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INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

MODEL QUESTION PAPER

Four Year B.Tech III Semester End Examinations, November – 2018

Regulation: R16

ELECTRONIC DEVICES AND CIRCUITS

(ECE/EEE)

Time: 3 Hours **Max Marks: 70**

Answer any ONE question from each Unit
All questions carry equal marks
All parts of the question must be answered in one place only

UNIT - I

1 a) Explainthe concept of diode capacitance in detail. Derive expression for transition capacitance? **[7M]**

b) Determinethe dynamic forward and reverse resistance of p-n junction silicon diode when the applied voltage is 0.25 V at T=3000K with given I_o=2μA? **[7M]**

2 a) Sketch the V-I characteristics of p-n junction diode for forward bias voltages. Analyze between incremental resistance and apparent resistance of the diode? **[7M]**

b) ExplainZener and avalanche breakdown mechanisms in detail? Explain how Zener is used as a regulator? **[7M]**

UNIT - II

3 a) Sketch the static characteristics and firing characteristics of SCR and explain the shape of the curve? **[7M]**

b) Derivethe expression for the ripple factor of LC-Section filter when used with a Full-wave-rectifier. Make necessary approximations. **[7M]**

4 a) Listout the merits and demerits of Bridge type Full Wave rectifiers over centre tapped type Full Wave rectifiers? **[7M]**

b) A HWR circuit supplies 100mA DC current to a 250Ω load. Findthe DC output voltage, PIV rating of a diode and the r.m.s. voltage for the transformer supplying the rectifier? **[7M]**

UNIT – III

5 a) With the help of input and output characteristics explain the working of a transistor in common emitter configuration. **[7M]**

b) Determinethe values of I_C and I_E for a transistor with α_{dc} = 0.99 and I_{CBO} = 5μA, if $I_B$is measured as 20μA? **[7M]**

6 a) Explain the construction & operation of a P-channel MOSFET in enhancement and depletion modes with the help of static drain characteristics and transfer characteristics. **[7M]**

b) In an n-channel FET, the effective channel width is $3x\ 10^{-4}$cm and the donor impurity concentration is 10^{15} electrons/cm3. Find the pinch-off voltage? **[7M]**

UNIT – IV

7 a) Draw the self-bias circuit and obtain the expression for the stability factor. Discuss the advantages and disadvantages of self-biasing? **[7M]**

b) Design a self bias circuit using silicon transistor to achieve a stability factor of 10, with the following specifications: V_{CC} = 16V, V_{BE} = 0.7V, V_{CEQ} = 8V, I_{CQ} = 4mA & β= 50? **[7M]**

8 a) Justify statement "Potential divider bias is the most commonly used biasing method" for BJT circuits. Explain how bias compensation can be done in such biasing through diodes? **[7M]**

b) Design a fixed bias circuit using silicon transistor, with the following specifications: V_{CC} = 16V, V_{BE} = 0.7V, V_{CEQ} = 8V, I_{CQ} = 4mA & β= 50? **[7M]**

UNIT – V

9 a) Draw the circuit diagram of CE amplifier using hybrid parameters and derive expressions for A_I, A_V, R_i, R_O? **[7M]**

b) A common collector circuit has the following components R_1=27kΩ, R_2=27kΩ, R_e=5.6kΩ, R_L=47kΩ, R_S=600Ω. The transistor parameters are h_{ie}=1KΩ, h_{fe}=85 and h_{oe}=2μA/V. Determine A_V, A_I, R_I and R_O? **[7M]**

10 a) Draw the small-signal model of common gate FET amplifier. Derive expressions for voltage gain and output resistance? **[7M]**

b) A Common Source FET amplifier circuit with un bypassed R_S has the following circuit parameters: R_d = 15KΩ, R_S = 0.5KΩ, R_g = 1MΩ, r_d = 5KΩ, g_m= 5mS and V_{DD} = 20 V. Determine A_V& R_O? **[7M]**

INSTITUTE OF AERONAUTICAL ENGINEERING

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I. COURSE OBJECTIVES

The course should enable the students to:

S.No	Description
I	Acquire knowledge ofelectricalcharacteristicsofidealandpracticaldiodesunderforwardandreverse biasto analyze and designdiodeapplicationcircuitssuch asrectifiers andvoltage regulators.
II	Utilizeoperationalprinciplesofbipolarjunctiontransistorsandfieldeffecttransistorstoderive appropriate small-signalmodelsand usethemfortheanalysis ofbasic amplifiercircuits.
III	Perform DC analysis (algebraically and graphically using current voltage curves with super imposed load line) and design of CB, CE and CC transistor circuits.
IV	Compare and contrast different biasing and compensation techniques.

