Hall Ticket No | | | | | | | | | | |

Question Paper Code: AECB06

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER – I

B.Tech III Semester End Examinations, November - 2019

Regulations: IARE-R18

ELECTRONIC DEVICES AND CIRCUITS

(Common to ECE/EEE)

Time: 3 hours **Max. Marks: 70**

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

MODULE – I

1	a)	Derive an expression for total diode current starting from Boltzmann relationship in terms of the applied voltage.	[7M]
	b)	Find the value of D.C. resistance and A.C resistance of a Germanium junction diode at 25˚C with reverse saturation current, Io = 25μA and at an applied voltage of 0.2V across the diode?	[7M]
2	a)	With suitable diagrams, explain the working of centre-tapped full wave rectifier. Derive an expression for V_{DC}, I_{DC}, V_{rms} and I_{rms} for it?	[7M]
	b)	Determine the ripple factor of an L-section filter comprising a 10H choke and 8μF capacitor, used with a Full Wave Rectifier. The DC voltage at the load is 50V. Assume the line frequency as 50Hz?	[7M]

MODULE – II

3	a)	Define Early-effect; explain why it is called as base-width modulation? Discuss its consequences in transistors in detail?	[7M]
	b)	The reverse leakage current of the transistor when connected in CB configuration is 0.2 μA while it is 18 μA when the same transistor is connected in CE configuration. Determine α and β of the transistor?	[7M]
4	a)	Define Thermal Runaway in transistors? Derive the condition to prevent Thermal Runaway in Bipolar Junction Transistors?	[7M]
	b)	Design a collector to base bias circuit using silicon transistor to achieve a stability factor of 20, with the following specifications: V_{CC} = 16V, V_{BE} = 0.7V, V_{CEQ} = 8V, Icq=4mA & β=50?	[7M]

MODULE – III

5	a)	Define biasing? Draw the fixed bias circuit and obtain the expression for the stability factor? List various disadvantages of fixed bias circuits?	[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} = 4 mA & β= 50?	[7M]
6	a)	Draw the circuit diagram and small signal equivalent of CB amplifier using accurate h-parameter model. Derive an expression for A_V, A_I, R_I and R_O?	[7M]

b) A common Emitter circuit has the following, components: R_s=1kΩ, R_1=110KΩ, R_2=12KΩ, R_c=6KΩ. h- Parameters are h_{ie}=1.2K, h_{re}=2.5x10^{-4}, h_{fe}=75,h_{oe}=25uA/V. Determine A_V, A_I, R_I and R_O. [7M]

MODULE – IV

7 a) Sketch the drain characteristics of MOSFET for different values of V_{GS} and mark different regions of operation. [7M]

b) The P-channel FET has a $|I_{DS}|$=-12mA, $|V_p|$=5V, V_{GS} is 1.6 V. Determine drain current I_D, G_m and G_{m0}. [7M]

8 a) Explain with the help of neat diagrams, the structure of N-channel FET, and its volt-ampere characteristic. In what way it is different from a bipolar junction transistor. [7M]

b) The following information is included on the data sheet for an N-channel JFET. I_{DSS}=20mA,V_P=-8V and g_{m0}=5mS. Determine the values of drain current and transconductance at V_{GS}=-4V. [7M]

MODULE – V

9 a) Explain the V-I characteristics of Zener diode and analyze Avalanche and Zener Break downs? [7M]

b) A 5.0V stabilised power supply is required to be produced from a 12V DC power supply input source. The maximum power rating P_Z of the zener diode is 2W. Using the zener regulator circuit above calculate: a) The maximum current flowing through the zener diode. b) The minimum value of the series resistor, R_S. c) The load current I_L if a load resistor of 1kΩ is connected across the zener diode. d) The zener current I_Z at full load. [7M]

10 a) Explain the effect of external source resistance on the voltage gain of a common source amplifier? Explain with necessary derivations? [7M]

b) A Common Source FET amplifier circuit with un bypassed Rs has the following circuit parameters: Rd = 15K, RS = 0.5K, Rg = 1M, rd = 5K, gm= 5mS and VDD = 20 V. Determine AV& RO? [7M]

INSTITUTE OF AERONAUTICAL ENGINEERING

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I. COURSE OBJECTIVES

The course should enable the students to:

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I	Introduce components such as diodes, BJTs and FETs.
II	Know the applications of components
III	Know the switching characteristics of components.
IV	Give understanding of various types of amplifier circuits.

