Sanjay Ghodawat University, Kolhapur
Established as State Private University under Govt. of Maharashtra. Act No XL, 2017
2018-19
EXM/P/09/01

**Year and Program:2018-19** **School of Science** **Department of Mathematics**
**FY B.Sc.**
**Course Code: MTS101** **Course Title: Mathematics-I** **Semester – I**
**Day and Date** **End Semester Examination** **Time:** **Max Marks: 100**
Friday 30Nov18 **(ESE)** 10:00 am to 10:30 am
**Student's Signature:** **Answer Booklet No.**

**PRN/Exam Seat No.:** **Invigilator's Signature:**

**Instructions:**

1) All questions are compulsory.
2) **Attempt Q.1 within first 30 minutes.**
3) Each MCQ type question has four choices out of which only one is correct.
4) Tick mark (√ ) the correct alternative which should be answered in question paper itself 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.

| | | Marks | Bloom's Level | CO |
|---|---|---|---|---|
| **Q.1** | **Tick the correct option.** | | | |
| i. | Let $f(x) = \frac{x}{x-2}$ is_____ | 01 | $L_2$ | CO1 |
| | A) Continuous over R<br>B) Discontinuous over R<br>C) Discontinuous at at x=2.<br>D) None of these | | | |
| ii. | $f(x) = 5x + \sin x + e^x$ is _____ | 02 | $L_2$ | CO1 |
| | A) Continuous over R<br>B) Discontinuous over R<br>C) Discontinuous at some points.<br>D) None. | | | |
| iii. | If $\lim_{h\to 0^+} \frac{f(c+h)-f(c)}{h}$ exists, then it is called as_____ | 01 | $L_1$ | CO2 |
| | A) Left Hand Derivative of $f(x)$ at c<br>B) Right Hand Derivative of $f(x)$at c<br>C) Left Hand Limit of $f(x)$ at c<br>D) Right Hand Limit of $f(x)$at c | | | |

iv. Let $f(x)$ is such that $f'(x) > 0$, $\forall x \in (a, b)$ then the function must be_____ 01 $L_1$ CO2

A) zero function over (a,b)

B) Constant over (a,b)

C) monotonically increasing function in (a,b)

D) monotonically decreasing function in (a,b).

v. If Lagrange's Mean Value theorem is satisfied for $f(x)$ in interval (a,b) then this theorem says that $\exists$ at least one point c $\in (a, b)$ such that _____ 02 $L_1$ CO2

A) Tangent at that point is parallel to Y-axis
B) Tangent at that point is parallel to X-axis
C) Tangent at that point is parallel to the chord joining end points ,say P,Q i.e P(a, $f(a)$) and Q(b, $f(b)$) of curve $f(x)$.
D) Tangent at that point is perpendicular to the chord joining end points say P,Q i.e P(a, $f(a)$) and Q(b, $f(b)$)

vi. If $y=4x^2$ then $y_7$=_____ 02 $L_3$ CO3

A) 4 B)0 C) 3! D)7!

vii. The value of $n^{th}$ derivative of $\cos(ax + b)$ is _____ 01 $L_1$ CO3

A) $a^n \cos(ax + b + n\pi)$ B) $b^n \cos\left(ax + b + \frac{1}{2}n\pi\right)$

C) $a^n \cos\left(ax + b + \frac{1}{2}n\pi\right)$ D) $b^n \cos(ax + b + n\pi)$

viii. The $(n+1)^{th}$ term in Maclaurin's series is_____ 01 $L_1$ CO4

A) $\frac{x^n}{n} f^{(n)}(a)$ B) $\frac{x^n}{n!} f^{(n)}(a)$

C) $\frac{x^n}{n!} f^{(n)}(0)$ D) $f^{(n)}(0)$

ix. $f(x) = 4x^3 + 7x^2 + 5x + 9$ can be expanded in powers of $(x - 2)$ by using _____ 01 $L_2$ CO4

A) Maclaurin's theorem B) Gregory's theorem.

