

MPH-005

ASSIGNMENT BOOKLET

**M.Sc. (Physics) Programme
(MSCPH)**

ELECTRONICS

Valid from 1st January, 2025 to 31st December, 2025



**School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2025)**

Dear Student,

Please read the section on assignments in the Programme Guide for M.Sc. (Physics). 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. The total marks for this assignment is 100, of which 40 marks 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:

ENROLMENT NO.:

NAME:

ADDRESS:

COURSE CODE:.....

COURSE TITLE:

ASSIGNMENT CODE:

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) **Submit the complete assignment answer sheets containing Part A and Part B, within the due date.**
- 6) The assignment answer sheets are to be submitted to your Study Centre as per the schedule. **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 2025 to 31st December 2025**. If you have failed in this assignment or fail to submit it by December 31, 2025, then you need to get the assignment for the year 2026, 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. For any queries, please contact: sgokhale@ignou.ac.in or mbnewmai@ignou.ac.in. Please note that we do not provide answers to the questions in this Assignment.

We wish you good luck.

Tutor Marked Assignment

ELECTRONICS

Course Code: MPH-005

Assignment Code: MPH-005/TMA/2025

Max. Marks: 100

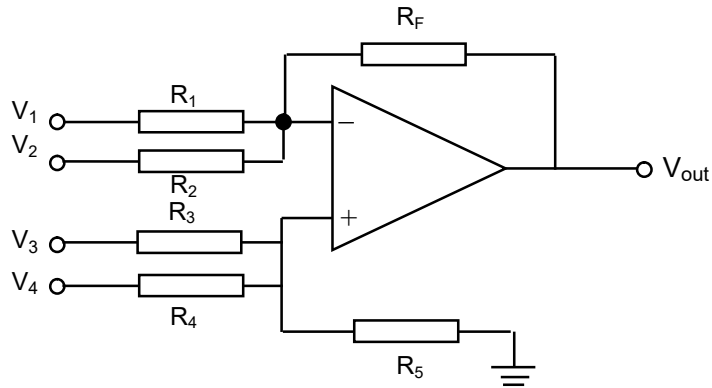
Note: Attempt all questions. The marks for each question are indicated against it.

PART A

1. a) Explain the construction and working of varactor diode. Write its two applications. (4+1)
b) Differentiate between construction and operation of E and D mode of MOSFET. (5)
c) With the help of circuit diagram explain the use of UJT as a diode pump stair case generator. (5)
2. a) Draw the circuit diagram of CMOS inverter circuit and explain its working with the help of truth table. (5)
b) What are the different pumping methods used in Laser diodes to achieve population inversion? Differentiate between LED and Laser diodes. (1+4)
3. a) For a common emitter transistor configuration if $\beta = 120$, $I_E = 5 \text{ mA}$, $r_O = \infty$ and $R_L = 2 \text{ k}\Omega$, calculate Z_i , A_V and A_i . (2+2+1)
b) In double ended input, double ended output configuration of a differential amplifier, the collector resistors $R_{C1} = R_{C2} = 51 \text{ k}\Omega$, emitter resistor $R_E = 47 \text{ k}\Omega$ and supply voltage is $\pm 10 \text{ V}$. Calculate the dc collector voltage and collector current in the circuit. For the matched pair of $n\text{-}p\text{-}n$ transistors with $\beta = 100$, calculate the common mode gain of the circuit. What is the advantage of using a constant current source in the emitter circuit of the differential amplifier? (2+2+1)
4. a) Draw the lead-lag network of Wien bridge oscillator and obtain the expression for its oscillation frequency. (1+4)
b) Explain the mechanical equivalences of $L\text{-}C\text{-}R$ components of an oscillating crystal. A crystal has $C = 0.05 \text{ pF}$, $L = 1 \text{ H}$ and $R = 1 \text{ k}\Omega$. Calculate its series and parallel resonant frequencies. (2+1+2)
c) Explain the construction and operation of Impact Ionization Avalanche Transit-Time (IMPATT) diode used for microwave generation. (5)

PART B

5. a) Obtain the expressions for the individual gains of the 4 input channels shown in the following circuit, and thereby write down the expression for V_{out} . (5)



- b) Design and draw the circuit using op amps to solve the following simultaneous equations:

$$2x + 3y = 13$$

$$-x + y = 1$$

(5)

6. a) What is slew rate of an op-amp? What is its effect on the performance of the op-amp? What is the minimum value of slew rate for reproducing a triangular wave of 100 kHz with ± 10 V amplitude at the output? (1+1+3)
- b) Design and draw the circuit of an inverting Schmitt trigger using op-amp with hysteresis of 40% of $\pm V_{SAT}$. (5)
- c) Design a first order active band pass filter using op-amps to pass the signal in the frequency range of 1 kHz to 10 kHz with voltage gain of 10. (5)
7. a) Explain with the help of circuit diagram the working of linear voltage regulator using bipolar junction transistor as series pass element. State its advantages over shunt regulator using zener diode. (4+1)
- b) Explain the principle of switch mode power supply with the help of schematic diagram. State its advantages over linear power supply. (4+1)
8. a) Draw the circuit diagram of monostable multivibrator using an op-amp and explain its operation. (5)
- b) Explain with the help of circuit diagram working of 4-bit R-2R ladder network DAC using op-amp. (5)
- c) Explain the organization of a typical microprocessor with the help of block diagram. (5)
