Problems

1. What is the current in the circuit in Fig. 6.72 ? Assume the diode to be ideal. **[10 mA]**

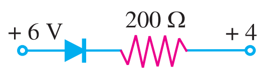


Fig. 6.72

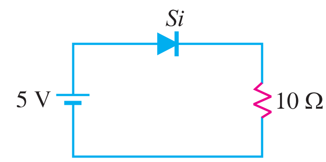


Fig. 6.73

2. Using equivalent circuit, determine the current in the circuit shown in Fig. 6.73. Assume the forward resistance of the diode to be 2 Ω. **[358 mA]**

3. Find the voltage V_A and current I in the circuit shown in Fig. 6.74. Use simplified model. **[14 V; 2 mA]**

4. Determine the magnitude of V_A in the circuit shown in Fig. 6.75. **[9.5 V]**

5. A half-wave rectifier uses a transformer of turn ratio 4 : 1. If the primary voltage is 240 V (r.m.s.), find (*i*) d.c. output voltage (*ii*) peak inverse voltage. Assume the diode to be ideal. **[(*i*) 27 V (*ii*) 85 V]**

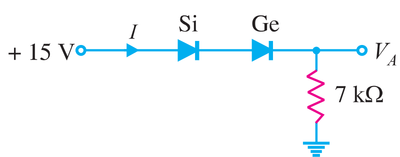


Fig. 6.74

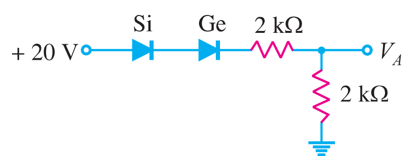


Fig. 6.75

6. A half-wave rectifier uses a transformer of turn ratio 2 : 1. The load resistance is 500 Ω. If the primary voltage (r.m.s.) is 240 V, find (*i*) d.c. output voltage (*ii*) peak inverse voltage. **[(*i*) 54 V (*ii*) 170 V]**

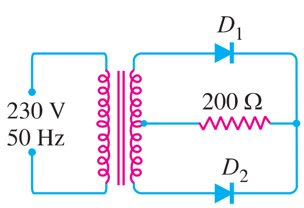


Fig. 6.76

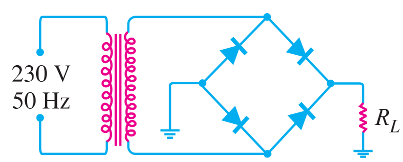


Fig. 6.77

7. In Fig. 6.76, the maximum voltage across half of secondary winding is 50 V. Find (*i*) the average load voltage (*ii*) peak inverse voltage (*iii*) output frequency. Assume the diodes to be ideal.
[(*i*) 31.8 V (*ii*) 100 V (*iii*) 100 Hz]

8. In Fig. 6.77, the maximum secondary voltage is 136 V. Find (*i*) the d.c. load voltage (*ii*) peak inverse voltage (*iii*) output frequency. **[(*i*) 86.6 V (*ii*) 136 V (*iii*) 100 Hz]**

9. A semiconductor diode having ideal forward and reverse characteristics is used in a half-wave rectifier circuit supplying a resistive load of 1000 Ω. If the r.m.s. value of the sinusoidal supply voltage is 250 V, determine (*i*) the r.m.s. diode current and (*ii*) power dissipated in the load.
[(*i*) 177 mA (*ii*) 31.3W]

10. The four semiconductor diodes used in a bridge rectifier circuit have forward resistance which can be considered constant at 0.1Ω and infinite reverse resistance. They supply a mean current of 10 A to a resistive load from a sinusoidally varying alternating supply of 20V r.m.s. Determine the resistance of the load and the efficiency of the circuit. **[1.6Ω ; 72%]**