C) Leibnitz theorem D) Taylor's theorem

x. If $\cos x = a_0 + a_1x + a_2x^2 + a_3x^3 + \cdots$, then the value of $a_1$ is_____ 02 $L_3$ CO4

A)1 B)0 C)-1 D)2

xi. The value of $\lim_{x\to\infty} \frac{\log x}{x}$ is_____ 02 $L_3$ CO5

A) 1 B) 0 C) -1 D) $\infty$

xii. $\lim_{x\to 0} (\cos x)^{\cot x}$ assumes the form _____ 01 $L_2$ CO5

A) $\frac{0}{0}$ B) $\infty - \infty$ C) $1^0$ D) $1^\infty$

xiii. Let $z$ be any real or complex number then 02 $L_2$ CO6

$e^{iz}$ =_____

A)cos $z$ +isin $z$ B) cos $z$ −isin $z$

C) cosi $z$ +isin $iz$ D) cosi $z$ −isin $iz$

xiv. Arg $(z_1.z_2)$= _____ 01 $L_1$ CO6

A) Arg $z_1$ +Arg $z_2$ B) $\frac{\text{Arg z1}}{\text{Arg z2}}$

C) Arg $z_1$ - Arg $z_2$ D) Arg $(z_1+z_2)$

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

| | | | Marks | Bloom's Level | CO |
|---|---|---|---|---|---|
| Q.2 | | **Solve the following.** | | | |
| | a) | Write $\epsilon$-$\delta$ definition of limit of a function and also if $\lim_{x\to a} f(x) = l$ , $\lim_{x\to a} g(x) = m$, then prove that $\lim_{x\to a}[f(x) + g(x)] = l + m$. | 08 | $L_3$ | CO1 |
| | | OR | | | |
| | a) | Define continuous function. Also show that $f(x) = \cos x$ is continuous for any given value of $x$ say c. | 08 | $L_4$ | CO1 |
| | b) | **Attempt any TWO** | | | |
| | | i) Evaluate $\lim_{x\to 0} \frac{x-\sin x}{x^3}$. | 04 | $L_3$ | CO5 |
| | | ii) Evaluate $\lim_{x\to 0} x \log x$. | 04 | $L_3$ | CO5 |
| | | iii) Evaluate $\lim_{x\to a} \frac{\log(x-a)}{\log(e^x-e^a)}$ | 04 | $L_3$ | CO5 |
| Q.3 | | **Solve any THREE** | | | |
| | a) | Show that the function $x\|x\|$ is derivable at the origin. | 08 | $L_4$ | CO2 |
| | b) | State Rolle's theorem and varify Rolle's theorem for $f(x) = (x - 2a)^{2/3}$ on [a, 3a]. | 08 | $L_4$ | CO2 |
| | c) | State and prove Cauchy's Mean Value Theorem. | 08 | $L_4$ | CO2 |
| | d) | Prove that $\frac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \frac{b-a}{1+a^2}$, if a < b. | 08 | $L_3$ | CO2 |
| | e) | Prove that the function $f(x) = logx$ is increasing in [a,∞) , a>0 and the function $g(x) = \cos x$ is decreasing in $(0, \pi)$ | 08 | $L_3$ | CO2 |
| Q.4 | a) | If $y = a\cos(\log x) + b\sin(\log x)$, then show that $x^2 y_{n+2} + (2n+1)x y_{n+1} + (n^2+1)y_n = 0$ | 08 | $L_5$ | CO3 |

OR

| | | | | | |
|---|---|---|---|---|---|
| | a) | i) If y = $a^x$, then show that $y_n = a^x(\log a)^n$ | 04 | $L_3$ | CO3 |
| | | ii) Find $n^{th}$ differential coefficient of $\sin 2x . \sin 3x$ | 04 | $L_3$ | CO3 |
| Q.5 | | **Attempt any FOUR** | | | |
| | a) | State and prove Taylor's Theorem. | 06 | $L_4$ | CO4 |
| | b) | Expand $\log \sec x$ in powers of $x$. | 06 | $L_3$ | CO4 |
| | c) | Expand $\sin x$ in powers of $x$ . | 06 | $L_3$ | CO4 |
| | d) | Expand $(1 + x)^m$ in powers of $x$. | 06 | $L_3$ | CO4 |
| | e) | Expand $\tan^{-1} x$ in powers of $x$. | 06 | $L_3$ | CO4 |
| | f) | Expand $2x^3 + 7x + x - 2$ in powers of $(x - 2)$. | 06 | $L_3$ | CO4 |
| Q.6 | a) | Find all the values of $(-1)^{1/3}$ | 08 | $L_3$ | CO6 |

OR

| | | | | | |
|---|---|---|---|---|---|
| | a) | If $\cos(\propto + i\beta) = x + iy$, then prove that $\frac{x^2}{\cosh^2\beta} + \frac{y^2}{\sinh^2\beta} = 1$ , $\frac{x^2}{\cos^2\alpha} - \frac{y^2}{\sin^2\alpha} = 1$ | 08 | $L_3$ | CO6 |

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