
10.	Find the Wronskian of $(D^2 + 9)y = \cot 3x$	2	K2	CO5

PART – B

(5 x 16 = 80 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	i. Verify the Roll's theorem for $f(x) = (x - a)^m(x - b)^n$ in $[a, b]$ .	8	K2	CO1
	ii. Find the maximum and minimum values $f(x) = 2x^3 - 9x^2 - 24x - 20$	8	K3	CO1
	(OR)			
b)	i. If $(\sin x)^{\cos y} = (\cos x)^{\sin y}$ find the value of $\frac{dy}{dx}$	8	K2	CO1
	ii. The equation of motion of a particle is $S = 2t^3 - 5t^2 + 3t + 7$ , where S is measured in centimeters and t in seconds. Find the acceleration as a function of time. What is the acceleration after 2 seconds?	8	K3	CO1
12. a)	i. Find the shortest and longest distance from the point $(1, 2, -1)$ to the sphere $x^2 + y^2 + z^2 = 24$ .	8	K4	CO2
	ii. Find the Jacobian's of u,v,w with respect to $x_1, x_2, x_3$ for given $u = \frac{x_2x_3}{x_1}, v = \frac{x_3x_1}{x_2}, w = \frac{x_1x_2}{x_3}$ .	8	K3	CO2
	(OR)			
b)	i. Expand $\tan^{-1}\left(\frac{y}{x}\right)$ in the neighbourhood of $(1, 1)$ using Taylor's Theorem.	8	K2	CO2
	ii. Obtain the maximum and minimum values of $f(x, y) = x^3 + y^3 - 3xy$	8	K3	CO2
13. a)	i. Find $\int \frac{dx}{x^2 - a^2}$ by the method of partial fraction.	8	K5	CO3
	ii. For what values of p is the integral $\int_1^\infty \frac{1}{x^p} dx$ is convergent?.	8	K4	CO3
	(OR)			
b)	i. Prove that $\int_0^1 \frac{dx}{(1+x^2)\sqrt{2+x^2}} = \frac{\pi}{6}$	8	K2	CO3
	ii. Evaluate $\int_0^{\frac{\pi}{2}} \sin^7 \theta \cos^5 \theta d\theta$ by using reduction formula.	8	K4	CO3

14. a) i. Change the order of integration in,  $\int_0^4 \int_{\frac{x^2}{4}}^{2\sqrt{x}} xydydx$  and hence evaluate it. 8 K2 CO4
- ii. Evaluate  $\iiint_V ((x+y+z)dxdydz)$  where, V is the volume of the rectangular parallelepiped region is bounded by  $x = 0, x = 1, y = 0, y = 2, z = 0, z = 3$  8 K3 CO4
- (OR)
- b) i. Find the volume of sphere  $x^2 + y^2 + z^2 = a^2$  using triple integration. 8 K3 CO4
- ii. Change into polar coordinates and then evaluate  $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dydx$  8 K4 CO4
15. a) i. Solve: 8 K2 CO5
- $(x+1)^2 \frac{d^2y}{dx^2} + (x+1) \frac{dy}{dx} + y = 4\cos \log(x+1)$
- ii. Solve the equation  $(D^2 + 4)y = \tan 2x$  by the method of variation of parameters 8 K3 CO5
- (OR)
- b) i. Solve  $(D^2 - 2D + 1)y = xe^x \sin x$  8 K2 CO5
- ii. Solve  $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = x^2 + \frac{1}{x^2}$  8 K3 CO5

