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PHE-10

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

ELECTRICAL CIRCUITS AND ELECTRONICS

Valid from January 1, 2022 to December 31, 2022

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.**

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

2022

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, 2022 to December 31, 2022.** 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/2022
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) Source impedance of an electronic circuit is $Z_S = 7 - j\sqrt{5}$. In this circuit, the load impedance should be $Z_L = 7 - j\sqrt{5}$ in order to transfer maximum power from the source to the load.

   ii) When germanium is doped with phosphorous, it becomes *p*-type semiconductor.

   iii) In common collector amplifier the output voltage is out of phase with the input voltage.

   iv) In a positive feedback amplifier gain increases but the bandwidth decreases.

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

   vi) CMRR indicates noise rejection capacity of an op-amp.

   vii) Op-amp works only under a negative feedback.

   viii) Drop-out voltage of a voltage regulator IC is zero.

   ix) Clocked *JK* flip-flop suffers with a problem of race condition.

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

2. Determine V_{ab} for the circuit shown in Fig. 1 using **superposition principle**. What is the current flowing through branch *a*-*b*? (8+2)

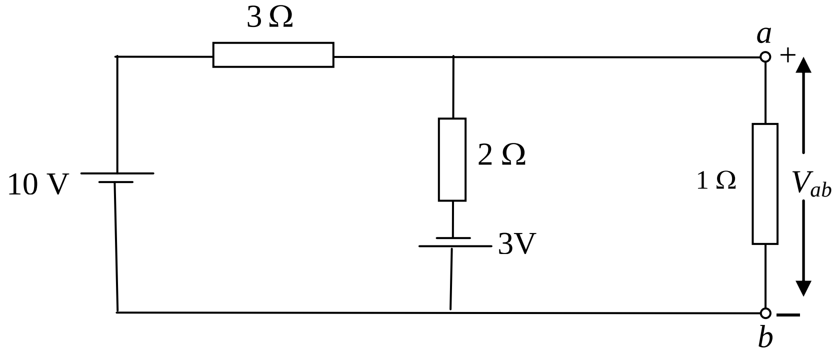

Fig. 1

3. a) Describe the formation of depletion layer in a *p*-*n* junction diode. Explain the *I*-*V* characteristics of *p*-*n* junction in forward and reversed biased conditions. (2+2)

   b) *h*-parameters of a single stage *CE* amplifier are given as $h_i = 1\ \text{k}\Omega$, $h_r = 3 \times 10^{-4}$, $h_f = 60$ and $h_o = 25\ \mu\text{AV}^{-1}$. Calculate A_i, A_v and Z_{out} with $r_s = 10\ \text{k}\Omega$ and $Z_{in} = 856\ \Omega$. (6)

4. a) What is meant by bias stability in an amplifier circuit? Why is universal biasing preferred over fixed or self biasing? Explain, how the universal biasing works in a linear circuit. (5)

   b) State the Barkhausen criterion for sustained oscillation. Explain the operation of Hartley Oscillator. A Hartley oscillator oscillates with 10 MHz frequency. Determine the total inductance, L forming the tank circuit with 5 pF capacitor. (1+2+2)

5. a) A phase shift oscillator has three identical RC sections, with $R = 10\ \text{k}\Omega$. If the oscillator is to generate frequencies in the range from 1 kHz to 100 kHz, determine the range of C. (3)

   b) Design and draw a zener regulated power supply for 5V and 100 mA maximum load current output. Assume the input unregulated voltage to be 10V and minimum zener operation current to be 5 mA. Specify the power rating of zener, value and power rating of resistor used. (7)

6. Draw the output waveform (with proper scales on both axes) of the circuit given in Fig. 2(a) for the input waveform shown in Fig. 2(b). (10)

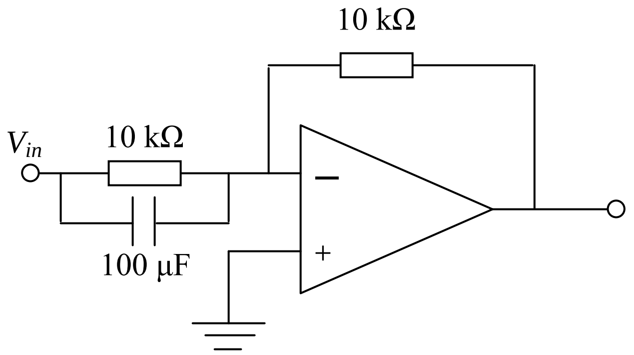

Fig. 2(a)

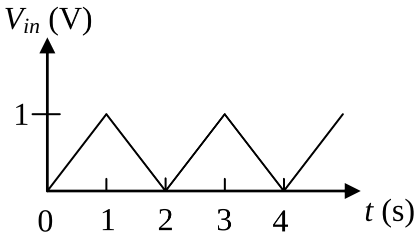

Fig. 2(b)

7. a) Design and draw a non-inverting amplifier using op-amp with gain +1. (4)

   b) Design a regulated power supply using LM 317 to provide 30 V output. (4)

   c) Why are special purpose amplifier ICs preferred over IC 741 Op-amp in audio systems? (2)

8. Build a half adder circuit using only NOR gates. (10)

9. a) Design and draw a Mod 3 ripple counter. (3)

   b) In a 4-bit DAC, 0001 input results into 0.8 V output. What is the maximum output voltage of this DAC? (2)

   c) Design a circuit of basic function generator to generate a triangular wave of 1 kHz frequency and ± 10 V amplitude. (5)

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