11. Find the average value of each voltage in Fig. 6.78.
[(*i*) 1.59 V (*ii*) 63.7 V (*iii*) 16.4 V (*iv*) 10.5 V]

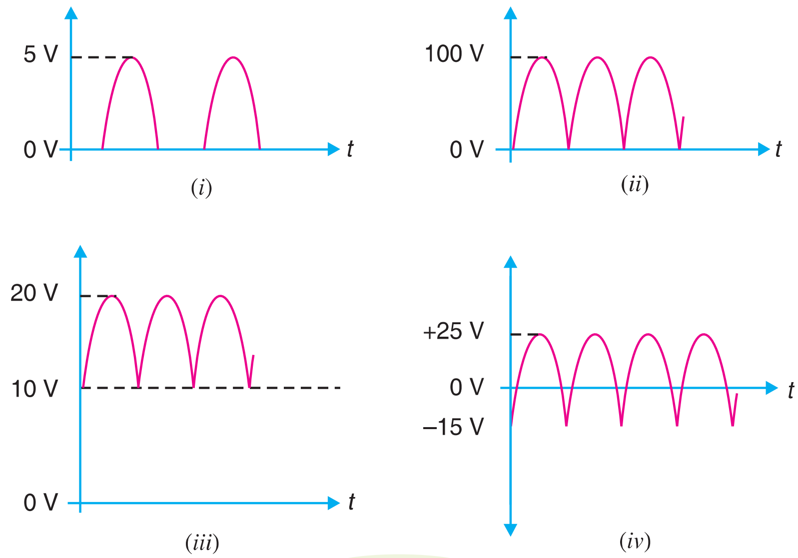


Fig. 6.78

12. Calculate the peak voltage across each half of a centre-tapped transformer used in a full-wave rectifier that has an average output voltage of 110V. **[173V]**

13. What PIV rating is required for the diodes in a bridge rectifier that produces an average output voltage of 50V? **[78.5 V]**

14. In the circuit shown in Fig. 6.79, is zener diode in the on or off state ? **[Off]**

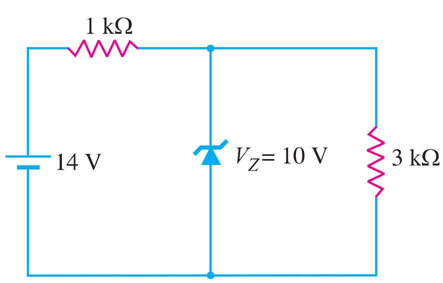


Fig. 6.79

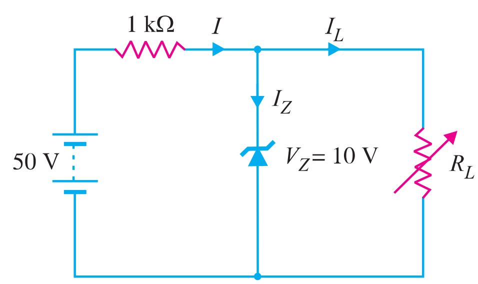


Fig. 6.80

15. In the circuit shown in Fig. 6.80, determine the range of R_L that will result in a constant voltage of 10 V across R_L. **[250 Ω to 1.25 kΩ]**

Discussion Questions

1. Why are diodes not operated in the breakdown region in rectifier service ?
2. Why do we use transformers in rectifier service ?
3. Why is *PIV* important in rectifier service ?
4. Why is zener diode used as a voltage regulator ?
5. Why is capacitor input filter preferred to choke input filter ?

Top

Problems

1. In a transistor if $I_C = 4.9\text{mA}$ and $I_E = 5\text{mA}$, what is the value of α ? **[0.98]**
2. In a transistor circuit, $I_E = 1\text{mA}$ and $I_C = 0.9\text{mA}$. What is the value of I_B ? **[0.1 mA]**
3. Find the value of β if $\alpha = 0.99$. **[100]**
4. In a transistor, $\beta = 45$, the voltage across 5kΩ resistance which is connected in the collector circuit is 5 volts. Find the base current. **[0.022 mA]**
5. In a transistor, $I_B = 68\ \mu\text{A}$, $I_E = 30$ mA and $\beta = 440$. Find the value of α. Hence determine the value of I_C. **[0.99 ; 29.92 mA]**
6. The maximum collector current that a transistor can carry is 500 mA. If $\beta = 300$, what is the maximum allowable base current for the device ? **[1.67 mA]**
7. For the circuit shown in Fig. 8.69, draw the d.c. load line.

