



SCHOOL OF ENGINEERING

MAKE UP EXAMINATIONS DECEMBER 2025

Semester: MK

Course Code: ECE 2001

Course Name: Analog Electronics

Date: 26-12-2025

Time: 01:00 PM – 04:00PM

Max Marks: 100

Weightage: 50%

Instructions:

- (i) *Read the question properly and answer accordingly.*
 - (ii) *Question paper consists of 3 parts.*
 - (iii) *Scientific and Non-programmable calculators are permitted.*
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Part A

(10Q x 2M = 20 Marks)

Answer any 10 questions:

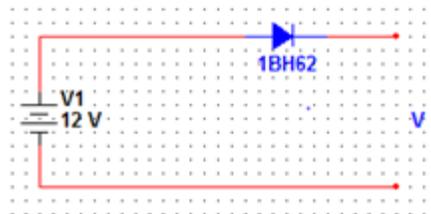
1. A PN junction even in the forward bias condition does not conduct current until a certain amount of potential is applied across its terminals. What is this potential called?
2. BJT is the current-controlled device whereas the FET is the voltage-controlled device. Why and explain your answer
3. Identify a semiconductor device that essentially acts as a one-way switch for current. What is the minimum voltage required to turn on such a device made of Germanium?
4. MOSFET stands for metal-oxide-semiconductor field-effect transistor. MOSFETs are of two types. Name them with their symbols.
5. Name the circuit in electronics, that is designed to prevent a signal from exceeding a predetermined reference voltage level.
6. The main difference between Colpitts and Hartley oscillators is the feedback network. Mention the difference and give the expression for frequency of Colpitts Oscillator.
7. How do you describe an electronic device that converts the input energy from a DC source into an AC output. Also recall and name at least four types of them?

8. The drain current is controlled by the gate to source voltage in a JFET. In the transfer characteristics of an n-channel JFET, the drain current is found to be maximum and zero at two different values of gate terminal voltage. What should be the corresponding gate terminal voltages for the above condition? Justify.

9. The Bipolar Junction Transistor is an active device which can operate in three different regions. Can you recall and name the three regions of operation of a BJT. Also suggest, For the BJT to act as an amplifier which operating region is preferred?

10. The operating point is a specific point within the operation characteristic of a technical device. How can you rephrase the meaning of the operating point of a transistor? How would you describe the effect of operating point on transistor biasing?

11. A diode is a two-terminal electronic component that conducts electricity primarily in one direction. What will be the output of the following circuit? (Assume 0.7V drop across the diode)



12. I am a three-legged device with electrons as the majority carriers. I am preferred over the other type because of the higher mobility of the electrons. Identify the device.

PART-B

(5QX10 Marks=50 Marks)

Answer any 5 Questions

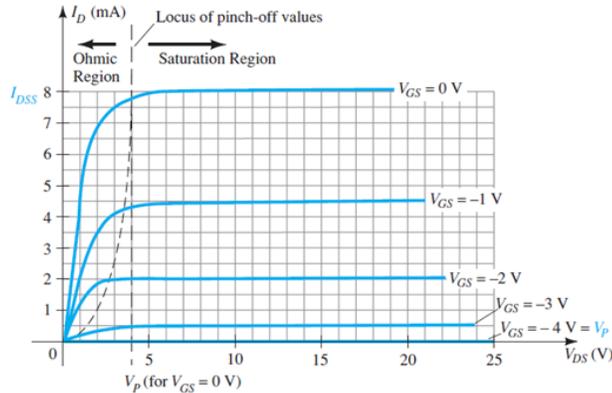
13. a) A negative-feedback amplifier is an electronic amplifier that subtracts a fraction of its output from its input so that negative feedback opposes the original signal. Design a voltage amplifier and describe the effects of negative feedback on this amplifier. (5 M)

b) Consider the parameters of voltage- to- voltage converter without feedback such as voltage gain $A=100$, input impedance $R_i=10K$ and output impedance $R_o=20K$. Design a negative feedback voltage-to-voltage converter with the feedback factor $\beta = 0.5$. and calculate voltage gain, input impedance and output impedance. (5 M)

