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PHE-10

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

ELECTRICAL CIRCUITS AND ELECTRONICS

Valid from January 1, 2020 to December 31, 2020

It is compulsory to submit the Assignment before filling in 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
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Maidan Garhi, New Delhi-110068

2020

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, 2020 to December 31, 2020.** 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/2020
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) Diode is a bilateral device.

   ii) Parallel *LCR* circuit can be used as a band-pass filter.

   iii) A pentavalent element is added to silicon to obtain an *p*-type semiconductor.

   iv) Feedback in a circuit always reduces its gain.

   v) Barkhausen criterion gives the condition for stabilization of an amplifier gain.

   vi) When input is given to an op-amp in open loop condition the output voltage is infinite.

   vii) Rectifier in a power supply regulates its output voltage.

   viii) According to De Morgens' theorem

   $$\overline{A} \times \overline{B} = \overline{A \times B}$$

   ix) Ring counter with 4 flip flops can count 32 pulses.

   x) The sensitivity of flux meter is independent of the number of turns of the search coil.

2. a) In the circuit shown in Fig. 1, determine the value of load impedance (Z_L) in order to get maximum power transfer at 100 Hz. What are the component values required to obtain this Z_L? (10)

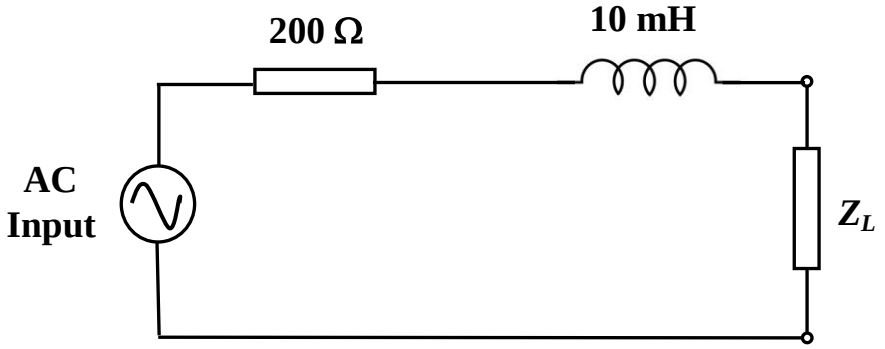

Fig. 1

3. What is depletion region in case of a *p-n* junction? Explain the origin of junction barrier potential. Discuss its dependence on the applied voltage, carrier concentration and type of semiconductor. (3+2+5)

4. Which type of amplifier is used for obtaining both current and voltage gains? Draw a circuit of such amplifier in fixed bias condition using a *p-n-p* transistor. (Clearly indicate the polarities of biasing voltages.) What are the limitations of fixed biasing? How are these limitations overcome by using universal bias? (2+4+2+2)

5. a) With the help of a circuit diagram explain, how regenerative feedback is provided in Hartley oscillator. (5)

   b) Design and draw a zener voltage regulator to provide 12V output if load resistance varies between 100 Ω and 200Ω. Assume that the input unregulated dc voltage is 18V and minimum zener operating current is 10 mA. Calculate the wattage of the Zener diode, value and wattage of R_S. (5)

6. a) Design an adder circuit using op-amp to satisfy following equation:

$$-V_o = V_1 + 3V_2 + 2V_3 + 2V_4 + 4V_5$$

   The supply voltage of the op-amp is ± 13V and output saturation voltage is ± 12 V. The circuit should always operate in its linear range. What are the minimum-maximum voltage values of V_1, V_2, V_3, V_4 and V_5 when only one of them is connected to the input at a given time (i.e. other input voltages are zero)? What is the value of maximum voltage V_i if $V_1 = V_2 = V_3 = V_4 = V_5 = V_i$?) (3+5+2)

7. a) Draw the output waveform indicating proper scales on the time and voltage axes for the given input waveform (V_i) to the circuit shown in Fig. 2. (5)

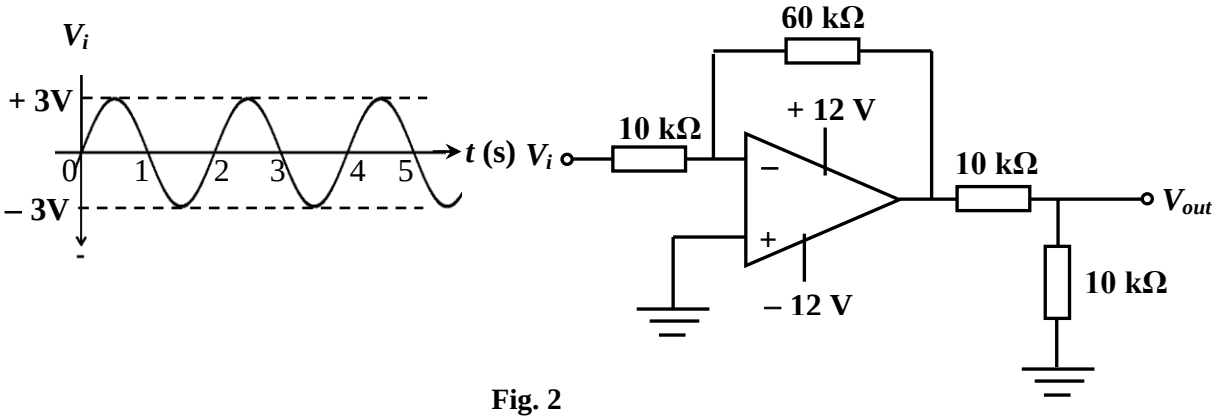

Fig. 2

   b) Design and draw voltage regulator to provide 4 to 10V variable output voltage using IC 7812. (5)

8. a) Divide 0001010001001001 (BCD) by 1001_2 and express the result in octal equivalent. (5)

   b) Design an XNOR gate with two inputs *A* and *B* using only NAND gates. Mention the expressions in terms of *A* & *B* at the output of each NAND gate in your circuit diagram. (5)

9. a) Design a Mod 13 counter. (5)

   b) What are the different modes of operating a dual trace CRO? Which mode is preferred at high frequencies? Why does it cause flicker at lower frequencies? (1+2+2)

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