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

2018-19
EXM/P/09/00

Year and Program:2018-19 M.Sc.I	**School of Science**	**Department of Mathematics**
Course Code – MTS 508	**Course Title – Multivariable Calculus**	**Semester – II**
Day and Date – Monday 27-05-2019	**End Semester Examination**	**Time:** 30 min (2·30 to 3·00 p) **Max Marks: 100**
PRN number –	**Seat no-**	**Answer Booklet No.-**
Students' Signature -	A	**Invigilator's Signature –**

Instructions:

1) All questions are compulsory.
2) **Attempt Q.1 within first 30 minutes.**
3) Each MCQ type question is followed by four plausible alternatives, Tick (√) the correct one.
4) Answer to question 1 should be written in the question paper and submit to the Jr. Supervisor.
5) If you tick more than one option it will not be evaluated.
6) Figures to the right indicate full marks.
7) Use **Blue ball pen** only.

Q.1	Tick Mark correct alternative	Mark	Bloom's Level	Cos
i)	Consider the statements I) Empty set is neither open nor closed. II) Singleton set is open but not closed. a) Only I true b) Only II true c) Both I and II true d) Both I and II False	02	L1	CO1
ii)	If $f(\bar{x}) = \left\|\bar{x}\right\|^2$ then the directional derivative $f\left(\bar{c},\bar{u}\right)$ is…… a) $2\bar{u}^2$ b) $2\bar{c}\bar{u}$ c) $4\bar{u}^2$ d) $4\bar{c}\bar{u}$	02	L3	CO2
iii)	Minimum value of the function $f(x) = \frac{x^3}{3} + \frac{x^2}{2} + x + 5$ is….. a) 16 b) 28 c) 23 d) Does not exists	02	L2	CO3

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iv) A curve which does not intersect itself is called……….. 02 L1 CO4

a) Simple curve b) Rectifiable curve

c) Jorden curve d) None of these

v) Using Green's theorem, the value of $\oint_C y^2 dx + x\,dy = \ldots\ldots$ 02 L3 CO4

where c is the square with vertices $(\pm 1, \pm 1)$

$a)\,2 \quad b)\,4 \quad c)\,8 \quad d)\,10$

vi) The area of surface S is given by $a(S)=$ 02 L5 CO4

$a)\ \iint_s f\,dxdy \quad b)\ \iint_s dxdy \quad c)\ \int_s f\,dx \quad d)\ \int_s f\,dxdydz$

vii) Let $\overline{f} = f(x)i + g(y)j + h(z)k$ then the curl of $\overline{f}$ is…… 02 L3 CO5

$a)\ 1 \quad b)\,0 \quad c)\ f'(x)+g'(y)+h'(z) \quad d)\ 3$

viii) Consider the statements, 02 L1 CO5

I) The vector field $\overline{f}$ for which $\nabla\overline{f} = 0$ is called irrotational vector field.

II) The vector field $\overline{f}$ for which $\nabla\times\overline{f} = 0$ is called Solenoidal vector field.

a) Only I true b) Only II true

c) Both I and II true d) Both I and II False

ix) Gradient is ……..function and Divergence is ……..function. 02 L1 CO5

a) Vector , Scalar b) Scalar, Vector

c) Vector , Vector d) Scalar, Scalar

x) The parametric representation of surface of cone is……. 02 L1 CO5

$a)\,\overline{r}(u,v) = (v\cos\alpha.\cos u)i + (v\sin\alpha.\sin u)j + v\sin\alpha k$

$b)\,\overline{r}(u,v) = (v\sin\alpha.\cos u)i + (v\sin\alpha.\sin u)j + v\cos\alpha k$

$c)\,\overline{r}(u,v) = (v\sin\alpha.\cos u)i + (v\sin\alpha.\cos u)j + v\cos\alpha k$

$d)\,\overline{r}(u,v) = (v\sin\alpha.\cos u)i + (v\sin\alpha.\sin u)j + v\sin\alpha k$

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Year and Program: 2018-19 M.Sc.I	**School of Science**	**Department of Mathematics**
Course Code: MTS508	**Course Title: Multivariable Calculus**	**Semester – II**
Day and Date: Monday 27-05-2019	**End Semester Examination (ESE)**	**Time:** 2.30 min (3.00 to 5.30 pm) **Max Marks: 100**

Instructions:
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Non-programmable calculator is allowed

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Q.N			Marks	Bloom's Level	CO
Q.2		Solve any **Two** of the following.			
	a)	Prove that finite intersection of open sets is an open set and also give one counter example.	06	L4	CO1
	b)	If f is differentiable then show that f is continuous.	06	L5	CO1
	c)	If $\overline{F} = R^2 \to R^2$ is a function defined by $\overline{F}(x, y) = (x+y,\ xy)$ then find total derivative of $\overline{F}$ at $\bar{c} = (9,5)$	06	L3	CO1
Q.3		Solve the following.			
	a)	Let the functions f and g where g is differentiable at the point x and f is differentiable at the point $g(x)= y$ Show that the composite function $f(g(x))$ at the point x such that $\lim\limits_{h\to 0}\dfrac{f(g(x+h))-f(g(x))}{h} = f'(g(x).g'(x))$	08	L5	CO2
	b)	If $\phi = r^2 e^{-r}$ then show that $\nabla\phi = (2-r)e^{-r}\bar{r}$.	06	L5	CO2
		OR			
	b)	Find the scalar function ϕ such that I) $\nabla\phi = xi + 2yj + zk$ II) $\nabla\phi = 2r^4\bar{r}$	06	L3	CO2
Q.4	a)	Define I) Smooth function II) Piece-wise continuous function	04	L1	CO3

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	b)	Solve any **TWO** of the following.			
		i) Let force field is given by $F(x,y,z) = xi + yj + (xz - y)k$. Find the work done by this force in moving a particle from (0,0,0) to (1,2,4) along a line segment joining these two points.	05	L3	CO3
		ii) Let f be a scalar field with continuous second order partial derivatives in an n ball *B(a)* and *H(a)* be the Hessian matrix at stationary point a. Show that if all the eigen values of *H(a)*are positive, then f has relative minimum at a.	05	L2	CO3
		iii) Evaluate the line integral $\int_C (xy + z^3)\,ds$ from $(1,0,0)$ to $(-1,0,\pi)$ along the helix C that is represented by the parametric equations $x = \cos t,\ y = \sin t,\ z = t\ ;\ 0 \le t \le \pi$	05	L3	CO3
Q.5		Solve the following.			
	a)	Define step function and Evaluate $\iint_Q xy(x+y)dx\,dy$, where $Q = [0,1]\times[0,1]$	06	L5	CO4
	b)	Solve any **TWO** of the following.			
		i) Find the volume of one-octant of a sphere of radius a.	07	L3	CO4
		ii) Find the volume of solid enclosed by ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	07	L3	CO4
		iii) Evaluate $\iint_S e^{\frac{y-x}{y+x}}\,dx\,dy$ where S is a triangle bounded by line $x+y=2$ in first quadrant.	07	L5	CO4
Q.6		Solve any **TWO** of the following.			
	a)	State and prove Stoke's theorem.	10	L5	CO5
	b)	Find the surface area of a hemisphere.	10	L3	CO5
	c)	Prove that V be a solid in three space bounded by orientable closed surface S and $\overline{n}$ be the unit normal to the surface S. If $\overline{F}$ is continuously differentiable vector field on V, then $\iiint_V div\,\overline{F}\,dx\,dy\,dz = \iint_S \overline{F}.\overline{n}\,ds$	10	L5	CO5

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