



Sanjay Ghodawat University, Kolhapur

2017-18

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

FY M.Sc.

School of Science

Semester II

MTS 508

Multivariable Calculus

Max Marks: 100

May 2018

End Semester Examination (ESE)

Time: 3 Hrs.

29 May 2018

Instructions for Students: 1) Use of non-programmable calculator is allowed
10:30 AM to 1:30 PM 2) All questions are compulsory

Q1	Attempt the following: (two marks each)	12Marks	COs
a)	Gradient is (i) Vector Quantity (ii) Scalar Quantity (iii) Vector Quantity and Scalar Quantity (iv) none	2	CO4
b)	If $\text{Curl } F = 0$ then F is (i) Solenoidal (ii) irrotational (iii) Divergence (iv) none	2	CO5
c)	Force is (i) Vector (ii) Scalar (iii) function (iv) None	2	CO1
d)	Function $f(x, y) = x^3 + y^3 - 63(x+y) + 12xy$ is minimum at (a) (3, 3) (b) (2,3) (c) (1,2) (d) (4,5)	2	CO3
e)	The derivative of differentiable even function is (a) odd function (b) even function (c) constant function (d) none	2	CO1
f)	A function $f(x) = x $ is (a) Discontinuous (b) Discontinuous at $x=0$ (c) Continuous everywhere (d) none	2	CO2
Q2	Attempt any two of the following: (ten marks each)	20 Marks	COs
a)	State and prove Taylor's theorem	10	CO2
b)	State and prove inverse function theorem	10	CO3
c)	State and prove implicit function theorem	10	CO3
Q3	Attempt any two of the following: (eight marks each)	16 Marks	COs
a)	State and prove Gauss divergence theorem	8	CO5

	b)	State and prove Stokes theorem	8	CO5
	c)	State and prove Green theorem	8	CO4
Q.4		Attempt any two of the following: (six marks each)	12 Marks	COs
	a)	State and prove Fundamental theorem of line integrals.	6	CO3
	b)	Let f and g denote scalar fields that are differentiable on an open set S . Derive the following properties of the gradient: (i) $\text{grad } f = 0$ iff f is constant on S . (ii) $\text{grad } (f + g) = \text{grad}(f) + \text{grad}(g)$. (iii) $\text{grad}(cf) = c \text{ grad}(f)$; c is a constant. (iv) $\text{grad } (fg) = f \text{ grad}(g) + g \text{ grad}(f)$	6	CO1
	c)	$F = (y \sin z - \sin x) \mathbf{i} + (x \sin z + 2yz) \mathbf{j} + (xy \cos z + y) \mathbf{k}$ then prove that it is irrotational & hence find its scalar potential.	6	CO5
Q.5		Attempt any three of the following: (four marks each)	12 Marks	COs
	a)	Show that $f = (y + z)\mathbf{i} + (z + x)\mathbf{j} + (x + y)\mathbf{k}$ is solenoidal	4	CO5
	b)	If $\lim_{x \rightarrow a} f(x)$ exists then it is unique.	4	CO1
	c)	A continuous function in a closed interval is bounded.	4	CO1
	d)	Define vector and Scalar field with an examples	4	CO3
Q.6		Attempt any four of the following: (seven marks each) Discuss the maxima and minima values of the following	28 Marks	COs
	a)	function $x^5 - 5x^4 + 5x - 1$.	7	CO3
	b)	Find Divergence and curl F where $F = \nabla(xy + yz + zx)$.	7	CO3

c)	If $u = x^2 \tan^{-1}\left(\frac{y}{x}\right) - y^2 \tan^{-1}\left(\frac{x}{y}\right)$; then Find $\frac{\partial^2 u}{\partial x \partial y}$	7	CO3
d)	Evaluate $\int_0^1 \int_0^{x^2} e^{y/x} dy dx$	7	CO4
e)	Evaluate $\iint_R xy(x-1) dx dy$. R is region bounded by $xy=4, y=0, x=1, x=4$	7	CO4