II. COURSE LEARNING OUTCOMES

Students who complete the course will have demonstrated the ability to do the following

CAEC001.01	Understand and analyze different types of diodes, operation and its characteristics in order to design basic form circuits.
CAEC001.02	Understand the different parameters of transistors such as depletion width and channel width for understanding the functioning and design of this component.
CAEC001.03	Estimate the performance of BJTs on the basis of their operation and working.
CAEC001.04	Distinguish the constructional features and operation of FET and MOSFET and their applications.
CAEC001.05	Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.
CAEC001.06	Describe amplifier circuits, oscillators and filter circuits employing BJT, FET devices.
CAEC001.07	Construct, and take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis.
CAEC001.08	Design full wave rectifier without filter and different filters for the given specifications.
CAEC001.09	Explain the operational characteristics of various special purpose diodes such as zener diode, Tunnel diode, varactor diode and photo diode.
CAEC001.10	Identify the various transistor biasing circuits and its usage in applications like amplifiers.
CAEC001.11	Analyze the performance of FETs on the basis of their operation and working.
CAEC001.12	Discuss and Design small signal amplifier circuits applying the various biasing techniques.
CAEC001.13	Apply small-signal models to devices and determine the voltage gain and input and output impedances.
CAEC001.14	Explain half wave rectifier without filter and with different filters for the given specifications.
CAEC001.15	Explain basic circuits like dc and biasing circuits, small-signal ac circuits with emphasis on single-stage amplifiers.
CAEC001.16	Acquire experience in building and trouble shouting simple electronic analog circuits.
CAEC001.17	Write Use of diodes in typical circuits: rectifiers, regulated power supplies, limiting circuits.
CAEC001.18	Understand the principle of operation and characteristics of silicon controlled rectifier and its application in power supply protection circuit.

CAEC001.19	Design and selection of appropriate filter to meet the requirements of voltage regulation and ripple factor.
CAEC001.20	Explain the operation of Zener diode and its usage in voltage regulating application
CAEC001.21	Analyze various transistor configurations and asses merits and demerits for different applications.
CAEC001.22	Explain the role of temperature variations on the performance of the BJT and necessary measures to be taken in deign to stabilize the amplifier
CAEC001.23	Discuss the construction of mosfet and steady the VI characteristics, as it is the prime component in VLSI technology.
CAEC001.24	Apply the concept of electronic devices and circuits to understand and analyze real time applications.
CAEC001.25	Acquire the knowledge and develop capability to succeed national and international level competitive examinations.

III. MAPPING OF SEMESTER END EXAMINATION TO COURSE LEARNING OUTCOMES

SEE Question No.		Course learning Outcomes		Blooms Taxonomy Level
1	a	CAEC001.01	Understand and analyze different types of diodes, operation and its characteristics in order to design basic circuits.	Understand
	b	CAEC001.01	Understand and analyze different types of diodes, operation and its characteristics in order to design basic circuits.	Understand
2	a	CAEC001.03	Explain the operational characteristics of various special purpose diodes such as zener diode, Tunnel diode, varactor diode and photo diode.	Remember
	b	CAEC001.20	Explain the operation of Zener diode and its usage in voltage regulating application	Understand
3	a	CAEC001.18	Understand the principle of operation and characteristics of silicon controlled rectifier and its application in power supply protection circuit.	Understand
	b	CAEC001.19	Design and selection of appropriate filter to meet the requirements of voltage regulation and ripple factor.	Understand
4	a	CAEC001.08	Design full wave rectifier without filter and different filters for the given specifications.	Remember
	b	CAEC001.14	Explain half wave rectifier without filter and with different filters for the given specifications.	Understand
5	a	CAEC001.21	Analyze various transistor configurations and asses merits and demerits for different applications.	Remember
	b	CAEC001.03	Estimate the performance of BJTs on the basis of their operation and working.	Remember
6	a	CAEC001.23	Discuss the construction of mosfet and steady the VI characteristics, as it is the prime component in VLSI technology.	Understand
	b	CAEC001.11	Analyze the performance of FETs on the basis of their operation and working.	Remember
7	a	CAEC001.10	Identify the various transistor biasing circuits and its usage in applications like amplifiers.	Remember
	b	CAEC001.10	Identify the various transistor biasing circuits and its usage in applications like amplifiers.	Understand
8	a	CAEC001.15	Explain basic circuits like dc and biasing circuits, small-signal ac circuits with emphasis on single-stage amplifiers.	Remember
	b	CAEC001.15	Explain basic circuits like dc and biasing circuits, small-signal ac circuits with emphasis on single-stage amplifiers.	Understand

9	a	CAEC001.21	Analyze various transistor configurations and asses merits and demerits for different applications.	Understand
	b	CAEC001.21	Analyze various transistor configurations and asses merits and demerits for different applications.	Remember
10	a	CAEC001.11	Analyze the performance of FETs on the basis of their operation and working.	Understand
	b	CAEC001.24	Apply the concept of electronic devices and circuits to understand and analyze real time applications.	Understand

Signature of Course Coordinator **HOD, ECE**