

III B. Tech I Semester Regular Examinations, Dec/Jan -2022-23
BASIC ELECTRONICS

(Common to EEE,ME,CSE,IT,CS,CSE(AI),CSE(AI&ML),CSE(DS),CSE(IOT))
 Time: 3 hours Max. Marks: 70

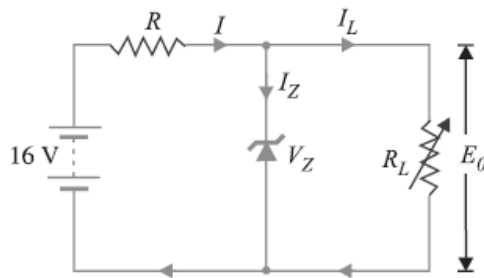
Answer any **FIVE** Questions **ONE** Question from **Each unit**
 All Questions Carry Equal Marks

UNIT-I

1. a) Explain briefly about extrinsic and intrinsic semiconductors with neat sketch. [7M]
 - b) Draw energy band diagram of semiconductors and write its characteristics. [7M]
- (OR)
2. a) Why Silicon is Preferred in Semiconductors? Explain the reasons. [7M]
 - b) Derive current and draw V – I Characteristics of a diode. [7M]

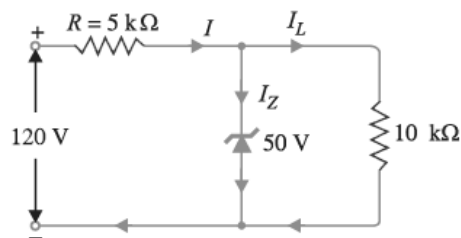
UNIT-II

3. a) Explain V-I characteristics of Zener diode with its operation [7M]
- b) In the circuit shown in figure, the voltage across the load is to be maintained at 12 V as load current varies from 0 to 200 mA. Design the regulator. Also find the maximum wattage rating of zener diode. [7M]

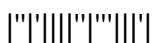


(OR)

4. a) For the circuit shown in figure, find: (i) the output voltage (ii) the voltage drop across series resistance (iii) the current through zener diode. [7M]



- b) What are the typical applications of varactor diode? Explain in detail about any one application with neat sketch. [7M]



UNIT-III

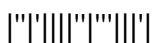
5. a) Explain operation of NPN transistor with neat diagram. [7M]
 b) For a transistor, $\beta = 45$ and voltage drop across $1k\Omega$ which is connected in the collector circuit is 1 volt. Find the base current for common emitter connection. [7M]
 (OR)
6. a) A transistor is connected in common emitter (CE) configuration in which collector supply is 8 V and the voltage drop across resistance RC connected in the collector circuit is 0.5 V. The value of RC = 800Ω . If $\alpha = 0.96$, determine: (i) collector-emitter voltage (ii) base current. [7M]
 b) An n-p-n transistor at room temperature has its emitter disconnected. A voltage of 5 V is applied between collector and base. With collector positive, a current of $0.2 \mu A$ flows. When the base is disconnected and the same voltage is applied between collector and emitter, the current is found to be $20 \mu A$. Find α , I_E and I_B when collector current is 1 mA. [7M]

UNIT-IV

7. a) What are the characteristic parameters of JFET? Explain in detail. [7M]
 b) (i) When a reverse gate voltage of 12 V is applied to JFET, the gate current is 1nA. Determine resistance between gate and source [7M]
 (ii) When the reverse gate voltage of JFET changes from 4.0 V to 3.9 V, the drain current changes from 1.3 mA to 1.6 mA. Find the value of trans conductance [7M]
 (OR)
8. a) Explain construction and operation of N-channel JFET with neat sketch. [7M]
 b) A FET has drain current of 4 mA. If $I_{DS} = 8$ mA and $V_{GS(OFF)} = -6$ V. Find the values of V_{GF} & V_P . [7M]

