

MTE-03

ASSIGNMENT BOOKLET

Bachelor's Degree Programme

MATHEMATICAL METHODS

(Valid from 1st January, 2021 to 31st December, 2021)

It is compulsory to submit the assignment before filling the exam form.



**School of Sciences
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New Delhi-110068
(2021)**

Dear Student,

Please read the section on assignments in the Programme Guide for Elective Courses that we sent you after your enrolment. A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

- 1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ROLL NO.:

NAME:

ADDRESS:

.....

.....

COURSE CODE:

COURSE TITLE:

ASSIGNMENT NO.:

STUDY CENTRE: **DATE:**

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

- 2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
- 3) Leave 4 cm margin on the left, top and bottom of your answer sheet.
- 4) Your answers should be precise.
- 5) While solving problems, clearly indicate which part of which question is being solved.
- 6) **This assignment is valid only upto December, 2021.** If you have failed in this assignment or fail to submit it by the last date, then you need to get the assignment for the next cycle and submit it as per the instructions given in that assignment.
- 7) It is compulsory to submit the assignment before filling in the exam form.

We strongly suggest that you retain a copy of your answer sheets.

We wish you good luck.

ASSIGNMENT

Course Code: MTE-03
Assignment Code: MTE-03/TMA/2021
Maximum Marks: 100

1. State whether the following statements are true or false. Justify your answer with the help of a short proof or a counter-example. (10)
- (i) The best measure of tendency for the data 2, 4, 6, 8, 10, 98, 100 is its mean.
 - (ii) $|\mathbf{a} \times \mathbf{b}|$ is maximum when \mathbf{a} and \mathbf{b} are parallel.
 - (iii) $f(x) = \begin{cases} 0.02(10-x); & 0 \leq x \leq 10 \\ 0, & \text{otherwise} \end{cases}$
is a p.d.f. of a random variable X .
 - (iv) Function f define by $f(x) = x + \frac{1}{x}$ is increasing for $0 < x \leq 1$.
 - (v) Total 5^3 simple random samples of size 3 can be drawn without replacement from a population of size 5.
2. (a) (i) Given $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = 3x + 1, x \in \mathbb{R}$, show that f is bijective. (3)
- (ii) Given $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = x^2 + 2, x \in \mathbb{R}$ and $g: \mathbb{R} \rightarrow \mathbb{R}, g(x) = 3x + 5, x \in \mathbb{R}$.
Is $f \circ g = g \circ f$? Justify. (3)
- (b) Evaluate $\int_1^2 \frac{dx}{x(1+2x)^2}$ (4)
3. (a) The probability that a man will get the contract A is $\frac{2}{3}$ and the probability that the will not get the contract B is $\frac{5}{9}$. If the probability of getting at least one contract is $\frac{4}{5}$, what is the probability that he will get both the contracts? (5)
- (b) Determine the standard derivation of the random variable X whose values are given below: (5)
- | | | | | | | | | | | |
|-----|----|----|----|----|----|----|----|----|----|----|
| X | 32 | 28 | 47 | 63 | 71 | 39 | 70 | 60 | 96 | 14 |
|-----|----|----|----|----|----|----|----|----|----|----|
4. (a) Show that the area A of a rectangle with a given perimeter S is maximum when it is a square. (5)
- (b) The sum of three numbers in A.P. is 18. If 2, 4, 11 are added successively to the numbers then the resulting numbers are in G.P. Find the numbers. (5)

5. (a) For 5 observations of pairs (x, y) of variables x and y , the following results are obtained:

$$\sum x = 15, \sum y = 25, \sum x^2 = 55, \sum y^2 = 135, \sum xy = 83. \text{ Find the two lines of regression. Also, estimate the values of } x \text{ and } y \text{ if } y = 12 \text{ and } x = 8. \quad (6)$$

(b) Find $\frac{dz}{dt}$ where $z = x^2 + 3xy + 5y^2$ and $x = \cos t, y = 2 \sin t$. (4)

6. (a) If the roots of the equation $x^2 - lx + m = 0$ differ by 1, then prove that

$$l^2 = 4m + 1. \quad (4)$$

- (b) In a Binomial distribution consisting of 5 independent trials, probabilities of 1 and 2 successes are 0.4096 and 0.2048 respectively. Find the probability of success. Also, find the mean and variance of the distribution. (6)

7. (a) Find the sine of the angle between the vectors $\alpha = 2i - j + k$ and $\beta = 3i + 4j - k$. (5)

(b) Given $\frac{dy}{dx} = -\frac{y^2}{25}$ and $y = 5$ when $x = 0$. Find x when $y = 2$. (5)

8. (a) Find the equation of the sphere whose radius is 5 and centre is the point of intersection of the plane $x + y + 2z = 2$ and the straight line $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-0}{-1}$. (5)

- (b) Find the equation of the normal to the curve $y(x-2)(x-3) - x + 7 = 0$, at the point where it cuts the x -axis. (5)

9. (a) The number of accidents in a highway as recorded every month over a 9-month period are 15, 18, 9, 11, 14, 10, 8, 13, 19. Test at 5% frequencies are in agreement with the belief that the number of accidents was the same during the 9 months. It is given that the table values of χ^2 at 5% level for 8 d.o.f. and 9 d.o.f. are 15.5 and 16.9 respectively. (6)

- (b) Find the equation of the straight line passing through the intersection of the lines $x + y = 1$ and $2x - 3y + 2 = 0$ and perpendicular to the line $3x + y + 9 = 0$. (4)

10. (a) Measurements of a sample of 6 weights were found to be $14.3, 16.6, 15.7, 14.8, 16.2$ and 15.4 kilogram respectively. (i) Determine an unbiased estimate of the population mean. (ii) Compare the sample standard deviation with the estimated population standard deviation. (6)

- (b) Evaluate: (4)

$$\lim_{x \rightarrow 3} \frac{\sqrt{x-3} + \sqrt{x} - \sqrt{3}}{\sqrt{x^2-9}}$$