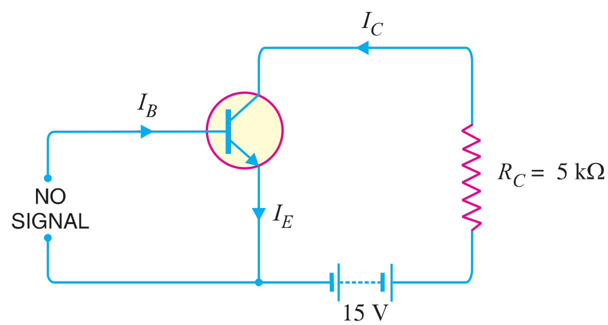


Fig. 8.69

8. Draw the d.c. load line for Fig. 8.70.

[The end points of load line are **6.06 mA** and **20 V**]

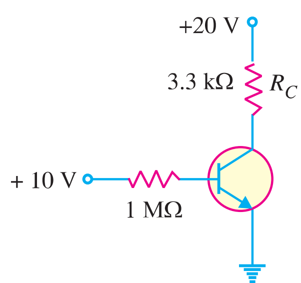


Fig. 8.70

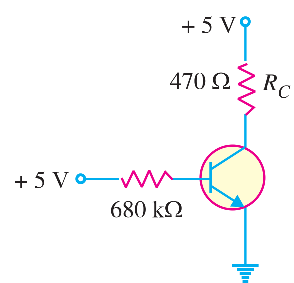


Fig. 8.71

9. If the collector resistance R_C in Fig. 8.70 is reduced to 1 kΩ, what happens to the d.c. load line ?

[The end points of d.c. load line are now **20 mA** and **20 V**]

10. Draw the d.c. load line for Fig. 8.71.

[The end points of d.c. load line are **10.6 mA** and **5V**]

11. If the collector resistance R_C in Fig. 8.71 is increased to 1 kΩ, what happens to the d.c. load line ?

[The end points of d.c. load line are now **5 mA** and **5 V**]

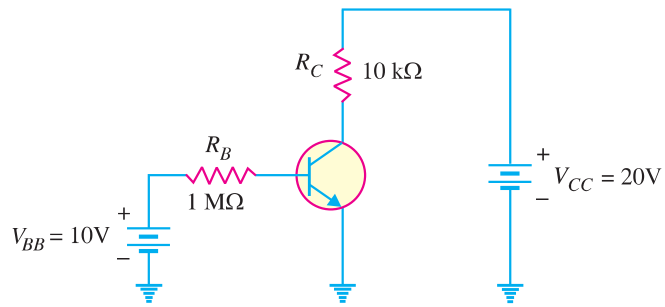


Fig. 8.72

12. Determine the intercept points of the d.c. load line on the vertical and horizontal axes of the collector curves in Fig. 8.72. **[2 mA ; 20 V]**

13. For the circuit shown in Fig. 8.73, find (*i*) the state of the transistor and (*ii*) transistor power. **[(*i*) active (*ii*) 4.52 mW]**

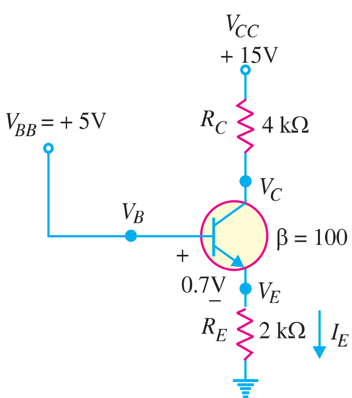


Fig. 8.73

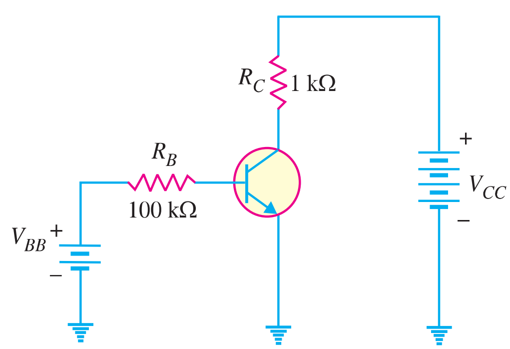


Fig. 8.74

14. A base current of 50 μA is applied to the transistor in Fig. 8.74 and a voltage of 5V is dropped across R_C. Calculate α for the transistor. **[0.99]**

15. A certain transistor is to be operated at a collector current of 50 mA. How high can V_{CE} go without exceeding $P_{D\,(max)}$ of 1.2 W ? **[24 V]**

Discussion Questions

1. Why is a transistor low powered device ?
2. What is the significance of arrow in the transistor symbol ?
3. Why is collector wider than emitter and base ?
4. Why is collector current slightly less than emitter current ?
5. Why is base made thin ?