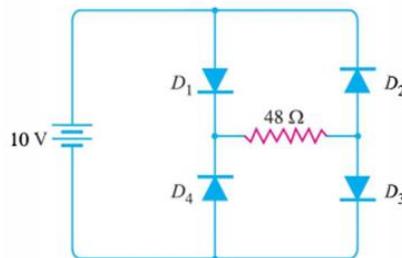
14. a) Voltage regulator is a device that maintains a constant dc output voltage irrespective of the changes in input voltage or load conditions. Explain how Zener Diode helps in voltage regulation with a neat circuit diagram. Give detailed mathematical analysis. (6 M)

b) How do you describe the process of setting a transistor's DC operating voltage or current conditions to the correct level so that any AC input signal can be amplified correctly by the transistor. Explain the need for biasing and the stability of Q-point with respect to BJT (4M)

15. The Junction Field Effect Transistor is a unipolar device in which current flow between its two electrodes is controlled by the action of an electric field at a reverse-biased pn-junction. For the given drain characteristics draw the transfer characteristics of the n-channel JFET and also give the expression for drain current when $V_{GS} = V_P$. (10 M)



16. a) The most efficient rectifier circuit that uses four or more diodes in a bridge circuit configuration to efficiently convert alternating current to direct current is a bridge rectifier circuit. Calculate the current through a 48Ω resistor in the circuit as shown in the figure given below. Assume the diode to be silicon. (3 Marks)



b) Explain the working of the Bridge rectifier with the circuit diagram and input-output waveform, and also derive the expression for I_{rms} , I_{dc} , efficiency, and ripple factor for same. (7 M)

17. a) For a certain D-MOSFET, $I_{DSS} = 10\text{mA}$ and $V_{GSoff} = -8\text{V}$. (5 M)

i) Is this an n channel or a p channel?

ii) Calculate I_D at $V_{GS} = -3\text{V}$ and at $V_{GS} = 3\text{V}$

b) Draw the neat drain characteristics and transfer characteristics of D-MOSFET indicating the region of operation in each. (5 M)

18. A transistor has three terminals. One of the three terminals could be connected to form the common input and output terminal. Compare the different transistor configurations illustrating their input and output parameters with typical input and output characteristics. Derive the relationship between Alpha, Beta, and gamma.

19. A plot of the current, I , versus the voltage drop across the diode, V_D , will yield a straight line, called the "Load Line", of possible values of current flow in the circuit. What is the operating point of the diode? Illustrate the load line analysis of the diode and its significance.

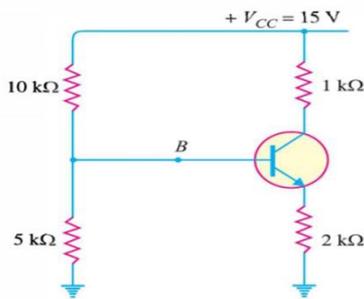
PART C

(2QX15Marks=30 Marks)

Answer any 2 questions

20. a) Transistor biasing is needed for faithful amplification. Mention the different types of transistor biasing. Draw the circuit of a BJT in potential divider bias configuration. Derive the expression for Q point voltage and current and draw the load line. (8 M)

b) Hence find the operating point for the circuit given below. Assume $\beta=99$. (7 M)



21. a) The most common place use of oscillators is in (electronic) watches. Which type of Oscillators are used in watches? Clearly explain the Barkhausen Criterion for Oscillations. (5 M)

b) With a neat diagram, explain the working of the Colpitts Oscillator. Derive the expression for the Feedback fraction of the Colpitts Oscillator. (5 M)

c) For the circuit shown determine the (i) operating frequency and (ii) feedback fraction for the Colpitts Oscillator. (5 M)

22. In electronics, biasing is the setting of DC operating conditions of an electronic component that processes time-varying signals. List the transistor biasing techniques. With a neat circuit explain the voltage divider configuration with appropriate expressions. (10M)

Determine the dc bias voltage V_{CE} and the current I_C for the voltage divider configuration. Given $R_1=39k\Omega$, $R_2=3.9K\Omega$, $R_E=1.5K\Omega$, $R_C=10K\Omega$, $V_{CC}=22V$, and $\beta=100$. (5M)

23. A multistage amplifier is an electronic amplifier that consists of two or more single-stage amplifiers connected. List the types of Multistage amplifiers. Explain the RC-coupled transistor amplifier with a neat circuit diagram. Explain the frequency response of the amplifier. (15M)