UNIT-V

9. a) Illustrate and describe the characteristics of an SCR and explain the two transistor version of an SCR. [7M]
 b) In a SCR half wave rectifier, the forward breakdown voltage of SCR is 110 V for a gate current of 1 mA. If 50 Hz sinusoidal voltage of 220 V peak is applied, find firing angle, conduction angle, average voltage, average current, power output and the time during which SCR remains OFF. Assume load resistance is 100Ω and holding current to be zero. [7M]
 (OR)
10. a) Define the following (i)Latching current (ii)Holding current (iii)Gate current. [7M]
 b) Derive V_{rms} by outlining the application of SCR as half wave rectifier. [7M]



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UNIT-I

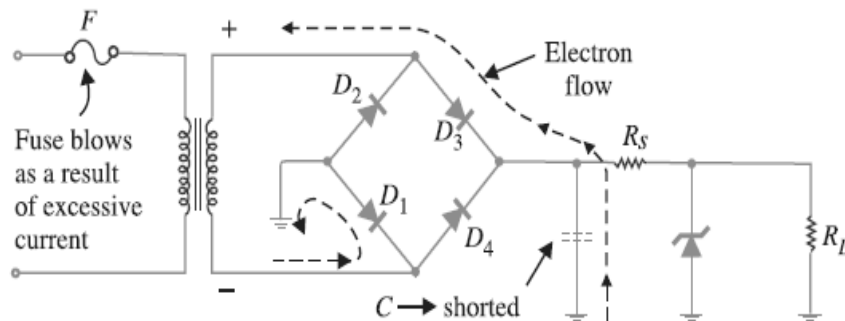
1. a) Explain the operation of p-n junction diode with neat sketch. [7M]
 b) Define the following: (i) Conduction band (ii) Valence band [7M]
 (iii) Forbidden gap.

(OR)

2. a) Explain the operation of Full Wave Rectifier with centre tap transformer. Also derive the following for this transformer dc output voltage, dc output current, RMS output voltage. [7M]
 b) Define Voltage Regulators. List and explain any one of the Voltage Regulators. [7M]

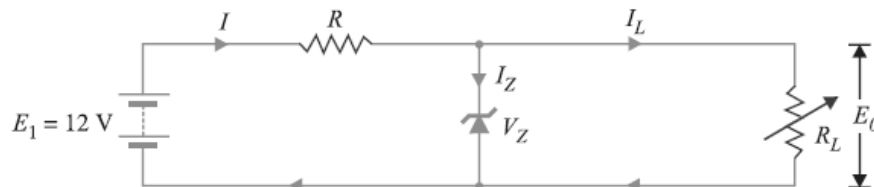
UNIT-II

3. a) Explain V-I characteristics of varactor diode with its operation. [7M]
 b) Figure shows regulated power supply using a zener diode. What will be the circuit behaviour if (i) filter capacitor shorts (ii) filter capacitor opens? [7M]

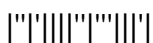


(OR)

4. a) A 7.2 V zener is used in the circuit shown in Figure and the load current is to vary from 12 to 100 mA. Find the value of series resistance R to maintain a voltage of 7.2 V across the load. The input voltage is constant at 12V and the minimum zener current is 10 mA. [7M]



- b) List out applications of varactor diode and explain any one application in detail with neat sketch [7M]



UNIT-III

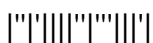
5. a) Explain operation of PNP transistor with neat diagram [7M]
b) What is the relation between I_B , I_E and I_C in CB configuration [7M]
(OR)
6. a) Explain the advantages and disadvantages of Bipolar junction transistor [7M]
b) i. In a common base connection, $I_E = 1\text{mA}$, $I_C = 0.95\text{mA}$. [7M]
Calculate the value of I_B .
ii. In a common base connection, $I_C = 0.95\text{mA}$ and $I_B = 0.05\text{mA}$. Find the value of α .

UNIT-IV

7. a) Compare JFET and BJT. [7M]
b) Determine pinch off voltage for N channel silicon FET with a [7M]
channel width of $5.6 \times 10^{-4}\text{cm}$ and donor concentration of $10^{15}/\text{cm}^3$. Consider dielectric constant of Si is 12.
(OR)
8. a) List out Applications of JFET. [7M]
b) Calculate operating point of self biased JFET having supply [7M]
voltage $V_{DD} = 20\text{V}$, maximum value of drain current $I_{DSS} = 10\text{mA}$, and $V_{GS} = -3\text{V}$ at $I_D = 4\text{mA}$. Also determine the values of resistors R_D and R_S to obtain this bias condition.

