Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination November 2025

Roll no.....

Name of the Course and semester: BTech, 1st Sem
Name of the Paper: Basic Electronics Engineering
Paper Code: TEC 101
Time: 3 hour Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks) **(CO1)**

a. (i) $(211)_x = (152)_8$, find the value of 'x'.

(ii) If AB'+A'B = C; then show that AC'+A'C = B.

b. Solve the following with the help of K-Map and realize the simplified equation usingNAND gate only and NOR gate only:

$$F(A,B,C,D)=\pi M(0,1,3,5,7,8,9,11,13,14,15)$$

c. Convert the following function into canonical SOP form and find the min terms and max terms:

$$F(A,B,C,D) = (A'.C)+(A.B.C')+(A'.C'.D)+(A.B.D')$$

Q2. (2X10=20 Marks) **(CO2)**

a. (i) Explain formation of energy bands in a solid crystal. Differentiate conductor, semiconductor and insulator based on energy band diagram.

(ii) In a doped semiconductor, there are 4.52×10^{24} holes/m^3 and 1.25×10^{14} electrons/m^3. What will be the carrier density of undoped specimen?

If electron and hole mobilities are 0.38 m^2/V-sec and 0.18 m^2/V-sec respectively, determine conductivity of intrinsic and doped semiconductor.

b. (i) Define mobility and drift velocity. Prove that conductivity of a conductor is given by $\sigma = \mu ne$.

(ii) The voltage across silicon diode at room temperature is 0.71 V when 2.5 mAmp current flows through it. If the voltage increases to 0.8 V, then calculate the new diode current.

c. (i) What is α and β? Derive the relationship between α and β.

(ii) In a transistor if $\alpha = 0.975$ and emitter current is 8 mA, I_{CBO} is 0.36 μA. Then determine I_C, I_B, β and I_{CEO}.

Q3. (2X10=20 Marks) **(CO3)**

a. Fig. (i) and Fig. (ii) show the centre-tap and bridge type circuits having the same load resistance (100 Ω) and transformer turn ratio (5:1). The primary of each is connected to 230V, 50 Hz supply. Find peak, avg. and rms current in each case. Assume the diodes to be ideal with forward resistance of 10 Ω.

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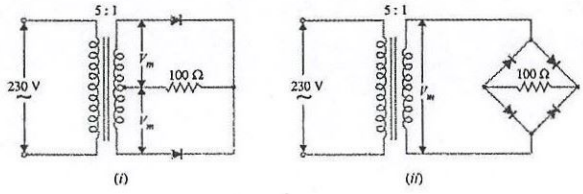


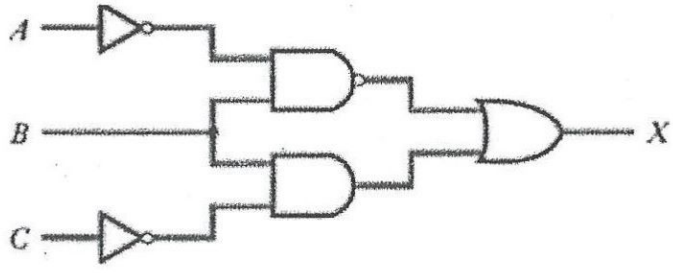
b. Derive an expression for ripple factor (γ) rectifier efficiency (η) of fullwave rectifier.

c. (i) Derive an expression for the output voltage of summing amplifier.

(ii) Design an adder circuit using op-amp. to get $V_o = -(V_1 + 10V_2 + 100V_3)$; if $R_f = 100k\Omega$.

Q4. (2X10=20 Marks) **(CO1/CO2)**

a. Derive Boolean expression for output X for given digital circuit and sketch truth table. Also find the min terms and max terms.



b. Simplify following expressions with the help of Boolean algebra:

(i) F=(A+B)(A+B')(A'+C)

(ii) F=[(AB)'(C+BD)+A'B']C

(iii) F=(C+D)'+A'CD'+AB'C+ACD'

(iv) F=(A'B+AB')'(A+B)

c. A bar of pure Si has a cross sectional area 1.5 mm^2. If the intrinsic concentration is $1.5 \times 10^{16}/m^3$.

(i) Determine conductivity if electrons and holes mobility are 0.14 m^2/V-sec and 0.06 m^2/V-sec respectively.

(ii) Find the length of the bar if it's resistance is 40 kΩ.

Q5 (2X10=20 Marks) **(CO2/CO3)**

a. (i) Draw the common base configuration circuit and explain its current gain, input and output characteristics.

(ii) Derive relationship between I_{CBO} and I_{CEO}.

b. Explain the working of halfwave rectifier with appropriate circuit diagram as well as input/output waveforms. Derive the avg. and rms current for half wave rectifier as well.

c. Draw and explain the inverting and non-inverting amplifier circuit. Also, derive an expression for their close loop gain as well.