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PHE-10

ASSIGNMENT BOOKLET
Bachelor's Degree Programme (B.Sc.)

ELECTRICAL CIRCUITS AND ELECTRONICS

Valid from January 1, 2025 to December 31, 2025

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

Please Note

- **You can take electives (56 to 64 credits) from a minimum of TWO and a maximum of FOUR science disciplines, viz. Physics, Chemistry, Life Sciences and Mathematics.**
- **You can opt for elective courses worth a MINIMUM OF 8 CREDITS and a MAXIMUM OF 48 CREDITS from any of these four disciplines.**
- **At least 25% of the total credits that you register for in the elective courses from Life Sciences, Chemistry and Physics disciplines must be from the laboratory courses. For example, if you opt for a total of 64 credits of electives in these 3 disciplines, at least 16 credits should be from lab courses.**
- **You cannot appear in the Term-End Examination of any course without registering for the course. Otherwise, your result will not be declared and the responsibility will be on you.**

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

2025

Dear Student,

We hope you are familiar with the system of evaluation to be followed for the Bachelor's Degree Programme. At this stage you may probably like to re-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 (TMA) for this course. Submit your assignment response at your Study Centre.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

1) On top of the first page of your **TMA** 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 and in your own words. Do not copy answers from study material.

5) While solving problems, clearly indicate the question number along with the part being solved. Write units at each step of your calculations as done in the text because marks will be deducted for such mistakes. Take care of significant digits in your work. Recheck your work before submitting it.

6) **This assignment will remain valid from January 1, 2025 to December 31, 2025.** However, you are advised to submit it within **12 weeks** of receiving this booklet to accomplish its purpose as a teaching-tool.

Answer sheets received after the due date shall not be accepted.

We strongly feel that you should retain a copy of your assignment response to avoid any unforeseen situation and append, if possible, a photocopy of this booklet with your response.

You could obtain response to the difficulties you may face in PHE-10 course via e-mail by writing to **sgokhale@ignou.ac.in**. Please note that, we do not provide answers to Assignment questions.

We wish you good luck.

Tutor Marked Assignment
ELECTRICAL CIRCUITS AND ELECTRONICS

Course Code: PHE-10
Assignment Code: PHE-10/TMA/2025
Max. Marks: 100

Note: Attempt all questions. Symbols have their usual meanings. The marks for each question are indicated against it.

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1. State, **with reasons**, whether the following statements are True or False. (2×10)

   i) Ideal voltage source has infinite internal resistance.

   ii) Transformer is a passive device hence it cannot increase the voltage.

   iii) Field effect transistor (FET) is a current controlled device.

   iv) Forward biasing of a semiconductor junction diode reduces its energy band gap.

   v) Amplifier with common collector mode offers maximum voltage gain.

   vi) Ripple factor of a center tapped full wave rectifier is greater than that of a bridge rectifier, which uses four diodes.

   vii) Operational amplifier in non-inverting mode cannot amplify negative signals.

   viii) IC LM380 is a small signal amplifier used to amplify the voltage.

   ix) Largest decimal number represented by a 2-digit hex number is 99.

   x) In a CRO sweep generator output is given to the vertical deflection plates.

2. a) Use superposition principle to find the current flowing through R_2 in Fig.1. (6)

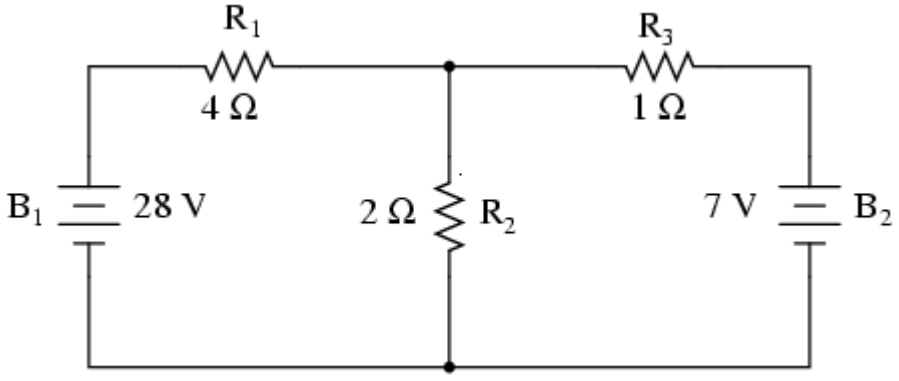

Fig. 1

   b) Explain with a neat diagram application of *p-n* junction diode as a peak voltage detector. (4)

3. a) A series *LCR* circuit with L = 400 mH, C = 20 nF and R = 250 Ω is connected to an AC source of 65 V. Calculate the resonance frequency and Q of the circuit. What is the current flowing through the circuit and voltage across the capacitor at resonance frequency? (6)

   b) Which processes are responsible for the charge carrier transport in a semiconductor? Which of these govern in the case of a bulk semiconductor when no potential is applied? (4)

4. a) Refer to the universal bias shown in Fig. 4.11 of your study material. If V_{cc} = 10V, $R_1 = R_2 = R_C = R_E$ = 10kΩ, V_{BE} = 0.7V and β = 100, calculate V_B, V_E, I_E, I_B, V_C and V_{CE}. (6)

b) *h*-parameters of a single stage *CE* amplifier are given as h_{ie} = 1 kΩ , $h_{re} = 3 \times 10^{-4}$, h_{fe} = 60 and h_{oe} = 25 μAV^{-1}. Calculate A_i, A_v and Z_{out} with r_s =100Ω and r_L =10kΩ. (4)

5. a) State the Barkhausen criterion for sustained oscillation. Explain the operation of Colpitt Oscillator. For a Colpitt oscillator with 10 MHz frequency determine the equivalent capacitance, *C* forming tank circuit with 0.1 mH inductor. (6)

b) In a voltage regulator circuit, the output voltage under no load condition is 12V while under full load it is 11.8V. Over the full range of input voltage variation the nominal voltage output of 12V varies by 50 mV. Calculate percentage line and load regulation. (4)

6. a) Draw a circuit of a non-inverting amplifier with gain 1 using op-amp. Draw the output voltage curve of this circuit for a step input of 5V amplitude and 50 kHz frequency, if the slew rate of the op-amp is 0.5 Vμs^{-1}. (Use proper scale on the time axis to illustrate the effect of slew rate). (5)

b) Design and draw the circuit of a three channel op-amp adder with channel gains of –5, –10 and –15 respectively. (5)

7. a) Draw a circuit of amplifier of gain 50 using IC 380. Use the non-inverting terminal as input signal terminal. (5)

b) Design and draw the circuit of a regulated power supply using LM 317 to provide 30V output. (5)

8. a) Design and draw the circuit diagram of a Mod-6 ripple counter. (5)

b) A 4–bit DAC produces 22 mV output for a digital input of 1011. What is the resolution for this DAC? Find out V_{out} for 0101? (5)

9. a) Explain the working of *D*-flip flop. How does it differ from a *D*-latch? (5)

b) Explain the construction and working of a differential amplifier type EVM. (5)

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