UNIT-V

9. a) When a SCR full wave rectifier is connected across a sinusoidal [7M]
voltage of $400 \sin 314t$, the rms value of current flowing through the device is 20 A. Find the power rating of SCR.
b) Derive V_{rms} by outlining the application of SCR as full wave [7M]
rectifier.
(OR)
10. a) Discuss the semiconductor switching device which can control [7M]
alternating current in a load.
b) Explain the structural functioning and characteristics of DIAC. [7M]



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UNIT-I

1. a) With a neat diagram explain the working of a PN junction diode in forward bias and reverse bias and show the effect of temperature on its V-I characteristics. [7M]
 b) Draw energy band diagram of conductors and write its characteristics. [7M]

(OR)

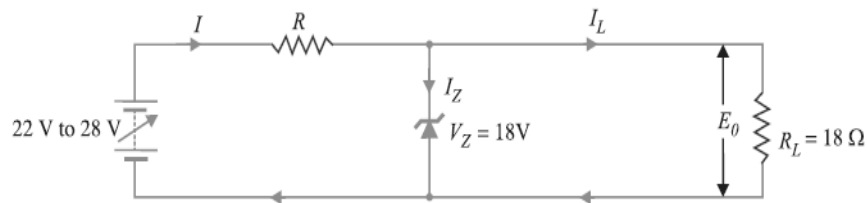
2. a) Define the following [7M]
 i. P-Type Semiconductors
 ii. N-Type Semi Conductors
 iii. Biasing
 b) i. Define Knee voltage of a Diode. [7M]
 ii. Define Rectifiers. List the types of Rectifiers.

UNIT-II

3. a) Explain V-I characteristics of Optical diode with its operation [7M]
 b) If the optical output power of a diode laser is linearly dependent on the drive current, then why does the failure rate be dependent exclusively on the mth power of current and nth power of the output optical power? [7M]

(OR)

4. a) The zener diode shown in Figure has $V_Z = 18\text{ V}$. The voltage across the load stays at 18 V as long as I_Z is maintained between 200 mA and 2 A. Find the value of series resistance R so that E_0 remains 18 V while input voltage E_i is free to vary between 22 V to 28V. [7M]

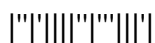


- b) List out applications of optical diode and explain any one application in detail with neat sketch. [7M]

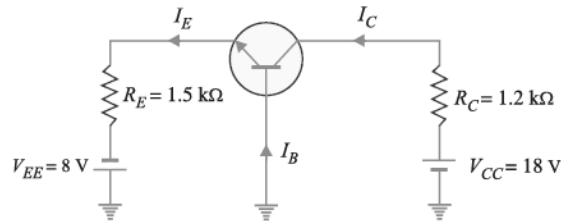
UNIT-III

5. a) Design a collector to base bias circuit for the specified conditions: $V_{CC}=15\text{V}$, $V_{CE}=5\text{V}$, $I_C=5\text{mA}$, $\beta=100$. [7M]
 b) What is the need of biasing in Transistor circuits? [7M]

(OR)



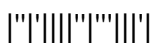
6. a) Explain how a Bipolar junction transistor works as Switch. [7M]
 b) i. In a common base connection, the emitter current is 1mA. [7M]
 If the emitter circuit is open, the collector current is 50 μ A. Find the total collector current. Given that $\alpha = 0.92$.
 ii. For the common base circuit shown in Figure, determine I_C and V_{CB} . Assume the transistor to be of silicon.

