

MTE-03

ASSIGNMENT BOOKLET

**Bachelor's Degree Programme
(B.Sc./B.A./B.Com.)**

MATHEMATICAL METHODS

(Valid from 1st January, 2020 to 31st December, 2020)

**It is compulsory to submit the Assignment before filling in the
Term-End Examination Form.**



**School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068**

(2020)

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 to be submitted to the Study Centre as per the schedule made by the study centre. **Answer sheets received after the due date shall not be accepted.**
We strongly suggest that you retain a copy of your answer sheets.
- 7) This assignment is valid only upto December, 2020. If you have failed in this assignment or fail to submit it by December, 2020, then you need to get the assignment for the year 2021 and submit it as per the instructions given in the programme guide.
- 8) **You cannot fill the Exam Form for this course** till you have submitted this assignment. So solve it and **submit it to your study centre at the earliest.**

We wish you good luck.

Assignment
(To be done after studying all the blocks)

Course Code: MTE-03
Assignment Code: MTE-03/TMA/2020
Maximum Marks: 100

1. Which of the following statements are true and which are false? Give a short proof or a counter example in support of your answer.

i) The sum of binomial coefficients in the expansion of $(1+x)^n$ is 2^n .

ii) If $f: \mathbf{R} \rightarrow \mathbf{R}$ is such that $f(x) = \cos(x+2)$, then f is invertible.

iii) The mean and standard deviation of a binomial distribution are same.

iv) The normal curve $f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$, $-\infty < x < \infty$, attains its maximum at $x = 0$.

v) The asymptote of the curve $x^3 + xy^2 - y^2 = 0$, parallel to y-axis is $x = 1$. (10)

2. a) If the roots of the equation $x^2 - lx + m = 0$ differ by 1, then prove that $l^2 = 4m + 1$. (3)

b) Solve the differential equation

$$(1-x^2) \frac{dy}{dx} + xy = x(1-x^2) \quad (4)$$

c) The product of first three terms of a GP is 1000. If 6 is added to its second term and 7 is added to its third term, then the terms becomes in AP. Find the GP. (3)

3. a) Examine the continuity of the function f defined by

$$f(x) = \begin{cases} \frac{|x-1|}{x-1}, & x \neq 1 \\ 1, & x = 1 \end{cases}$$

at the point $x = 1$. (3)

b) Evaluate $\int_1^2 x \ln x \, dx$. (3)

c) Find two non-zero numbers whose sum is 15 and the square of one multiplied by the cube of the other is maximum. (4)

4. a) If $z = \sin(x^2 + y^2)$ where $a^2x^2 + b^2y^2 = c^2$, the find $\frac{dz}{dx}$. (3)

b) Compute quartile deviation for the following data: (5)

Marks:	20-30	30-40	40-50	50-60	60-70	70 and above
No. of students:	5	20	14	10	8	5

- c) Check whether the function $f : \mathbf{N} \rightarrow \mathbf{N}$ defined by $f(x) = x - (-1)^x$ is one-one and onto. (2)
5. a) In eight throws of a die, 5 or 6 is considered a success. Find the mean and standard deviation of number of successes. (3)
- b) Find the middle term of the binomial expansion of $\left(\frac{2}{3}x^2 - \frac{3}{2x}\right)^{10}$. (3)
- c) A die is thrown twice and the sum of numbers appearing is observed to be 7. What is the conditional probability that the number 2 has appeared at least once? (4)
6. a) Consider a population of 6 units with values 1, 2, 3, 4, 5 and 6. Write down all possible samples of size 2 from this population. Obtain the sampling distribution of the sample mean. Compute mean and variance of the sampling distribution obtained. (6)
- b) Find the distance between the point $(-1, -5, -10)$ and the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ with the plane $x - y + z = 5$. (4)
7. a) Verify Euler's theorem for the function $\frac{xy}{x+y}$. (3)
- b) Compute the correlation coefficient between x and y for the following data: (4)
- | | | | | | | | |
|-----|---|---|---|---|---|---|---|
| x | 9 | 7 | 6 | 1 | 3 | 9 | 4 |
| y | 1 | 3 | 5 | 6 | 9 | 6 | 4 |
- c) Find the $(\mathbf{a} \times \mathbf{c}) \cdot \mathbf{c}$, where $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$, $\mathbf{b} = \mathbf{i} - 2\mathbf{j} + \mathbf{k}$, $\mathbf{c} = 3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k}$. (3)
8. a) Find the mean and the standard deviation of a random variable with pdf, $f(x) = e^{-x}$, $x \geq 0$. (4)
- b) Show that $\sin x(1 + \cos x)$ has a maximum at $x = \frac{\pi}{3}$. (4)
- c) Find the sum of the first n terms of the series $\log 2 + \log 6 + \log 18 + \log 54 + \dots$ (2)
9. a) A garden pea plant is genetically mixed for the gene pair Tt , where the gene T (for tall) is dominant over the gene t (for short). The plant produced 40 tall and 20 short offsprings. Using χ^2 -test find out whether the plant was self fertilized by a short plant at 5% level of significance. (5)

b) If $f(x) = \left(\frac{a+x}{b+x}\right)^{a+b+2x}$, then find $f'(0)$. (3)

c) Find the point of inflection for the curve $y = x^3 - 8$. (2)

10. a) Find the mean, standard deviation and mean deviation of the following distribution. (6)

x	20	25	30	35	40
f	8	10	16	10	6

b) If $y = x^3$, then verify that $\frac{dy'}{dx} = y' \frac{dy'}{dy}$, where $y' = \frac{dy}{dx}$. (4)