QUESTION PAPER

Name:

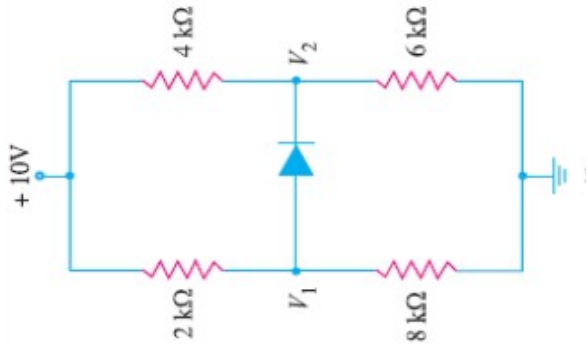
Enrolment No:

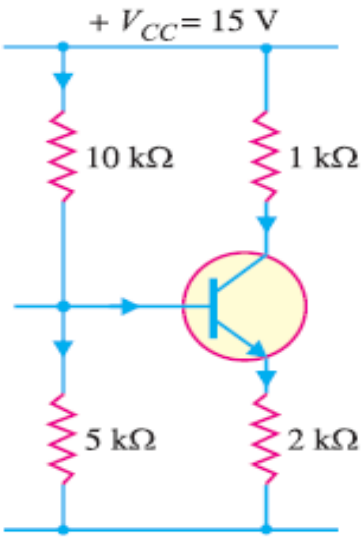
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Analog and Digital Electronics (ECEG-2024) **Semester: III**
Program: B. Tech- Electrical Engineering
Time: 03 hrs. **Max. Marks: 100**

Instructions: Attempt all the sections.

SECTION A (20 Marks)

S. No.	**Answer all the questions.**	**Marks**	**CO**
Q 1	Define a hole in semiconductor and indicate pictorially how it contributes in conduction?	**4**	**CO1**
Q 2	Elucidate the two basic processes which are responsible for the movement of electrons and holes in a semiconductor.	**4**	**CO1**
Q 3	Determine if the diode (ideal) in Fig. (1) is forward bias or reverse biased.  **Fig. (1)**	**4**	**CO2**
Q 4	Minimize and implement the following multiple output functions using K-map $F_1 = \sum m\,(1, 2, 3, 6, 8, 12, 14, 15)$ $F_2 = \prod M\,(0, 4, 9, 10, 11, 14, 15)$	**4**	**CO3**
Q 5	Attempt all the parts: (i) $(11011)_2 \rightarrow (?)_{\text{Gray code}}$ (ii) $(10011)_{\text{Gray code}} \rightarrow (?)_2$ (iii) $(126)_{10} \rightarrow (?)_{Excess-3}$	**4**	**CO3**

	(iv) $(1367)_{BCD} \rightarrow (?)_2$		
	SECTION B (40 Marks)		
	Answer all the questions.		
Q 6	A binary ripple counter is required to count up to $(16,383)_{10}$. How many FFs are required? If the clock frequency is 8.192MHz, What is frequency at the output of the MSB?	**10**	**CO4**
Q 7	**Attempt both the parts:** **(a)** How does photo diode differ from an ordinary diode? Analyze the performance characteristics of the photo diode. **(b)** Derive the expression for the efficiency of a full-wave rectifier.	**10**	**CO2**
Q 8	A semiconductor diode having ideal forward and reverse characteristics is used in a half wave rectifier circuit supplying a resistive load of 1000 ohm. If the r.m.s. value is 250V, determine (i) the r.m.s. value of diode current (ii) power dissipated in the load.	**10**	**CO2**
Q 9	Determine the operating point of the transistor biasing circuit shown in Fig. (2) by using Thevenin theorem.  **Fig. (2)** **OR** Reduce both the Boolean expressions as, **(i)** $Y = A\left[B + \overline{C}\left(\overline{AB + A\overline{C}}\right)\right]$ **(ii)** $Y=(B+BC)(B+\overline{B}C)(B+D)$	**10**	**CO3**

	SECTION-C (40 Marks)		
	Answer all the questions.		
Q 10	You are presented with a set of requirements under which an insurance policy can be issued. The applicant must be: **1.** a married female 25 years old or over, or **2.** a female under 25, or **3.** a married male under 25 who has not been involved in a car accident, or **4.** a married male under 25 who has not been involved in a car accident, or **5.** a married male 25 years or over who has not been involved in a car accident. Find an algebraic expression which assumes a value '1' whenever the policy is issued. Simplify the expression obtained and design logic diagram for the same.	**15+5**	**CO3**
Q 11	• **Attempt both the parts:** **a)** Design a synchronous BCD counter using J-K flip flops. **b)** Design a logic circuit with 4 inputs A, B, C, D that will produce output '1' only whenever two adjacent input variables are 1s. "A and D are also to be treated as adjacent." Implement it using 'OR' universal logic gate. **OR** Design a circuit that can be built using AOI logic and output is '1' when a 4-bit BCD code translated to a number that uses the upper right segment of a single 7-Segment display system.	**10+10**	**CO4/ CO3**

