**BMTC-132**

# ASSIGNMENT BOOKLET

**Bachelor's of Sciences/Arts (General) Programme**
**(BSCG/BAG)**

## DIFFERENTIAL EQUATIONS

**Valid from 1st January, 2023 to 31st December, 2023**

**School of Sciences**
**Indira Gandhi National Open University**
**Maidan Garhi**
**New Delhi-110068**
**(2023)**

Dear Student,

Please read the section on assignments in the Programme Guide for B.Sc. 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, and it consists of three parts, Part A, Part B, Part C, covering all the blocks of the course. The total marks of the three parts are 100, of which 35% are needed to pass it.

**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) Solve Part A, Part B and Part C of this assignment, and **submit the complete assignment answer sheets within the due date.**

6) The assignment answer sheets are to be submitted to your Study Centre within the due date. **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 from 1st January, 2023 to 31st December, 2023**. If you have failed in this assignment or fail to submit it by December, 2023, then you need to get the assignment for the year 2024, and submit it as per the instructions given in the Programme Guide.

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

We wish you good luck.

# ASSIGNMENT

**Course Code: BMTC-132**
**Assignment Code: BMTC-132/TMA/2023**
**Maximum Marks: 100**

## Part A (30 Marks)

1. State whether the following statements are true or false. Justify your answer with the help of a short proof or a counter example: (5×2=10)

   a) $y^2$ is an integrating factor of the differential equation:
   $$6xy\ dx + (4y + 9x^2)dy = 0.$$

   b) The solution of the differential equation $\frac{dy}{d} = y$ with $y(0) = 0$ exists, but is not unique.

   c) $\sin x \frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0$ in $]0, \pi[$ is a linear homogeneous equation.

   d) The solution of the differential equation
   $$\frac{dy}{dx} = y \text{ with } y(0) = 0$$
   exists, but is not unique.

   e) The Pfaffian equation $(2xy^2 + 2xy + 2xz^2 + 1)dx + dy + 2z\ dz = 0$ is integrable.

2. a) Apply the method of variation of parameter to solve the differential equation:
   $$y'' + 6y' + 9y = \frac{1}{x^3}e^{-3x},\ x > 0.$$ (5)

   b) Suppose that a thermometer having a reading of $75^\circ F$ inside a house is placed outside where the air temperature is $15^\circ F$. Two minutes later it is found that the thermometer reading is $30^\circ F$. Find the temperature reading $T(t)$ of the thermometer at any time $t$. (5)

3. a) Find the integral surface of the p.d.e.:
   $$(x - y)p + (y - x - z)q = z$$
   through the circle $z = 1,\ x^2 + y^2 = 1$. (5)

   b) Solve: $(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0.$ (5)

## Part B (40 Marks)

4. a) Using Charpit's method, find the complete integral of the p.d.e.:
   $$2xz - px^2 - 2qxy + pq = 0.$$ (4)

b) Using the method of undetermined coefficients, solve the differential equation:
$(D^3 + 2D^2 - D - 2)y = e^x + x^2.$ (4)

c) Solve the differential equation: $\frac{dy}{dx} = (x + y)^2.$ (2)

5. a) A particle falls from rest in a medium in which the resistance is $\lambda v^2$ per unit mass, $v$ being the velocity of the particle at time $t$. Prove that the distance fallen in time $t$ is $\frac{1}{\lambda}\ln\cosh(t\sqrt{g\lambda})$, where $g$ is the acceleration due to gravity. (5)

b) Solve: $(y^2 + yz)dx + (z^2 + zx)dy + (y^2 - xy)dz = 0.$ (5)

6. a) Solve: $(D^2 + 5DD' + 5D'^2)z = x \sin(3x - 2y).$ (5)

b) Solve: $\frac{dx}{y^2 + yz + z^2} = \frac{dy}{z^2 + zx + x^2} = \frac{dz}{x^2 + xy + y^2}.$ (5)

7. a) Using the method of variation of parameters, solve the equation
$\frac{d^2y}{dx^2} + a^2y = \sec ax.$ (4)

b) Solve $(p + q)(px + qy) = 1,$ using Charpit's method. (4)

c) Solve: $\frac{dy}{dx} = \frac{1}{x + y + 1}.$ (2)

**Part C (30 Marks)**

8. a) Solve: $(D^2 - DD' - 2D)\ z = \sin(3x + 4y) + e^{2x+y}.$ (5)

b) Use the method of variation of parameters to solve the following differential equation:
$y'' - 2y' + y = \frac{12e^x}{x^3}.$ (5)

9. a) Solve: $x^2y'' - 2xy' - 4y = x^2 + 2\ln x.$ (5)

b) Solve the equation $(7y - 3x + 3)dy + (3y - 7x + 7)dx = 0.$ (5)

10. a) Using the method of undetermined coefficients, solve the equation
$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 4x^2.$ (5)

b) Using Charpit's method, solve the equation
$zp^2 - y^2p + y^2q = 0.$ (5)