Top

Chapter Review Topics

1. Explain the construction and working of a *JFET*.
2. What is the difference between a *JFET* and a bipolar transistor ?
3. How will you determine the drain characteristics of *JFET* ? What do they indicate?
4. Define the *JFET* parameters and establish the relationship between them.
5. Briefly describe some practical applications of *JFET*.
6. Explain the construction and working of *MOSFET*.
7. Write short notes on the following :
   (*i*) Advantages of *JFET* (*ii*) Difference between *MOSFET* and *JFET*

Problems

1. A *JFET* has a drain current of 5 mA. If I_{DSS} = 10 mA and $V_{GS(off)}$ is – 6 V, find the value of (*i*) V_{GS} and (*ii*) V_P. **[(*i*) – 1.5 V (*ii*) 6 V]**
2. A *JFET* has an I_{DSS} of 9 mA and a $V_{GS\,(off)}$ of – 3V. Find the value of drain current when V_{GS} = –1.5V. **[2.25mA]**
3. In the *JFET* circuit shown in Fig. 19.64 if I_D = 1.9 mA, find V_{GS} and V_{DS}. **[– 1.56V; 13.5V]**

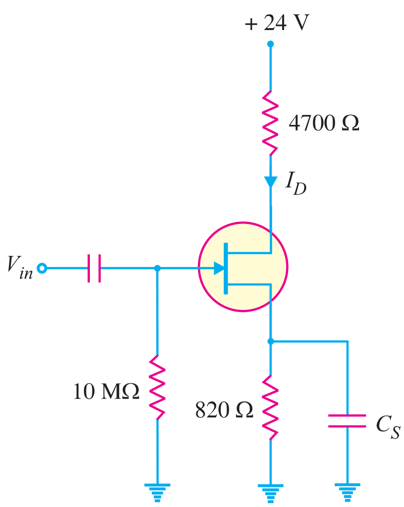


Fig. 19.64

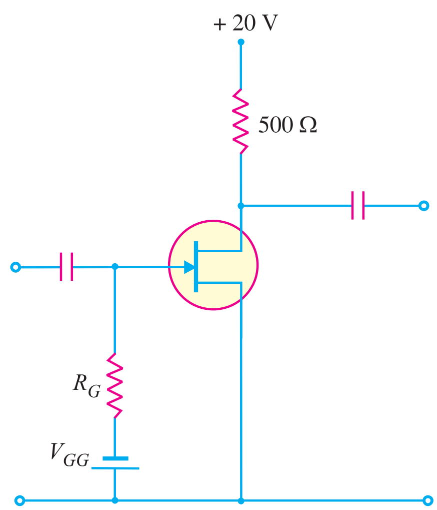
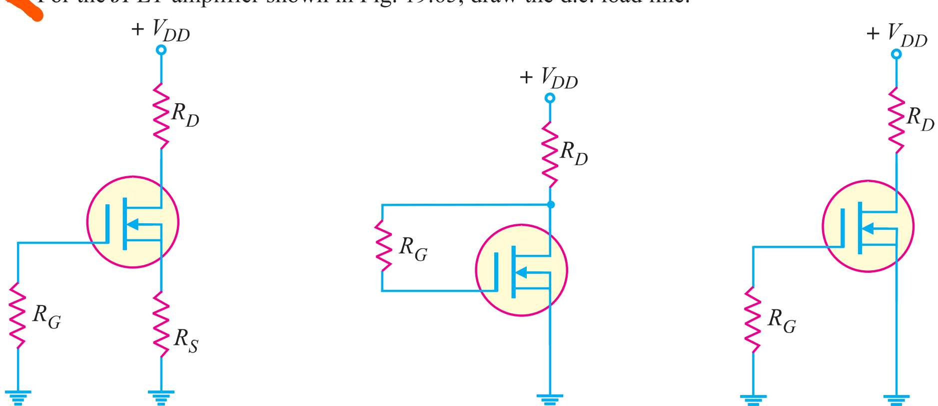


Fig. 19.65

For the *JFET* amplifier shown in Fig. 19.65, draw the d.c. load line.



