Hall Ticket No | | | | | | | | | | | Question Paper Code: AECB05

# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-II

B.Tech III Semester End Examinations, November 2020

Regulations: IARE - R18

## ANALOG AND DIGITAL ELECTRONICS

INFORMATION TECHNOLOGY

Time: 3 hour Maximum Marks: 70

**Answer ONE Question from each MODULE**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### MODULE-I

1. (a) Explain the formation of depletion region in an open-circuited p-n junction diode and also the effect of forward and reverse biasing of p-n junction on the depletion region with neat sketches? [**7m**]

   (b) A P-N junction germanium diode has a reverse saturation current of 0.10 A at the room temperature of 270C.It is observed to be 30A, when the room temperature is increased. Evaluate the room temperature? [**7m**]

2. (a) Construct the circuit diagrams of a full wave rectifier and Bridge rectifier. Explain the operation of the circuit with relevant waveforms. [**7m**]

   (b) A full wave bridge rectifier having load resistance of 100 is fed with 220V, Assuming the diodes are ideal, Find the following terms: [**7m**]

   (i) DC output voltage
   (ii) Peak inverse voltage
   (iii) Rectifier efficiency

### MODULE-II

3. (a) Explain clearly the DC and AC load line and also explain how to obtain quiescent point graphically for a transistor amplifier of CE configuration. [**7m**]

   (b) Common emitter circuit has the following components.$R_s = 1k\Omega$, $R_1 = 110k\Omega$, $R_1 = 12k\Omega$ $R_c = 6k\Omega$. H-parameters are $h_{ie} = 1.2k\Omega$, $h_{fe} = 75$ and $h_{oe} = 25\mu A/V$ $h_{re} = 25 * 10^{-4}\mu A/V$. Draw the equivalent hybrid model and calculate $A_i$, $R_i$, $A_v$, $R_0$? [**7m**]

4. (a) Explain following terms with neat sketch : [**7m**]

   (i) cut off region,
   (ii) saturation region
   (iii) active region

(b) Compute current gain, voltage gain, input and output impedance of the CB amplifier if it is driven by a voltage source of internal resistance $R_s = 1k$.The load impedance is $R_L = 1K$. The transistor parameters are $h_{ib} = 22$, $h_{fb} = -0.98$, $h_{rb} = 2.910^{-4}$, $h_{ob} = 0.5\mu A/V$.[**7m**]

## MODULE-III

5. (a) Develop the gray to binary and binary to gray conversion logic with neat sketches. [**7m**]

   (b) Perform the subtraction using 1s complement and 2s Complement [**7m**]

   (i) $(11010)_2 - (10000)_2$

   (ii) $(1000100)_2 - (1010100)_2$

6. (a) Give the Boolean expressions, symbols and truth tables for following gates: (i) AND NOR (ii) EX-OR (iii) OR (iv) EX-NOR. [**7m**]

   (b) Obtain the canonical SOP form of the following functions: [**7m**]

   (i) Y(A,B) = A+B.

   (ii) Y(A,B,C,D) = AB+ACD

## MODULE-IV

7. (a) Construct a 64:1 MUX using 8:1 MUXs with suitable neat block diagram. [**7m**]

   (b) Solve the following Boolean expressions using K-map and implement it by using NOR gates. [**7m**]

   (i) $F(A, B, C, D) = AB^{'}C^{'} + AC + A^{'}CD^{'}$

   (ii) $F(W, X, Y, Z) = w^{'}x^{'}y^{'}z^{'} + wxy^{'}z^{'} + w^{'}x^{'}yz + wxyz$

8. (a) Implement the given function in 4:1 mux f= m(0,1,3,5,6) [**7m**]

   (b) Build a De-Multiplexer using F(w,x,y,z) = m (1,4,5,6,7,9,14,15) [**7m**]

## MODULE-V

9. (a) Write short notes on shift register? Mention its application along with the Serial Transfer in 4-bit shift Registers? [**7m**]

   (b) Identify the steps involved in design of asynchronous sequential circuit in detail with an example? [**7m**]

10. (a) Explain 3 bit ring counter? Discuss how ring counters differ from twisted ring counter? [**7m**]

    (b) Construct and implement 4-bit binary counter (using D flip flops) which counts all possible odd numbers only? [**7m**]