**UNIT-IV**

7. a) Compare MOSFET with JFET. [7M]
 b) For a P channel silicon FET with an effective channel width of 2×10^{-4} cm and channel resistivity $\rho = 20 \Omega \text{ cm}$ Find Pinch off voltage. [7M]
- (OR)
8. a) Compare n channel with p channel MOSFET. [7M]
 b) Derive current equation for JFET. [7M]

UNIT-V

9. a) Illustrate the structure and describe the functioning of Gate Turn OFF Thyristors. Outline its characteristics, advantages and applications. [7M]
 b) Derive V_{rms} by outlining the application of SCR as Bridge rectifier. [7M]
- (OR)
10. a) Define Snubber current and explain about thyristor protection. [7M]
 b) Illustrate and explain light activated SCR (LASCR) and its characteristics. [7M]



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UNIT-I

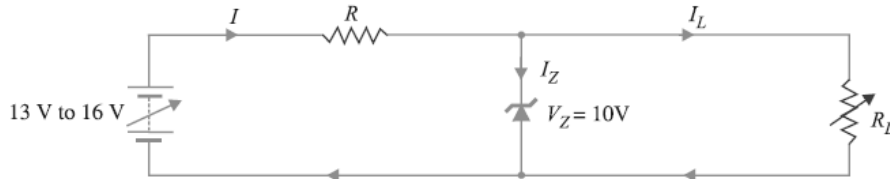
1. a) Draw the circuit diagram and explain the working of full wave bridge rectifier and derive the expression for average output current and rectification efficiency. [7M]
- b) Draw energy band diagram of insulators and write its characteristics. [7M]

(OR)

2. a) Explain forward bias, reverse bias and depletion region in a p-n junction diode. [7M]
- b) Explain working operation of Half wave rectifier with neat sketch. [7M]

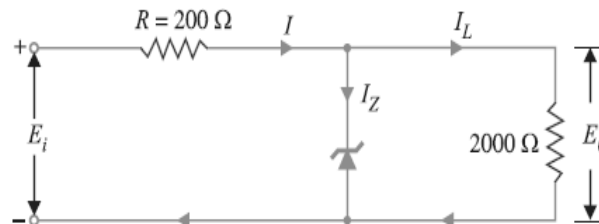
UNIT-II

3. a) Discuss the working principle of varactor diode with a neat sketch. [7M]
- b) A 10-V zener diode is used to regulate the voltage across a variable load resistor [See figure]. The input voltage varies between 13 V and 16 V and the load current varies between 10 mA and 85 mA. The minimum zener current is 15 mA. Calculate the value of series resistance R. [7M]



(OR)

4. Over what range of input voltage will the zener circuit shown in Fig. 8 maintain 30 V across 2000 Ω load, assuming that series resistance R = 200 Ω and zener current rating is 25 mA ? [14M]

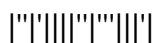


[7M]

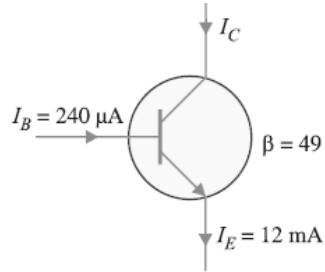
UNIT-III

5. a) Explain how a Bipolar junction transistor works as an amplifier. [7M]
- b) Derive current and draw V-I characteristics of a transistor. [7M]

(OR)



6. a) Find the value of β if (i) $\alpha = 0.9$ (ii) $\alpha = 0.98$ (iii) $\alpha = 0.99$ [7M]
 (iv) $\alpha = 0.95$ (v) $\alpha = 0.93$.
- b) Find the α rating of the transistor shown in Figure. Hence [7M]
 determine the value of I_C using both α and β rating of the transistor.

**UNIT-IV**

7. a) Briefly explain temperature effects in a MOSFET. [7M]
 b) What is biasing for zero current drift. Derive g_m . [7M]
 (OR)
8. a) Define the following [7M]
 (i) Self Bias
 (ii) Fixed Bias
 (iii) Operating Point
- b) Explain the construction and working of enhancement and [7M]
 depletion mode MOSFETs.

UNIT-V

9. a) Illustrate and describe the operation of PNP diode. [7M]
 b) Describe the operation of Phototransistor with neat sketch. [7M]
 (OR)
10. a) Explain about two transistor version of SCR with neat diagrams. [7M]
 b) A full wave rectifier employs 2 SCRs and 2 diodes in bridge [7M]
 configuration to rectify 230 V, 50 Hz AC mains and give a output
 of 150 V to a resistive load of 10Ω . Find firing angle, the time
 during which SCR remains OFF and the load current.

