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Code No. : 11101 S

**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD**

Accredited by NAAC with A++ Grade

**B.E. I-Semester Supplementary Examinations, September-2022**

**Calculus**

(Common to Civil, EEE, ECE & Mech.)

Time: 3 hours

Max. Marks: 60

Note: Answer all questions from Part-A and any FIVE from Part-B

**Part-A (10 × 2 = 20 Marks)**

Q. No.	Stem of the question	M	L	CO	PO
1.	Define curvature and radius of curvature.	2	1	1	1,12
2.	Write the formula for centre of curvature and define Evolute.	2	1	1	1,12
3.	Show that the limit of $f(x, y) = \frac{x+\sqrt{y}}{x^2+y}$ does not exist as $(x, y) \rightarrow (0,0)$ .	2	2	2	1,12
4.	Find the total derivative of $z = \tan^{-1}(x/y)$ .	2	2	2	1,12
5.	Define scalar potential function and conservative vector field.	2	1	3	1,2,12
6.	Define Solenoidal and Irrotational vectors.	2	1	3	1,2,12
7.	Evaluate $\int_0^a \int_0^b \int_0^c xyz \, dx dy dz$ .	2	1	4	1,2,12
8.	State Gauss divergence theorem.	2	1	4	1,2,12
9.	Write the test for convergence of the geometric series.	2	1	5	1,2,12
10.	State D'Alembert's ratio test.	2	1	5	1,2,12
<b>Part-B (5 × 8 = 40 Marks)</b>					
11. a)	Expand $e^{\sin x}$ upto the term containing $x^4$ .	4	2	1	1,12
b)	Show that the radius of curvature at any point of the cycloid $x = a(\theta + \sin \theta)$ , $y = a(1 - \cos \theta)$ is $4a \cos \theta/2$ .	4	2	1	1,12
12. a)	If $u = \log(x^3 + y^3 + z^3 - 3xyz)$ , show that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = \frac{-9}{(x+y+z)^2}$ .	4	2	2	1,2,12
b)	Expand $f(x, y) = \tan^{-1}(xy)$ in powers of $(x - 1)$ and $(y + 1)$ upto third degree terms.	4	3	2	1,2,12
13. a)	Find the value of $a$ if the vector $\vec{F} = (ax^2y + yz)\vec{i} + (xy^2 - xz^2)\vec{j} + (2xyz - 2x^2y^2)\vec{k}$ has zero divergence. Find the curl of the above vector which has zero divergence.	4	3	3	1,2,12
b)	Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point $A(1, -2, 1)$ in the direction of the vector $2\vec{i} - \vec{j} - 2\vec{k}$ .	4	3	3	1,2,12

Contd... 2

14. a)	Apply Green's theorem to evaluate $\int_C [(xy + y^2)dx + x^2dy]$ , where C is bounded by $y = x$ and $y = x^2$ .	4	3	4	1,2,12
b)	Evaluate $\int_0^5 \int_0^{x^2} x(x^2 + y^2)dxdy$ .	4	2	4	1,12
15. a)	Test for convergence of the series $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \frac{7}{4.5.6} + \dots$	4	4	5	1,2,12
b)	Test for convergence of the series $\sum \frac{x^{2n-2}}{(n+1)\sqrt{n}}$	4	4	5	1,2,12
16. a)	Find the evolute of the parabola $y^2 = 4ax$ .	4	3	1	1,2,12
b)	A rectangular box is open at the top is to have volume of 32 cubic ft. Find the dimension of the box requiring least material for its construction.	4	3	2	1,2,12
17.	Answer any <i>two</i> of the following:				
a)	Prove that $\text{div}(r^n \bar{r}) = (n + 3)r^n$ . Hence show that $\bar{r}/r^3$ is Solenoidal.	4	2	3	1,2,12
b)	Evaluate $\int_0^1 \int_{e^x}^e \frac{1}{\log y} dydx$ by changing the order of integration.	4	3	4	1,2,12
c)	Test whether the series $\sum \frac{\cos n\pi}{n^2+1}$ is absolutely convergent or not?	4	3	5	1,2,12

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level - 1	20%
ii)	Blooms Taxonomy Level - 2	30%
iii)	Blooms Taxonomy Level - 3 & 4	50%

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