II. COURSE OUTCOMES

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

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Describe diode operation, transition capacitance, diffusion capacitance and the use of diode in various electronic circuits.	CLO 1	Understand and analyze diodes operation and static and dynamic resistance in order to design basic circuits.
		CLO 2	Understand diffusion and transition capacitance of diode in forward and reverse bias conditions.
		CLO 3	Understand and analyze diode applications and how the diode acts as a switch.
		CLO 4	Design rectifier without and with capacitive filters for the given specifications.
		CLO 5	Understand the use of diodes in typical circuits like, clipping, clamping circuits and comparator circuits.
CO 2	Understand the principle of operation of BJT in CE, CB, CC configuration and analyze transistor hybrid model.	CLO 6	Understand the principle of operation and characteristics of common emitter, common base and common collector configurations.
		CLO 7	Understand the concept of operating point, DC & AC load lines.
		CLO 8	Analyze transistor hybrid parameter model for CE, CB and CC configurations.
		CLO 9	Determine of h-parameters of BJT amplifier from transistor characteristics.
		CLO 10	Understand the use of conversion of h-parameters among CE, CB and CC configurations.
CO 3	Bias the transistors and analyze the low frequency response of BJT amplifiers.	CLO 11	Identify the various transistor biasing circuits, compensation circuits and its usage in applications like amplifiers.
		CLO 12	Analyze various transistor configurations and asses merits and demerits for different applications.
		CLO 13	Analyze CE Amplifier with emitter resistance.
		CLO 14	Analyze low frequency response of BJT Amplifiers.
		CLO 15	Understand the effect of coupling and bypass capacitors on CE Amplifier.

COs	Course Outcome	CLOs	Course Learning Outcome
CO 4	Study and analyze the behaviour of FET and MOSFET.	CLO 16	Explain construction and principle of operation of JFET.
		CLO 17	Understand the concept of pinch-off voltage and volt-ampere characteristic of JFET.
		CLO 18	Distinguish the constructional features and operation of BJT and FET and their applications.
		CLO 19	Understand biasing of FET and how it acts as voltage variable resistor.
		CLO 20	Discuss the construction of MOSFET and steady the VI characteristics, as it is the prime component in VLSI technology.
CO 5	Analyze FET amplifiers in CS,CG,CD modes using small signal model and study the behaviour of special purpose diodes.	CLO 21	Apply small-signal models to field effect transistors and determine the voltage gain and input and output impedances.
		CLO 22	Analyzes CS, CD, CG JFET amplifiers using small signal model.
		CLO 23	Understand basic concepts of MOSFET amplifiers.
		CLO 24	Explain the operation of Zener diode and its usage in voltage regulating application.
		CLO 25	Understand the principle of operation and characteristics of silicon controlled rectifier, tunnel diode, UJT and varactor diode.

MAPPING OF SEMESTER END EXAMINATION TO COURSE OUTCOMES

SEE Question No.		CO	Course Outcomes	Blooms Taxonomy Level
1	a	CO 1	Describe diode operation, transition capacitance, diffusion capacitance and the use of diode in various electronic circuits.	Understand
	b	CO 1	Describe diode operation, transition capacitance, diffusion capacitance and the use of diode in various electronic circuits.	Understand
2	a	CO 1	Describe diode operation, transition capacitance, diffusion capacitance and the use of diode in various electronic circuits.	Remember
	b	CO 1	Describe diode operation, transition capacitance, diffusion capacitance and the use of diode in various electronic circuits.	Understand
3	a	CO 2	Understand the principle of operation of BJT in CE, CB, CC configuration and analyze transistor hybrid model.	Understand
	b	CO 2	Understand the principle of operation of BJT in CE, CB, CC configuration and analyze transistor hybrid model.	Understand

SEE Question No.		CO	Course Outcomes	Blooms Taxonomy Level
4	a	CO 2	Understand the principle of operation of BJT in CE, CB, CC configuration and analyze transistor hybrid model.	Remember
	b	CO 23	Understand the principle of operation of BJT in CE, CB, CC configuration and analyze transistor hybrid model.	Understand
5	a	CO 3	Bias the transistors and analyze the low frequency response of BJT amplifiers.	Remember
	b	CO 3	Bias the transistors and analyze the low frequency response of BJT amplifiers.	Remember
6	a	CO 3	Bias the transistors and analyze the low frequency response of BJT amplifiers.	Understand
	b	CO 3	Bias the transistors and analyze the low frequency response of BJT amplifiers.	Remember
7	a	CO 4	Study and analyze the behaviour of FET and MOSFET.	Remember
	b	CO 4	Study and analyze the behaviour of FET and MOSFET.	Understand
8	a	CO 4	Study and analyze the behaviour of FET and MOSFET.	Remember
	b	CO 4	Study and analyze the behaviour of FET and MOSFET.	Understand
9	a	CO 5	Analyze FET amplifiers in CS,CG,CD modes using small signal model and study the behaviour of special purpose diodes.	Understand
	b	CO 5	Analyze FET amplifiers in CS,CG,CD modes using small signal model and study the behaviour of special purpose diodes.	Remember
10	a	CO 5	Analyze FET amplifiers in CS,CG,CD modes using small signal model and study the behaviour of special purpose diodes.	Understand
	b	CO 5	Analyze FET amplifiers in CS,CG,CD modes using small signal model and study the behaviour of special purpose diodes.	Understand

Signature of Course Coordinator **HOD, ECE**