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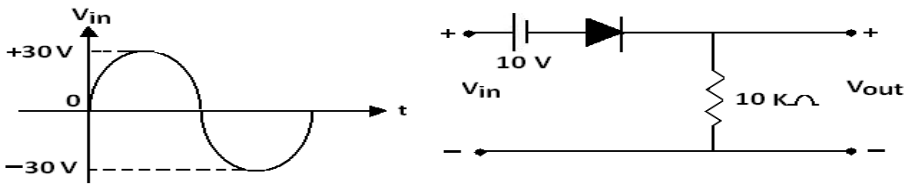
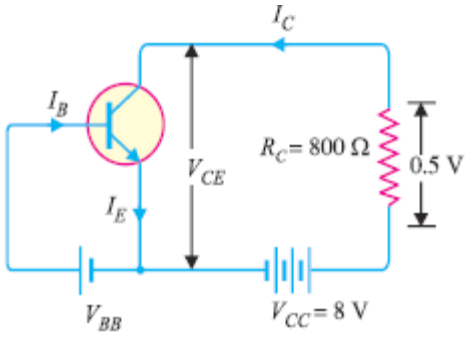
| **Name:**<br>**Enrolment No:** | UPES |

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

**Course: Analog and Digital Electronics (ECEG2025)** **Semester: III**
**Program: B. Tech. / PSE**
**Time: 03 hrs.** **Max. Marks: 100**

**Instructions: Attempt all the sections.**

**SECTION A** **(5 X 4 = 20)**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | Draw the output waveform for the clipper circuit shown in figure 1.<br>  <br><br>Figure 1 | 4 | CO1 |
| Q 2 | A transistor is connected in common emitter (CE) configuration in which collector supply ($V_{cc}$) is 8V and the voltage drop across resistance $R_C$ connected in the collector circuit is 0.5 V. The value of $R_C$ = 800 ohm. If α = 0.96, determine:<br><br>(i) collector-emitter voltage<br>(ii) base current<br>  <br><br>Figure 2 | 4 | CO2 |
| Q 3 | Simplify the expression F(A,B,C,D) = ∏(0,1,4,5,6,8,9,12,13,14) using K-map and implement the result using NAND gates. | 4 | CO3 |

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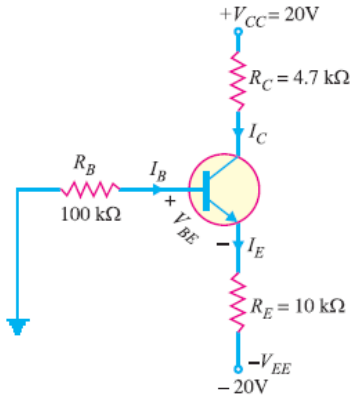
| Q 4 | Differentiate the following<br>(a) Combinational and Sequential circuits<br>(b) Level-triggered and Edge-triggered flip-flops | **4** | **CO4** |
| Q 5 | (a) Encode data bits 0101 into a 7-bit even parity Hamming code.<br>(b) A 7-bit Hamming code is received as 0101101. What is its correct code? | **4** | **CO3** |
| | **SECTION B** | | **(4 X 10 = 40)** |
| Q 6 | (a) Implement the following boolean expression using a 8 to 1 multiplexer.<br>$F(A,B,C,D) = \sum (0,1,3,4,8,9,15)$<br>(b) Design and implement octal to binary encoder. | **5+5** | **CO3** |
| Q 7 | (a) A 230 V, 50 Hz a. c. voltage is applied to the primary of a 5:1 step-down transformer which is used in a bridge rectifier having a load resistor of value 500 ohm. Assuming the diodes to be ideal, determine the following:<br>(i) d. c. output voltage (ii) d. c. power delivered to the load<br>(iii) PIV of each diode (iv) output frequency<br>(b) Design and implement D flip-flop using S-R flip-flop. | **5+5** | **CO1, CO4** |
| Q 8 | (a) Determine the operating point of the transistor biasing circuit shown in figure 3. The value of $\beta = 85$ and $V_{BE} = 0.7V$.<br>  <br><br>Figure 3<br>(b) Derive the expression of stability factor for the voltage divider bias circuit. | **5+5** | **CO2** |
| Q 9 | Design a MOD-6 counter using J-K flip flops.<br>OR<br>Design a synchronous BCD counter using J-K flip flops. | **10** | **CO4** |
| | **SECTION C** | | **(2 X 20 = 40)** |
| Q 10 | (a) Design a 4-bit gray to binary code converter. | **10** | **CO3** |

