UNIT I
INTRODUCTION
PART –A

1. What are the three basic rotating Electric machines?
2. Name the three materials used in machine manufacture.
3. What is magneto motive force?
4. Define Leakage flux and leakage inductance.
5. Explain Flux Fringing at air – gap .
6. Write short note on stacking factor and give its value .
7. Give the classification of material based on relative permeability μ_r .
8. Define relative permeability μ_r .
9. What is B-H curve and sketch it ?
10. Define Faraday's law of induction.
11. What is Lenz's law?
12. Define statically induced emf and dynamically induced emf .
13. Write the Lorentz force equation.
14. Give few magnetic properties.
15. What is magnetic permeability ?

PART - B

1. Compare the various magnetic materials ?
2. Derive the expression of the flux , relucatance of the magnetic material with air gap .
3. Derive the inductance ,energy and power of a magnetic circuit with two windings.
4. Differentiate between Electric nad magnetic circuits.
5. Explain with a neat diagram the B-H curve .

UNIT II
TRANSFORMERS

1. What is a Transformer?
2. Enumerate the various kinds of transformers.
3. Why is the transformer windings are divided into several coils ?
4. Draw the phasor diagram of an ideal transformer.
5. Give the two general types of transformer.
6. What is an air – core transformer?
7. Draw the equivalent circuit of single phase transformer.

8. Name the two tests that are used to determine parameters of equivalent circuit, voltage regulation and efficiency.
9. State the different losses in transformer.
10. Define hysteresis and eddy current losses.
11. What is Steinmetz's constant and give its range.
12. Define efficiency and All day efficiency.
13. Enumerate the various testing of transformers.
14. What is Auto – transformer?
15. Distinguish between transformer and Auto – transformer.
16. What is tap- changer ?
17. Classify the various types of tap- changer.
18. What are the different three phase connections?
19. What is the EMF equation of a transformer?
20. Define voltage regulation.
21. What is transformation ratio?
22. At what frequency core loss and iron loss are equal?
23. What is polarity test in transformers?
24. What is equivalent resistance of transformer ? How it is calculated in primary terms ?
25. Define all- day efficiency .
26. What is equivalent reactance of transformer ? How it is calculated in primary terms ?
27. What are the two components of core loss ?
28. Draw the phasor diagram of inductive and capacitive load.
29. At what condition core loss and iron loss equal ?
30. Define voltage transformation ratio.

PART- B

1. Explain the operation of transformer in no load and loaded condition with phasor diagram.
2. Draw the equivalent circuit of a transformer and derive the components with respect to primary side .
3. Derive the EMF equation of a transformer .
4. Explain with a neat diagram the O.C and S.C test of transformer.
5. What is auto- transformer ? State the application of auto- transformer .
6. Explain the parallel operation of transformer.
7. What is tap – changer and explain its various types.
8. Explain the various testing of transformers.
9. What are the various losses of the transformers and give its efficiency .
10. What is voltage regulation.
11. Draw the various three phase connections.
12. What is sumpner's test ? Draw the circuit diagram to conduct the test .
13. Explain Scott connection and explain in detail .
14. Explain Hysteresis and eddy current loss.
15. What is polarity test of transformer ?

Unit III - ELECTROMECHANICAL ENERGY CONVERSION

Part A

1. Write the applications of singly excited and multiple excited magnetic systems.
2. Define field energy and co energy.
3. Why all the practical energy conversion devices do makes use of magnetic field as coupling medium rather than electric field?
4. Draw the i-λ characteristic of a non linear magnetic circuit when the armature is moved from x_1 to x_2.
5. Draw an energy flow diagram of an electromechanical energy conversion device when it acts as a motor.
6. Draw an energy flow diagram of an electromechanical energy conversion device when it acts as a generator.
7. Define excitation.

What is electromechanical energy conversion?

8. List three types of electromechanical energy conversion devices.
9. What is energy balance equation? Write it for the generating as well as motoring device.
10. Draw a single excited magnetic system.
11. Draw a double excited magnetic system.
12. State the assumptions made for analyzing singly excited system.
13. What is co energy? What is its use?
14. Write the expression for mechanical force for singly excited system.
15. State examples of singly excited system.
16. State examples of multiply excited system.
17. Write the expression for energy in terms of λ_1, λ_2, θ for doubly excited system.
18. State the advantages of electromechanical energy conversion principles.

Part B

1. Derive the expression for field energy and co energy in a doubly excited system assuming constant current system.
2. Derive the expression for field energy and co energy in a doubly excited system assuming constant voltage system.
3. Two coupled coils have self and mutual inductance of

$L_{11} = 2+ (1/2x)$, $L_{22} = 1+ (1/2x)$, $L_{21} = 1/2x$

over a certain range of linear displacement x. The first coil is excited by a constant current of 20A and the second by a constant current of -10A.

Find a) Mechanical work done if x changes from 0.5 to 1m.

b) Energy supplied by each electrical source in part (a).

c) Change in field energy in part (a).

Hence verify that the energy supplied by the sources is equal to the increase in the field energy plus the mechanical work done.

4. Derive the expression for torque in a singly excited system.

5. Write a note on energy balance equation.
6. For a singly excited system derive the expression for magnetic field energy stored.
7. For a singly excited system derive the expression for electrical energy input.
8. Explain the concept of co energy with i-λ curve.
9. Consider an attracted armature relay is excited by an electric source. Explain about the mechanical force developed and the mechanical energy output with necessary equations, for linear and non linear cases.
10. Write in brief about multiple-excited magnetic field system.
11. Explain the i-λ characteristic of a magnetic system. Also derive expression for co energy density assumed the i-λ relationship of the magnetic circuit is linear.
12. Give a brief note on flow of energy in electromechanical devices.
13. The magnetic flux density on the surface of an iron face is 1.8T which is typical saturation level value for ferromagnetic material. Find the force density on the iron face.