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****END OF EXAMINATION****

## COURSE OBJECTIVES:

**The course should enable the students to:**

| | |
|---|---|
| 1 | The Fundamental knowledge of the operational principles and characteristics of semiconductor devices and their applications. |
| 2 | The basic concept of number systems, boolean algebra and optimized implementation of combinational and sequential circuits. |
| 3 | The perceive subsequent studies in the area of microprocessors, microcontrollers, VLSI design and embedded systems effectively use of fundamentals of digital electronics. |

## COURSE OUTCOMES:

**After successful completion of the course, students should be able to:**

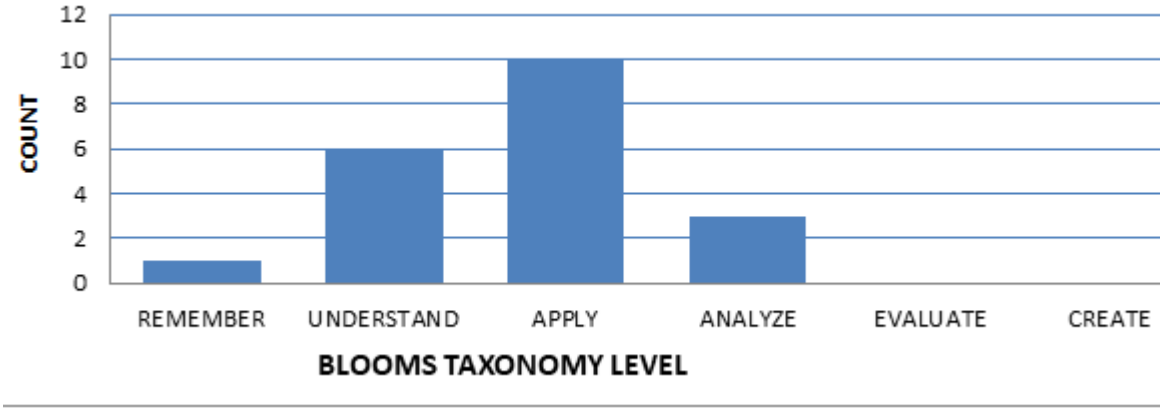
| | |
|---|---|
| CO 1 | Recall the properties of semiconductor materials which form the basis for the formation of PN junction diode. |
| CO 2 | Illustrate the volt-ampere characteristics of semiconductor devices for finding cut-in voltage, static, dynamic resistance and transition, diffusion capacitance. |
| CO 3 | Apply the pn junction characteristics for the diode.Applications such as switch and rectifiers. |
| CO 4 | Explain half wave and full wave rectifier circuits with filter and without filters for conversion of alternating current in to direct current. |
| CO 5 | Interpret DC and AC load line analysis of different amplifiers for optimal operating level regardless of input, load placed on the device. |
| CO 6 | Analyse the input and output characteristics of transistor configurations and small signal h-parameter models for determining the input - output resistances, current gain and voltage gain. |
| CO 7 | Compare the binary decimal, octal and hexadecimal number systems in terms of basic arithmetic operations. |
| CO 8 | Identify the functionality of logic gates, parity code and hamming code techniques for error detection and correction of single bit in digital systems. |
| CO 9 | Apply Boolean postulates and theorems, k-map and tabular methods for obtaining minimized Boolean expressions. |
| CO 10 | Develop gate level combinational circuits to built adders, subtractors, multiplexers, demultiplexers, encoder and decoders. |
| CO 11 | Describe the operation of Flip-Flops and latches for constructing sequential circuits . |
| CO 12 | Implement the synchronous& asynchronous counters for memory storing applications. |

