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**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JUN 2023**

Semester : Semester II - 2022

Course Code : ECE2001

Course Name : Sem II - ECE2001 - Analog Electronics

Program : ECE

Date : 23-JUN-2023

Time : 1.00PM - 4.00PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
 - (ii) Question paper consists of 3 parts.
 - (iii) Scientific and non-programmable calculator are permitted.
 - (iv) Do not write any information on the question paper other than Roll Number.
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PART A

ANSWER ALL THE QUESTIONS

(10 X 2 = 20M)

1. BJT is the current-controlled device whereas the FET is the voltage-controlled device. Why and explain your answer.
(CO5,CO2) [Knowledge]
2. 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?
(CO1) [Knowledge]
3. MOSFET stands for metal-oxide-semiconductor field-effect transistor. MOSFETs are of two types. Name them with their symbols.
(CO5,CO3) [Knowledge]
4. 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?
(CO2,CO5) [Knowledge]
5. Name the circuit in electronics, that is designed to prevent a signal from exceeding a predetermined reference voltage level.
(CO1) [Knowledge]
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.
(CO4,CO5) [Knowledge]
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?
(CO4,CO5) [Knowledge]

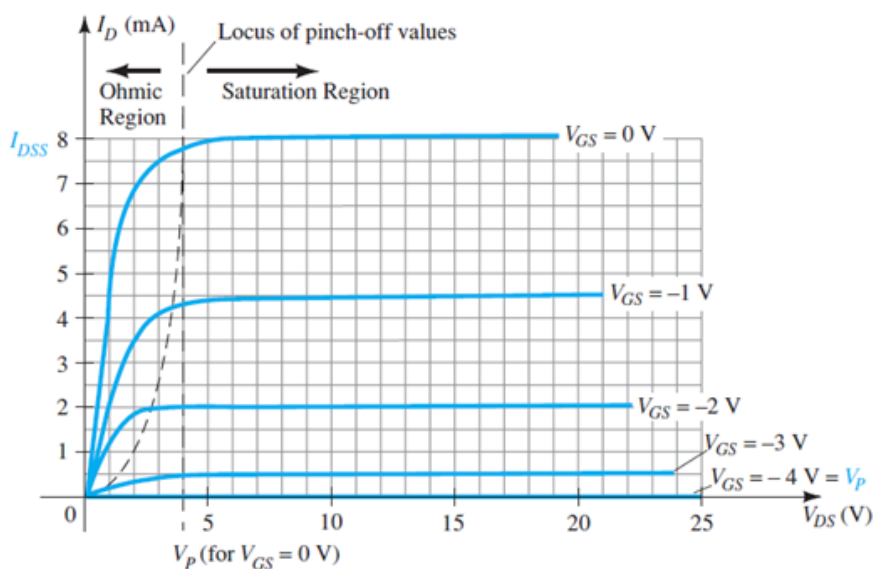
8. The drain current is controlled by the gate to source voltage in a JFET. In the transfer characteristics of an n-channel JFET, the drain current is found to be maximum and zero at two different values of gate terminal voltage. What should be the corresponding gate terminal voltages for the above condition? Justify.
(CO5,CO3) [Knowledge]
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?
(CO5,CO2) [Knowledge]
10. At a constant temperature, the product of the number of electrons in the conduction band and the number of holes in the valence band remains constant, regardless of the quantity of donor and acceptor impurities added. Name the law?
(CO1) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS

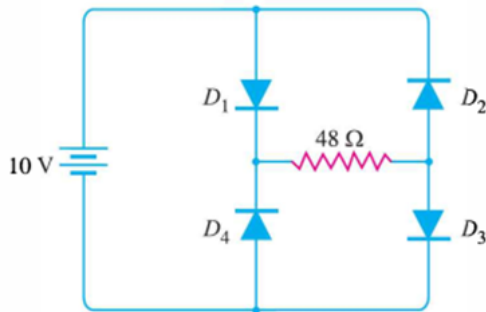
(5 X 10 = 50M)

