BMTC-132

ASSIGNMENT BOOKLET

DIFFERENTIAL EQUATIONS

Valid from 1st Jan, 2025 to 31st Dec, 2025

School of Sciences
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Maidan Garhi
New Delhi-110068
(2025)

Dear Student,

Please read the section on assignments in the Programme Guide 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 from 1st Jan, 2025 to 31st Dec, 2025**. If you have failed in this assignment or fail to submit it by Dec, 2025, then you need to get the assignment for the year 2026, and submit it as per the instructions given in the Programme Guide.

7) **You cannot fill the examination form for this course** until you have submitted this assignment.

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

We wish you good luck.

ASSIGNMENT

Course Code: BMTC-132
Assignment Code: BMTC-132/TMA/2025
Maximum Marks: 100

1. a) Solve the differential equations: (8)

$$\frac{dy}{dx} = -\frac{2x + y + 1}{4x + 2y - 1}$$

b) Solve the simultaneous equations: (7)

$$\frac{dx}{y - z} = \frac{dy}{z - x} = \frac{dz}{x - y}$$

2. a) By using the method of variation of parameter, find the general solution of the differential equation: (8)

$$y'' + y = \sec^2 x$$

b) If : (7)

$$Z = x^2 y + 2xy^4$$

where $x = \sin zt$

and $y = \cos t$

find $\frac{dz}{dt}$ when $t = 0$ by (i) chain rule and by (ii) the direct substitution.

3. a) Verify that the differential equation: (10)

$$z(x^2 - y^2 - z^2)dx + (x + z)xz\,dy + x(z^2 - x^2 - xy)\,dz = 0$$

is integrable and find its integral.

b) Solve: (5)

$$y' = \frac{zy^4 + x^4}{xy^3}$$

4. a) Find the general solution of the equation: (8)

$$x(y^2 - z^2)u_x + y(z^2 - x^2)u_y + z(x^2 - y^2)u_z = 0$$

b) Show that for the function f given by: (7)

$$f(x,y)=\frac{xy}{x^2+y^2}$$

$$\lim_{x\to 0}\lim_{y\to 0} f(x,y)=\lim_{y\to 0}\lim_{x\to 0} f(x,y)=0$$

But $\lim_{(x,y)\to(0,0)} f(x,y)$ does not exist.

5. a) Show that the following function f is differentiable at $(0,0)$: (8)

$$f(x,y)=\begin{cases}\dfrac{x^2y^2}{x^2+y^2}, & \text{if } (x,y)\neq(0,0)\\ 0, & \text{if } (x,y)=(0,0)\end{cases}$$

b) Find the complete solution of the equation $px+qy=pq$. (7)

6. a) Using Charpit's method, find the complete integral of the differential equation: (7)

$$p^2x+q^2y=z$$

b) Find partial derivatives f_x and f_y for the function: (3)

$$f(x,y)=5x^4y^2+6x^2y^3$$

at the point $(1,-1)$.

c) State Euler's theorem for homogeneous functions and verify it for the function: (5)

$$u=\frac{x^3+y^3}{x+y}$$

7. a) The population of a town grows at a rate proportional to the population at any time. Its initial population of 500 increases by 15% in 10 years. What will be the population in 30 years? (6)

b) Show that the following function is not continuous at $(0,0)$: (4)

$$f(x,y)=\begin{cases}y\sin\dfrac{1}{x}+x\sin\dfrac{1}{y}, & x\neq 0, y\neq 0\\ 1, & \text{otherwise}\end{cases}$$