Module 2: AC Circuits (Concepts + Theory + Numerical)

1. What is the necessary condition for resonance in series circuit, Derive expression for resonance frequency?

2. Show that the total power and p.f in a 3 phase balanced system can be determined using two wattmeter method.

3. A series RLC circuit, if ω_0 is the resonant frequency, ω_1 and ω_2 are the half power frequencies, prove that $\omega_0 = \sqrt{\omega_1 \omega_2}$

4. Draw impedance triangle of a series RLC circuit.

5. List the advantages of Three Phase AC over Single phase AC

6. Show that the average power consumed by a pure capacitor is zero

7. Show that the average power consumed by a pure inductor is zero

8. Draw the phasor diagram of three phase start connected circuit for lagging power factor

9. With neat diagram, explain the generation of Single Phase AC voltages.

10. Define the following w.r.t AC signal
   i) Instantaneous value
   ii) Time period
   iii) Frequency
   iv) Amplitude
   v) Peak value / Maximum value
   vi) Average value
   vii) RMS value
   viii) Form factor
   ix) Crest factor

11. Prove that in a pure inductive circuit, current I lags behind voltage V by 90 degrees

12. Prove that in a pure inductive circuit, current I leads the voltage V by 90 degrees

13. For series RC circuit,
   i) What is the nature of the circuit
   ii) What is power factor for the circuit
   iii) Draw impedance triangle for the circuit
   iv) Draw voltage triangle for the circuit
   v) Draw power triangle for the circuit
   vi) Write the expression of active power, reactive power and apparent power for this circuit

14. For series RL circuit,
   i) What is the nature of the circuit
   ii) What is power factor for the circuit
   iii) Draw impedance triangle for the circuit
   iv) Draw voltage triangle for the circuit
   v) Draw power triangle for the circuit
   vi) Write the expression of active power, reactive power and apparent power for this circuit

15. For series RLC circuit,
   i) What is the nature of the circuit
   ii) What is power factor for the circuit
   iii) Draw impedance triangle for the circuit
   iv) Draw voltage triangle for the circuit
   v) Draw power triangle for the circuit
   vi) Write the expression of active power, reactive power and apparent power for this circuit

16. Write short on:
   i) Parallel RC circuit
   ii) Parallel RL circuit

17. Draw phasor diagram for parallel RLC circuit

18. What is a power factor? How to improve power factor in AC circuit.

19. For a Series RLC resonance circuit,
   i) Draw phasor diagram at resonance
   ii) Condition for series resonance
   iii) Draw series resonance curve (I vs f)
   iv) What is the Quality factor for this circuit
   v) What is the bandwidth for this circuit

20. Derive the expression for measurement of power by two wattmeter method.

21. Derive the expression for measurement of power by two wattmeter method; also derive the expression for measurement of power factor by two wattmeter method.

22. For a parallel RLC resonance circuit,
   i) Draw phasor diagram at resonance
   ii) Condition for resonance
   iii) Draw resonance curve (I vs f)
   iv) What is the Quality factor for this circuit
   v) What is the bandwidth for this circuit

23. Compare series and parallel resonance

24. Draw a circuit for a 3 phase star connected system, and answer the following:
   i) Write the relation between line voltages and phase voltages.
   ii) Write the expression for Active power, Reactive power and apparent power

25. Draw phasor diagram for 3 phase Star connected balanced system (Assume inductive load)

26. Draw a circuit for a 3 phase Delta connected system, and answer the following:
i) Write the relation between line voltages and phase voltages.
ii) Write the expression for Active power, Reactive power and apparent power

27. Draw phasor diagram for 3 phase Delta connected balanced system (Assume inductive load)

28. Compare 3 phase star connection and 3 phase delta connection (any ten points)

29. Write short note on Measurement of power in a 3 phase system using two wattmeter method.

30. Explain two wattmeter method for Measurement of power in a 3 phase system

31. Mention the advantages of two wattmeter method

32. Draw phasor diagram for two wattmeter method for Measurement of power in a 3 phase system

Module 3: Electrical Machines

1. Draw and explain the phasor diagram of single phase transformer on No load.

2. Explain the principle of working for a single phase transformer and derive the emf equation for the same.

3. What are iron losses in the transformer? How they are minimized.

4. Draw an equivalent circuit of the transformer and write an equation of voltage regulation.

5. What are the roles of commutator and brushes in the construction of DC motors.

6. Explain the construction and working of all types of 3 phase induction motor and explain its application in different fields.

7. Explain with help of double revolving filed theory whether a single phase induction motor is self-starting or not?

8. Derive the emf equation of transformer. Also explain the losses in transformer in detail?

9. Draw and explain phasor diagram of a transformer for
a) Unity power factor or resistance load
b) Lagging power factor or inductive load
c) Leading power factor or capacitive load

10. Explain working principle of a transformer. Show that the emf per turn in a transformer is 4.44 f ϕ_m where f is the frequency of supply and ϕ_m is maximum flux associated with transformer winding.