11. 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. (5M)
- 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. (5M)
(CO5,CO4) [Comprehension]
12. 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. (6M)
- 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)
(CO5,CO2) [Comprehension]
13. 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 $V_{GS} = V_P$. (10M)



(CO3,CO5) [Comprehension]

14. a) The most efficient rectifier circuit that uses four or more diodes in a bridge circuit configuration to efficiently convert alternating (AC) current to a direct (DC) current is a Bridge rectifier Circuit. Can you compare the rectifier circuit with other type by explaining 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 the same. (7M)
- b) Mr. Ravi has designed a circuit as shown below for the technical competition conducted in the University. Help him to find the current through a 48Ω resistor in the circuit as shown in the figure given below. Assume the diode to be silicon. (3M)



(CO5,CO1) [Comprehension]

15. a) My professor, in an experiment is working with D-MOSFET which is widely used in a start-up circuit of auxiliary power supplies.
 For a certain D-MOSFET, $I_{DSS} = 10\text{mA}$ and $V_{GSoff} = -8\text{V}$. (5M)
- Is this an n channel or a p channel?
 - Compute to illustrate to him how the drain current changes for $V_{GS} = -3\text{V}$ 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. (5M)

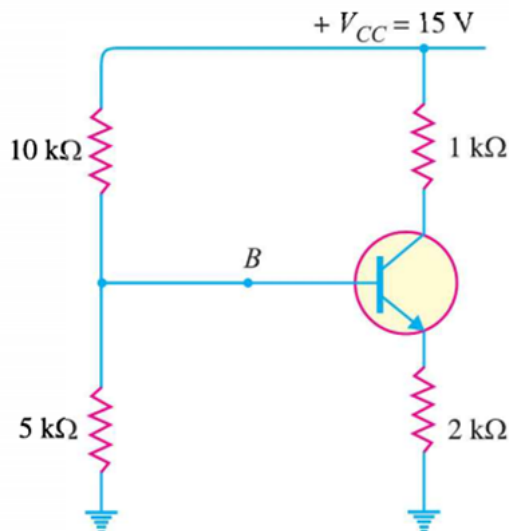
(CO3,CO5) [Comprehension]

PART C

ANSWER ALL THE TWO QUESTIONS

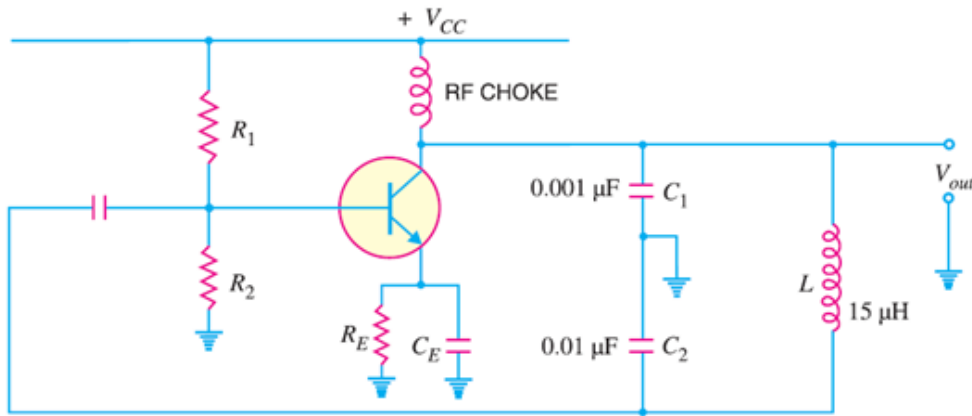
2 X 15 = 30M

16. (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. (8M)
- b) Hence find the operating point for the circuit given below. Assume $\beta = 99$. (7M)



(CO5,CO2) [Application]

17. 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. (5M)
- b) With a neat diagram, explain the working of the Colpitts Oscillator. Derive the expression for the Feedback fraction of the Colpitts Oscillator. (5M)
- c) For the circuit shown determine the (i) operating frequency and (ii) feedback fraction for the Colpitts Oscillator. (5M)



(CO5,CO4) [Application]