## MAPPING OF SEMESTER END EXAMINATION QUESTIONS TO COURSE OUTCOMES

| Q.No | | All Questions carry equal marks | Taxonomy | CO's | PO's |
|---|---|---|---|---|---|
| 1 | a | Explain the formation of depletion region in an open-circuited p-n junction diode and also the effect of forward and reverse biasing of p-n junction on the depletion region with neat sketches? | Remember | CO 1 | PO 1 |
| | b | A P-N junction germanium diode has a reverse saturation current of 0.10 A at the room temperature of 270C.It is observed to be 30A, when the room temperature is increased. Evaluate the room temperature? | Understand | CO 2 | PO 1,2 |
| 2 | a | Construct the circuit diagrams of a full wave rectifier and Bridge rectifier. Explain the operation of the circuit with relevant waveforms. | Apply | CO 3 | PO 2 |
| | b | A full wave bridge rectifier having load resistance of 100 is fed with 220V, Assuming the diodes are ideal, Find the following terms: (i) DC output voltage (ii) Peak inverse voltage (iii) Rectifier efficiency | Understand | CO 4 | PO 1 |
| 3 | a | Explain clearly the DC and AC load line and also explain how to obtain quiescent point graphically for a transistor amplifier of CE configuration. | Understand | CO 5 | PO 1,3 |
| | b | Common emitter circuit has the following components.$R_s = 1k\Omega$, $R_1 = 110k\Omega$, $R_1 = 12k\Omega$ $R_c = 6k\Omega$. H-parameters are$h_{ie} = 1.2k\Omega$, $h_{fe} = 75$ and $h_{oe} = 25\mu A/V$ $h_{re} = 25 * 10^{-4}\mu A/V$. Draw the equivalent hybrid model and calculate $A_i$, $R_i$, $A_v$, $R_0$? | Analyze | CO 6 | PO 1,3 |
| 4 | a | Explain following terms with neat sketches(i) cut off region, (ii) saturation region (iii) active region | Understand | CO 5 | PO 1,3 |
| | b | Compute current gain, voltage gain, input and output impedance of the CB amplifier if it is driven by a voltage source of internal resistance Rs=1k.The load impedance is RL=1K. The transistor parameters are $h_{ib} = 22$, $h_{fb} = -0.98$, $h_{rb} = 2.910^{-4}$, $h_{ob} = 0.5\mu A/V$ | Analyze | CO 6 | PO 1,3 |
| 5 | a | Develop the gray to binary and binary to gray conversion logic with neat sketches. | Apply | CO 8 | PO 1,2 |

| | | | | | |
|---|---|---|---|---|---|
| | b | Perform the subtraction using 1s complement and 2s Complement (i) $(11010)_2(10000)_2$ (ii) $(1000100)_2(1010100)_2$ | Analyze | CO 7 | PO 1 |
| 6 | a | Give the Boolean expressions, symbols and truth tables for following gates: (i) AND NOR (ii) EX-OR (iii) OR (iv) EX-NOR. | Apply | CO 8 | PO 1,2 |
| | b | Obtain the canonical SOP form of the following functions: (i) Y(A,B) = A+B. (ii) Y(A,B,C,D) = AB+ACD | Apply | CO 9 | PO 1,2 |
| 7 | a | Construct a 64:1 MUX using 8:1 MUXs with suitable neat block diagram. | Apply | CO 10 | PO 1,2 |
| | b | Solve the following Boolean expressions using K-map and implement it by using NOR gates. (i) $F(A,B,C,D) = AB^{'}C^{'} + AC + A^{'}CD^{'}$ (ii) $F(W,X,Y,Z) = w^{'}x^{'}y^{'}z^{'}+wxy^{'}z^{'}+w^{'}x^{'}yz+wxyz$ | Apply | CO 9 | PO 1,2 |
| 8 | a | Implement the given function in 4:1 mux $F = \sum m(0,1,3,5,6)$ | Apply | CO 10 | PO 1,2 |
| | b | Build a De-Multiplexer using $F(w,x,y,z) = \sum m(1,4,5,6,7,9,14,15)$ | Apply | CO 9 | PO 1,2 |
| 9 | a | Write short notes on shift register? Mention its application along with the Serial Transfer in 4-bit shift Registers? | Understand | CO 11 | PO 1,3 |
| | b | Identify the steps involved in design of asynchronous sequential circuit in detail with an example? | Apply | CO 12 | PO 2,3 |
| 10 | a | Explain 3 bit ring counter? Discuss how ring counters differ from twisted ring counter? | Understand | CO 12 | PO 1,3 |
| | b | Construct and implement 4-bit binary counter (using D flip flops) which counts all possible odd numbers only? | Apply | CO 10 | PO 2,3 |

## KNOWLEDGE COMPETENCY LEVELS OF MODEL QUESTION PAPER




**Signature of Course Coordinator** **HOD, IT**