11. Explain in detail construction and working of three phase induction motor.

12. Draw and explain the phasor diagram of Single Phase Transformer on load (Inductive load) considering winding resistance and magnetic leakages.

13. Explain iron loss in transformer

14. Draw and explain torque speed characteristics of series, shunt and compound DC motor.

15. Draw the phasor diagram of transformer on load (Capacitive load)

16. Explain construction, working and applications of three phase induction motor with neat diagram

17. Explain the principle and construction of single phase transformer with a neat labelled diagram.

18. Compare Practical transformer and Ideal transformer

19. Why transformers do not work with DC input ?

20. Explain the following w.r.t transformer, a) Winding resistance b) Leakage reactance

21. Draw equivalent circuit of a practical transformer. Hence, draw exact equivalent circuit of the transformer referred to the primary side.

22. Write short note on Transformer on load

23. Write short note on Transformer ratings

24. What is voltage regulation of transformer? Write the expression for voltage regulation.

25. Define efficiency for a transformer. Mention the condition to achieve maximum efficiency. Write the expression for maximum efficiency

26. Explain the working principle, construction of a DC series motor

27. Draw phasor diagram of single phase transformer considering its winding resistance and magnetic leakages, when capacitive load is connected to it.

28. Explain double field revolving theory related to single phase induction motor.

29. Explain the principle and construction of three phase induction motor with a neat labelled diagram.

30. How rotating magnetic field is generated in 3 phase induction motor.

31. Explain different types of single phase induction motor.

32. Explain the construction and working principle of DC motors.

Module 4: Diodes and their applications

1. Define rectifier and state different types of it.

2. Explain the working of centre tapped full wave rectifier.

3. Draw the circuit diagram and the input & output waveforms for a full wave bridge rectifier.

4. Draw the circuit diagram of a half wave rectifier with capacitor filter and the corresponding input and output waveforms for the same.

5. With the help of a neat circuit diagram and input and output waveform. Explain the working of a full wave center tapped rectifier.

6. Explain the construction and working of the following: a) Zener diode b) LED

7. Define the following for a full-wave bridge Rectifier
   i) Average value of load current
   ii) RMS value of load current
   iii) Output voltage
   iv) Rectifier efficiency
   v) Ripple factor

8. Define the following w.r.t Rectifier
   i) Rectification efficiency
   ii) Ripple factor
   iii) PIV rating
   iv) Transformer utilization factor

9. Explain the working of zener diode as voltage regulator.

10. Explain in detail construction of PN junction diode, Explain working of PN junction diode in forward and reverse bias mode with neat diagram of V-I characteristics.

11. Explain the input and output characteristics of an NPN transistor in a CE configuration. Clearly mark various regions on the characteristics. Show how different parameters can be determined from the above characteristics.

12. Explain the application of zener diode as a voltage regulator.

13. Explain full wave bridge rectifier using a capacitor filter

14. What are the advantages of zener diode?

15. Draw neat circuit diagram of a single phase bridge rectifier and explain its working.

16. Define the following for a Half-wave Rectifier
   i) Average value of load current
   ii) RMS value of load current
   iii) Output voltage
   iv) Rectifier efficiency
   v) Ripple factor

17. Define the following for a full-wave center tapped Rectifier
   i) Average value of load current
   ii) RMS value of load current
   iii) Output voltage
   iv) Rectifier efficiency
   v) Ripple factor

18. Explain the working, construction and current voltage characteristics of Photo diode

19. Mention the application of LED, photo diode, PN junction diode, Zener diode.

20. Explain any one application of PN junction diode.

21. What is peak inverse voltage (PIV) of diode? What are minimum values of PIV required in case of half wave rectifier, full wave center-tap and bridge rectifier?

Module 5: Bipolar Junction Transistor and their applications

1. Draw output characteristics of BJT in CE configurations. Mark all operating regions.

2. Draw the circuit diagram of single stage CE BJT amplifier. Explain operation in brief with input output waveforms.

3. In a BJT, what does operating point and DC basing mean?

4. Draw and explain input characteristics of npn BJT in CE configuration.

5. Draw input and output characteristics of npn BJT in CE configuration.

6. Draw and explain output characteristics of npn BJT in CE configuration.

8. Draw and explain input characteristics of npn BJT in CB configuration.

9. Draw input and output characteristics of npn BJT in CB configuration.

10. Draw and explain output characteristics of npn BJT in CB configuration.

8. Draw input and output characteristics of npn BJT in CC configuration.

9. Explain the working and construction of NPN BJT.

10. Explain application of electronic switch using NPN BJT in CE configuration.

11. Explain any one DC biasing circuit using NPN BJT.

12. Explain the significance of operating point for NPN BJT

13. For a BJT derive the relation between α and β

14. With respect to BJT, define α and β

15. Draw structure of NPN BJT and describe the different operating modes for NPN BJT

16. Compare CE, CC and CB configuration

17. Write short note on application of BJT:
    i) Voltage amplifier
    ii) Electronic switch