V/D/TZ

Reg. No:

VIT®

Vellore Institute of Technology

Final Assessment Test – April 2026

Course: **BECS201L - Semiconductor Devices and Circuits**

Class NBR(s): **6454**

Slot: **A2+TA2**

Time: **Three Hours**

Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

COs	CO Statements
CO1	Comprehend the basics of semiconductor materials
CO2	Understand the behavior of semiconductor devices and their applications
CO3	Comprehend design aspects of amplifier circuits
CO4	Analyze the performance characteristics and applications of Op-Amp
CO5	Design engineering applications using analog ICs

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Define extrinsic semiconductors and explain the formation of n-type and p-type semiconductors. Describe the role of donor and acceptor impurity atoms in each type and support your explanation with neat energy band and carrier diagrams. **CO1** **BL2**

2. With the help of neat circuit diagrams, explain the operation of a p–n junction diode under forward bias and reverse bias conditions. Illustrate and explain the V-I characteristics of the diode. Also, define static resistance, dynamic resistance, and AC resistance of a diode and demonstrate their calculation using a simple numerical example. **CO2** **BL2**

3. Draw and analyze the four types of biased diode clamper circuits. For each case, illustrate the circuit diagram, write the corresponding output voltage equations, and sketch the resulting output waveforms. Explain how the bias voltage affects the clamping level of the signal. **CO2** **BL2**

4. With the help of neat circuit diagrams, explain the input and output characteristics of a BJT in the Common Emitter (CE) configuration. Sketch the corresponding characteristic curves, identify the cutoff, active, and saturation regions from the output characteristics, and indicate how the input impedance (Z_i) and output impedance (Z_o) can be determined from the curves. **CO2** **BL2**

5. In a BJT common-emitter amplifier using voltage-divider bias, the circuit parameters are:
   $V_{CC} = 20\ V$, $R_1 = 39\ k\Omega$, $R_2 = 3.9\ k\Omega$, $R_C = 10\ k\Omega$, $R_E = 1.5\ k\Omega$, and $\beta = 100$.
   Determine the cutoff and saturation points using the DC load-line concept.
   Sketch the DC load line on the I_C–V_{CE} characteristics of the transistor.
   Indicate the approximate operating point (Q-point) on the load line and identify the expected region of operation. **CO3** **BL3**

6.	With the help of a neat circuit diagram, explain the construction and working principle of a Class-B push-pull amplifier. Illustrate the input and output waveforms, and describe how the circuit achieves full-cycle amplification using two transistors.	CO3	BL2
7.	An E-MOSFET common-source (CS) amplifier using voltage-divider bias (VDB) has the following parameters: $V_{DD} = 40\,V$, $R_1 = 22\,M\Omega$, $R_2 = 18\,M\Omega$, $R_D = 3\,k\Omega$, $R_S = 0.82\,k\Omega$, $k = 0.12\,mA/V^2$, $V_{TH} = 10V$, input signal $V_s = 5\,mV$, and load resistance $R_L = 10\,k\Omega$. Determine the input impedance (Z_i) of the amplifier. Calculate the output impedance (Z_o) of the circuit. Evaluate the voltage gain (A_v) of the amplifier. Determine the output voltage (V_o) corresponding to the given input signal V_s.	CO3	BL3
8.	With the help of neat circuit diagrams, explain the voltage-series and voltage-shunt feedback amplifier configurations. Describe the basic principle of negative feedback and derive the expression for the closed-loop gain (A_{CL}) of a feedback amplifier.	CO3	BL2
9.a)	With the help of a neat circuit diagram, explain the four-input op-amp adder–subtractor circuit. Write the expression for the output voltage (V_o) of the circuit and illustrate its operation with a simple numerical example.	CO4	BL2
	OR		
9.b)	With the help of a neat circuit diagram, explain the operation of an op-amp Schmitt trigger circuit. Write the expressions for the output voltage levels and threshold voltages, and illustrate the operation with a simple numerical example.	CO4	BL2
10.a)	With the help of a neat circuit diagram, explain the operation of an astable multivibrator. Sketch the corresponding output waveforms and illustrate its working with a simple numerical example.	CO5	BL3
	OR		
10.b)	With the help of neat circuit diagrams, explain the +5 V regulated power supply using the IC 7805 voltage regulator. The circuit uses a single-phase 230 V AC input supply and provides a regulated output to a load drawing 0.5 A. Describe the working of each stage of the power supply, including the transformer, rectifier, filter, and voltage regulator and explain how the IC maintains a constant output voltage.	CO5	BL3

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