(*i*) (*ii*) (*iii*)

Fig. 19.66

5. For a *JFET*, I_{DSS} = 9 mA and V_{GS} = –3.5 V. Determine I_D when (*i*) V_{GS} = 0 V (*ii*) V_{GS} = – 2V. **[(*i*) 9mA (*ii*) 1.65 mA]**
6. Sketch the transfer curve for a *p*-channel *JFET* with I_{DSS} = 4 mA and V_P = 3 V.
7. In a *D-MOSFET*, determine I_{DSS}, given I_D = 3 mA, V_{GS} = – 2V and $V_{GS\,(off)}$ = – 10V. **[4.69 mA]**
8. Determine in which mode each *D-MOSFET* in Fig. 19.66 is biased. **[(*i*) Depletion (*ii*) Enhancement (*iii*) Zero bias]**
9. Determine V_{DS} for each circuit in Fig. 19.67. Given I_{DSS} = 8 mA. **[(*i*) 4V (*ii*) 5.4V (*iii*) – 4.52V]**

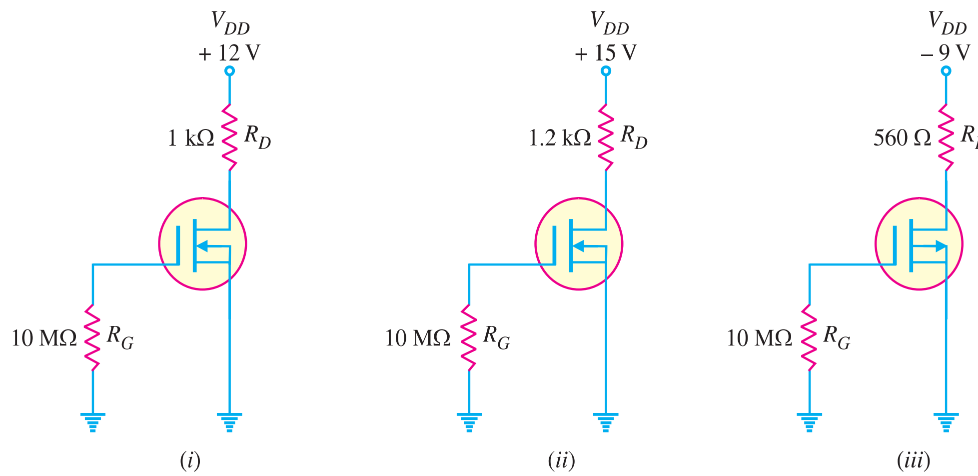


Fig. 19.67

10. If a 50 mV r.m.s. input signal is applied to the amplifier in Fig. 19.68, what is the peak-to-peak output voltage? Given that g_m = 5000 µS. **[920 mV]**

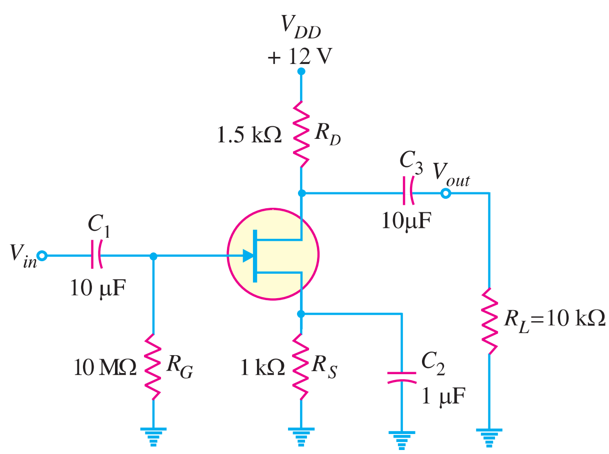


Fig. 19.68

Discussion Questions

1. Why is the input impedance of *JFET* more than that of the transistor ?
2. What is the importance of *JFET* ?
3. Why is *JFET* called unipolar transistor ?
4. What is the basic difference between *D-MOSFET* and *E-MOSFET* ?
5. What was the need to develop *MOSFET* ?

Top