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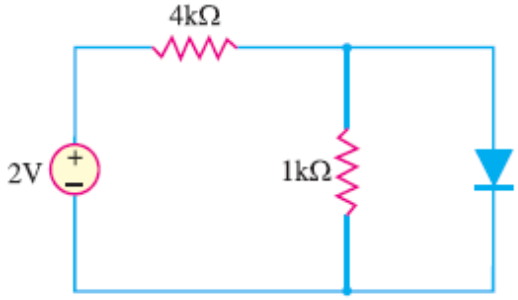
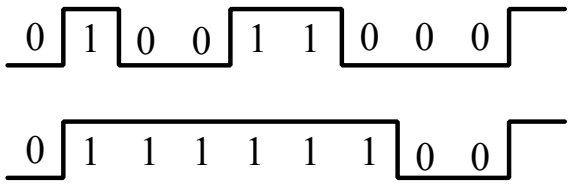
SECTION A (20 Marks)

S. No.	**Answer all the questions.**	**Marks**	**CO**
Q 1	How does a tunnel diode work and analyze tunneling effect in tunnel diode with the performance characteristics.	**4**	**CO1**
Q 2	Determine the state of diode for the circuit shown in Fig. (1) and find I_D and V_D. Assume simplified model for the diode.  **Fig. (1)**	**4**	**CO2**
Q 3	Minimize the following multiple output functions $F_1 = \sum m\,(0, 2, 6, 10, 11, 12, 13) + d\,(3, 4, 5, 14, 15)$ $F_2 = \sum m\,(1, 2, 6, 7, 8, 13, 14, 15) + d\,(3, 5, 15)$	**4**	**CO3**
Q 4	(i) $(123)_{10} \rightarrow (?)_{Excess-3}$ (ii) $(110110)_2 \rightarrow (?)_{\text{Gray code}}$ (ii) $(11011)_{\text{Gray code}} \rightarrow (?)_2$ (iv) $(1275)_{BCD} \rightarrow (?)_2$	**4**	**CO3**
Q 5	How combinational circuits are differing from the sequential circuits? Defend it with the specific reasons.	**4**	**CO4**

	SECTION B (40 Marks)		
	Answer all the questions.		
Q 6	For what minimum value of propagation delay in each flip-flop (FF) will a 10-bit ripple counter skip a count when it is clocked at 10MHz?	**10**	**CO4**
Q 7	**Attempt the both parts:** **(a)** Derive the expression for the efficiency of a Half-wave rectifier. **(b)** The four diode used in a bridge rectifier circuit have forward resistance which may be considered constant at 1Ω and infinite reverse resistance. The alternating supply voltage is 240 r.m.s. and load resistance is 480 Ω. Calculate: (i) mean load current (ii) power dissipated in each diode.	**10**	**CO2**
Q 8	Obtain the minimal expression for F= ∑m (1, 2, 3, 5, 6, 7, 8, 9, 12, 15) using the Quine- McCluskey (Tabulation) method.	**10**	**CO3**
Q 9	Design a 2- input 2-output synchronous sequential circuit which produces an output z=1, whenever any of the following input sequences 1100, 1010, or 1001 occurs. The circuit resets to its initial state after a 1 output has been generated. **OR** Design and 4-bit binary data B_4, B_3, B_2, B_1 to Gray code converter.	**10**	**CO4**
	SECTION-C (40 Marks)		
	Answer all the questions.		
Q 10	A lawn-sprinkling system is controlled automatically by certain combinations of the following variables, (i) Season (S=1, if summer; 0, otherwise (ii) Moisture content of soil (M=1, if High; 0, if Low) (iii) Outside temperature (T= 1, if High; 0, if Low) (iv) Outside humidity (H= 1, if High; 0, if Low) The sprinkler is turned on under any of the following circumstances, (1) The moisture content is Low in winter (2) The temperature is High and the moisture content is Low in summer (3) The temperature is High and the humidity is High in summer (4) The temperature is Low and the moisture content is Low in summer (5) The temperature is High and the humidity is low. Use a K-map to find the simplest possible logic expression involving the variables S, M, T and H for turning on the sprinkler system.	**20**	**CO3**

Q 11	• **Attempt both the parts:** **(a)** Design a pulse generator using indirect logic to produce the following waveforms shown in Fig. (2) as,  **Fig. (2)** **(b)** Analyze the operation of encoder and design an Octal –to-Binary (8-line to 3-line) encoder. **OR** Design a combinational circuit that accepts a 3-bit BCD number (A, B, D) and generates an output binary number equal to the square of the input numbers.	**10+10**	**CO4/ CO3**