Unit IV - BASIC CONCEPTS IN ROTATING MACHINES

Part A

1. Explain the following terms with respect to rotating electrical machines
    a) Pole pitch.
    b) Chording angle.
2. Write the relation between electrical and mechanical degree.
3. Define the term synchronous speed, breadth factor.
4. What are the advantages when the stator coils are short pitched?
5. State the essential parts of any rotating machine.
6. State the expression for the generated voltage in a dc machine.
7. What is full pitch and short pitch winding?
8. What is concentrated and distributed winding?
9. State the expression for coil span factor. What is its effect?
10. State the expression for distribution factor. What is its effect?
11. State the assumptions made while obtaining mmf space wave of a single coil.
12. Draw the mmf space wave of a single coil.
13. Draw the mmf space wave of one phase of distributed winding.
14. What is rotating magnetic field.
15. State the assumptions made in deriving the torque equation for round rotor machine.
16. State the torque equation for round rotor machine.

Part B

1. Derive the expression for generated voltage in DC machine.
2. Derive the expression for generated voltage in AC machine.
3. Explain the various types of three phase AC windings.
4. Draw and explain the mmf space wave of a single coil.
5. Draw and explain the mmf space wave of one phase of distributed winding.
6. Derive the expression for peak value of the fundamental mmf space wave of single phase distributed winding.
7. Explain the concept of rotating magnetic field.
8. Explain about rotating mmf waves in AC machines.

9. A 4 pole machine as 60 slots and 8 conductors per slot. The total flux per pole is 20 m Wb. For a relative speed of 1500 rpm between field flux and armature winding calculate the generated armature voltage if the machine is a) a DC machine with lap-connected winding.
b) A 3 phase star-connected machine with winding factor equal to 0.96. All the turns in each phase are in series.
10. Derive the torque equation of a round rotor machine. Also clearly state what are the assumptions made?

Unit V - DC MACHINES

Part A

1. State Fleming right hand rule.
2. List the main parts of DC machine.
3. State the functions of yoke in a DC machine.
4. State the functions of poles in a DC machine.
5. Compare lap and wave winding.
6. State the number of parallel paths in a lap and wave connected armature winding.
7. State the various types of DC generators.
8. What are the causes of failure to excite self excited generator?
9. What is a magnetization characteristic?
10. Sketch the load characteristics of dc shunt generator, dc series generator and dc compound generator.
11. State the applications of various types of dc generators.
12. Define commutation.
13. Name the methods of improving commutation.
14. State the expression for reactance voltage.
15. Define armature reaction.
16. Name the various methods of decreasing the effects of armature reaction.
17. What are the effects of armature reaction?
18. Define critical field resistance in dc shunt generator.
19. What is back emf in dc motor? State its expression.
20. State the voltage and power equations of a dc motor.
21. State the various types of dc motors.
22. Draw the mechanical characteristics of all types of dc motor.
23. What is the necessity of starter for a dc motor?
24. State the function of overload release in dc motor starters.
25. Why dc series motor is never started on no load?
26. How to change the direction of rotation of dc motor?
27. List the various methods of controlling speed of dc shunt motor.
28. List the various methods of controlling speed of dc series motor.
29. State the various losses in dc machine.
30. Draw the power flow diagram for a dc generator and dc motor.
31. Write the condition for maximum efficiency.
32. Name the various methods of testing dc machine.
33. State the advantages and disadvantages of Swinburne's test.
34. State the advantages and disadvantages of Hopkinson's test.

35. State the advantages and disadvantages of Brake test.
36. What is the necessity for the parallel operation of dc machine?

Part B

1. Explain with a neat sketch, the construction of a dc machine.
2. Derive from first principles an expression for emf in dc generator.
3. In a particular dc machine, if P = 8, Z = 400, N = 300 rpm and Φ = 100 m Wb, calculate generated emf if winding is connected in lap and wave fashion.
4. Draw the circuit diagrams of dc separately and self excited generator indicating all the currents and voltages.
5. Explain the working of a single turn alternator. How it can be used as a dc generator?
6. With neat diagrams explain the phenomenon of armature reaction in a dc machine. Discuss its effects.
7. Develop an expression for the demagnetizing and cross magnetizing armature ampere-turns in a dc generator.
8. Explain how the effect of armature reaction can be neutralized by using inter poles and compensating winding.
9. Explain clearly the process of commutation in a dc machine. What causes sparking at the commutator surface?
10. Explain the various methods of commutation.
11. Draw the performance characteristics of different types of dc generators and explain them.
12. A 4 pole lap wound dc shunt generator has a useful flux per pole of 0.6 Wb. The armature winding consists of 200 turns, each turn having a resistance of 0.003Ω. Calculate the terminal voltage when running at 1000 rpm if armature current is 45A.
13. Sketch and explain the mechanical and electrical characteristics of all types of dc motors.
14. Explain the operation of three point starter with a neat sketch.
15. Explain the methods of speed control of dc series motor.
16. Explain the methods of speed control of dc shunt motor.
17. Explain Ward-Leonard system of speed control of a dc machine.
18. Explain Swinburne's test for finding efficiency of a dc machine.
19. Describe Hopkinson's test in detail with its advantages and disadvantages.
20. Explain how two dc shunt genitors can be connected in parallel.