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| | (b) Design a combinational circuit that accepts a 4-bit number and generates a output binary number equal to the square of the input number. | **10** | **CO3** |
| Q 11 | (a) Design a self-correcting MOD-9 shift counter using D flip-flops.<br><br>(b) An air-conditioning unit is controlled by four variables: temperature T, humidity H, the time of the day D, and the day of the week W. The unit is turned on under any of the following circumstances.<br>1. The temperature exceeds 78$^{o}$F, and the time of the day is between 8 a. m. and 5 p. m.<br>2. The humidity exceeds 85%, the temperature exceeds 78$^{o}$F, and the time of the day is between 8 a. m. and 5 p.m.<br>3. The humidity exceeds 85%, the temperature exceeds 78$^{o}$F and it is a weekend.<br>4. It is Saturday or Sunday and humidity exceeds 85%.<br><br>Write a logic expression for controlling the air-conditioning unit. Simplify the expression obtained as far as possible. | **10+10** | **CO4, CO3** |

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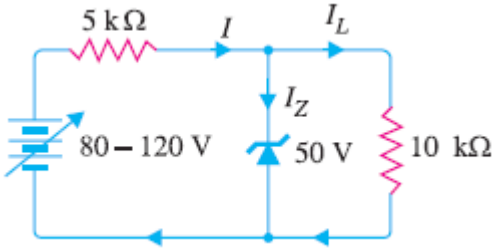
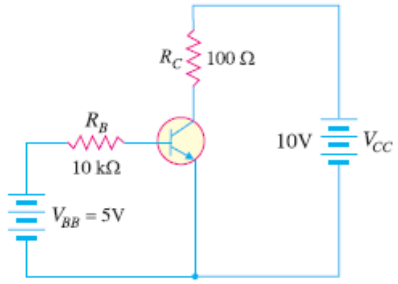
**Instructions: Attempt all the sections.**

**SECTION A** **(5 X 4 = 20)**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | In the figure 1, find the minimum and maximum value of zener diode current.<br>  <br><br>Figure 1 | 4 | CO1 |
| Q 2 | Determine the VCB in the circuit shown in figure 2. The transistor is of silicon and has β =150.<br>  <br><br>Figure 2 | 4 | CO2 |
| Q 3 | Simplify the following Boolean function and obtain (i) minimal SOP (ii) minimal POS expressions<br>$F(A,B,C,D)=\sum m(1,3,7,11,15)+\sum_d (0,2,5)$ | 4 | CO3 |
| Q 4 | Explain the operation of master-slave flip-flop and show how the race around condition is eliminated in it. | 4 | CO4 |

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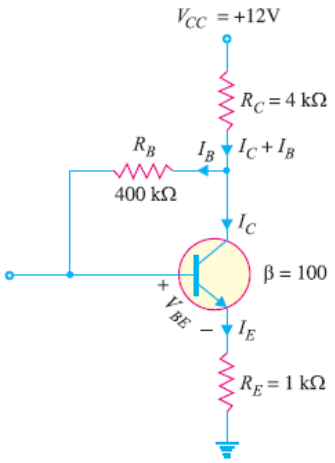
| Q 5 | Convert the following codes<br><br>(i) $(96.42)_{10} = ()_{BCD}$<br>(ii)$(643)_{10} = ()_{Excess3}$<br>(iii) $(10101101)_2 = ()_{Gray\ code}$<br>(iv) $(110101)_{Gray\ code} = ()_2$ | **4** | **CO3** |
| | **SECTION B** | **(4 X10 =40 Marks)** | |
| Q 6 | (a) Design and implement J-K flip-flop using S-R flip-flop.<br><br>(b) A 220 V, 50 Hz a. c. voltage is applied at the primary of a 4:1 step-down, center-tap transformer used in a full wave rectifier having a load resistance of 800 ohm. If the diode resistance has a value of 200 ohm, determine:<br>(i) d. c. voltage across the load<br>(ii) d. c. current flowing through the load<br>(iii) d. c. power delivered to the load<br>(iv) PIV across each diode<br>(v) output frequency | **5+5** | **CO4, CO1** |
| Q 7 | Find the minimal sum of product for the Boolean expression using the Quine- McCluskey (Tabulation) method.<br><br>F(A,B,C,D) = ∑m (0, 1, 2, 3, 6, 7, 8, 10, 12, 15) | **10** | **CO3** |
| Q 8 | Determine the operating point and the stability factor for the biasing circuit shown in figure 3. The value of β = 100 and $V_{BE}$ = 0.7V.<br><br>  <br><br>Figure 3 | **10** | **CO2** |
| Q 9 | Design a 4-bit synchronous down counter that counts through all states from 1111 down to 0000.<br><br>**OR** | **10** | **CO4** |

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| | Design a 4-bit unit distance Up-Down counter using D flip-flops. | | |
| | **SECTION C** | | **(2 X 20 = 40)** |
| Q 10 | (a) Design a 4-bit binary to Gray code converter.<br><br>(b) Implement three-variable Boolean function $F = \bar{A}C + A\bar{B}C + B\bar{C}$ using<br><br>(i) 8-to-1 multiplexer<br>(ii) 4-to-1 multiplexer. | **10+10** | **CO3** |
| Q 11 | (a) Design a even parity bit generator for a 4-bit input.<br><br>(b) Design a MOD-7 Johnson counter using J-K flip-flops. | **10+10** | **CO3, CO4** |