ASSIGNMENT BOOKLET

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

MATHEMATICAL METHODS

(Valid from 1st January, 2022 to 31st December, 2022)

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

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THE PEOPLE'S
UNIVERSITY

School of Sciences
Indira Gandhi National Open University
Maidan Garhi
New Delhi-110068
(2022)

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: ……………………………………………

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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, 2022**. 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

(To be done after studying all the blocks)

1) State whether the following statements are true or false. Give reasons for your answers. (5×2=10)

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

   ii) If $f : \mathbf{R} \to \mathbf{R}$ 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 of $f = \dfrac{1}{\sqrt{2\pi}} e^{-1/2 \, x^2}$; $-\infty < x < \infty$ attains its maximum at $x = 0$.

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

2) a) Which of the following functions from $\mathbf{N}$ to $\mathbf{N}$ are one-one and onto (2)

   i) $f(x) = x - (-1)^x \ \forall \ x \in \mathbf{N}$

   ii) $f(x) = x^2 + x + 1 \ \forall \ x \in \mathbf{N}$

   b) If $z = \sin(x^2 + y^2)$ where $a^2 x^2 + b^2 y^2 = c^2$ then find dz/dx. (3)

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

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

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

   b) Solve the differential equation $(1 - x^2) \dfrac{dy}{dx} + xy = x(1 - x^2)$. (4)

   c) The probabilities of X, Y and Z becoming managers are $\dfrac{4}{9}, \dfrac{2}{9}$ and $\dfrac{1}{3}$, respectively. The probabilities that bonus scheme will be introduced if X, Y and Z become managers and $\dfrac{3}{10}, \dfrac{1}{2}$ and $\dfrac{4}{5}$, respectively. What is the probability that bonus scheme will be introduced? Who is the most likely manager to introduce the bonus scheme? (4)

4) a) The product of first three terms of a G.P. is 1000. If 6 is added to its second term and 7 added to its third term, the terms became in A.P. Find the G.P. (3)

b) Examine the continuity of the function defined by:

$$f(x) = \begin{cases} \dfrac{|x-a|}{x-a}; & x \neq a \\ 1; & x = a \end{cases}$$

at the point $x = a$. (2)

c) The p.d.f. of a continuous random variable X is $f(x) = C(10 - x); 0 \leq x < 10$. Find (5)
   i)   C
   ii) C D F of X
   iii) mean of X
   iv) standard deviation of X.

5. a) Find the equation of a sphere with its center at $(-1, 2, 3)$ and which passes through $(1, -1, 2)$. (2)

b) Evaluate $\displaystyle\int_1^2 x \ell_n x \ dx$. (2)

c) The city council of Delhi state has gathered data on the number of minor traffic accidents (Y) and number of youth soccer games (X) that occur in town over a weekend (6)

X:	20	30	10	12	15	25	34
Y:	6	9	4	5	7	8	9

Fit a linear regression to this data to predict the number of minor traffic accidents.

6. a) The position vectors of points, P, Q, R are $i + 2j + 3k$, $-2i + 3j + 5k$ and $7i - k$ respectively. Prove that P, Q and R are collinear. (3)

b) Find the equation of the tangent at $t = 2$ to the curve $x = at^2$, $y = 2at$. (2)

c) 200 college students were classified according to their intelligence and economic conditions as per the data given below. Test at 5% level of significance, whether there is any association between intelligence and economic condition's of the students. (5)

		Intelligence		
		Excellent	Good	Dull
Economic	Good	24	43	13
Condition's	Not Good	31	57	32

You may like to use the following values ($\chi^2_{20.05} = 5.991$, $\chi^2_{30.05} = 7.82$ and $\chi^2_{60.05} = 12.59$).

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

b) A committee of 5 persons is to be constituted from a group of 4 men and 3 women. In how many ways can this be done? How many of these committees would consist of 3 men and 2 women? (2)

c) A fair coin is tossed five times. Find the probabilities that a **head** appears (4)

   i) exactly three times

   ii) at least two times

   iii) at the most four times.

8) a) Let X be a random variable with p.d.f. $f(x) = ke^{-\theta x}$, $\theta > 0$, $x \geq 0$. Find (i) the constant k (ii) CDF of X (iii) mean of X (iv) Standard deviation of X. (4)

b) Express the recurring decimal $0.\overline{6} = 0.666...$ as infinite geometric series and hence reduce it to a rational fraction. (2)

c) Find the asymptotes of the curve $y^2 = (x-1) - x^3 = 0$. (4)

9) a) In a mass production process 0.1% of the articles are defective. Articles are packed in boxes of 1000. Find what proportion would contain 2 or more defective articles? (3)

b) Solve the following differential equation $\dfrac{dy}{dx} + \dfrac{2x}{x^2 - 1}y = e^x$. (4)

c) A random sample of 170 boys from 8502 boys in an area showed that 21 had some nutritional deficiency. Estimate the proportion of nutritionally deficient boys and the standard error of this estimate. (3)

10) a) In a survey conducted to observe the life of a refrigerator, the following data is obtained: (5)

Life (in years):	0-2	2-4	4-6	6-8	8-10	10-12
No. of refrigerators:	2	7	12	19	9	1

Calculate mean deviation from median for this data.

b) Find the equation of a line passing through (1, 2, 3) and parallel to the planes $x - y + 2z = 5$ and $3x + y + z = 6$. (5)