MODULE 1

CAPTER 1 DC CIRCUITS

1. State and explain ohm's law?
2. Mention application and limitations of ohm's law?
3. State and explain KCL and KVL?
4. A resistance 'R' is connected in series with a parallel combination of 20ohm and 48 ohm. The total power dissipated in the circuit 1 KW, and applied voltage is 250V. Calculate R.
5. The total power consumed by the network shown in the below figure is 16 W. Find the value of R and the total current

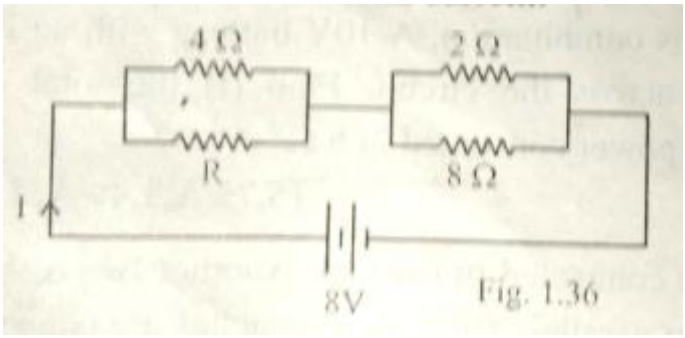
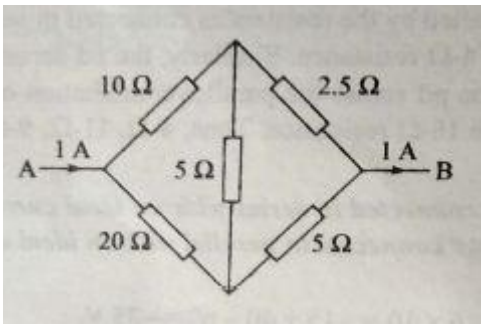
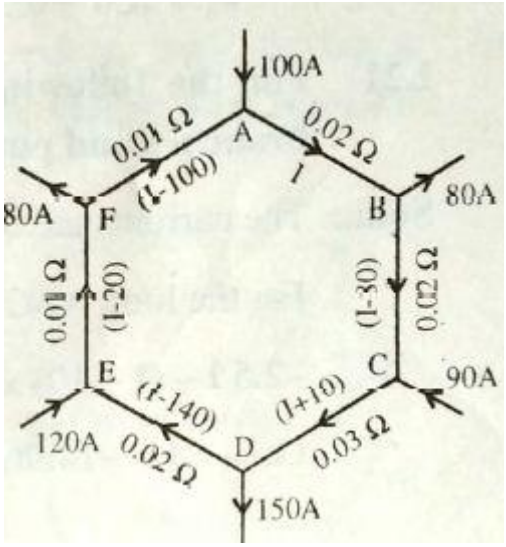


Fig. 1.36

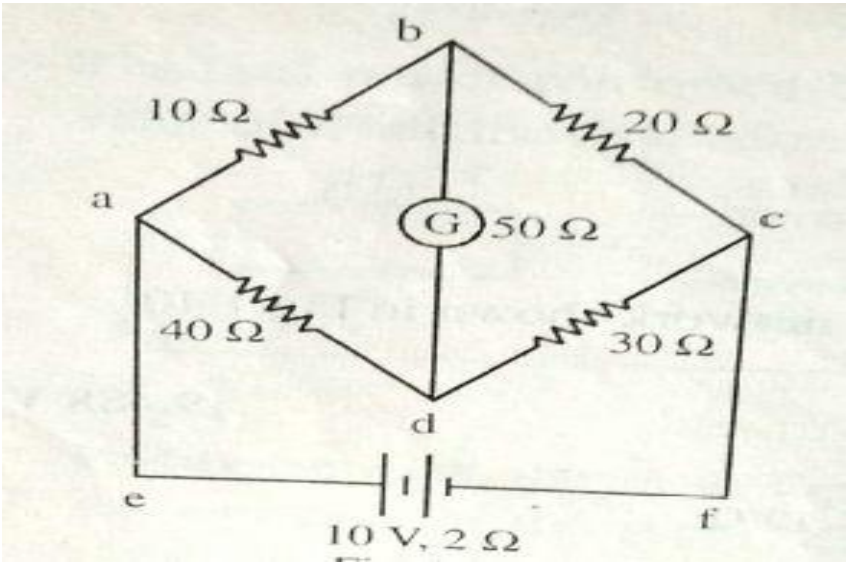
6. A circuit consists of two parallel resistor having resistance of 20 ohm and 30 ohm respectively. Connected in series with a 15 ohm resistor. if the current through 15 ohm resistor is 3A , find
   .i The current in 20 ohm and 30 ohm resistance
   .ii The voltage across the whole circuit
   .iii The total power and power consumed in all resistors
7. A current of 20A flows through 2 ammeter A & B in series. The potential difference across A is 0.2 v and across B is 0.3V. Find how the same current will divided A & B , when they are in parallel
8. Find the current in all the resistance of the network shown below. Find the voltage across AB.

9. 

10.Find the current in all branches of the network



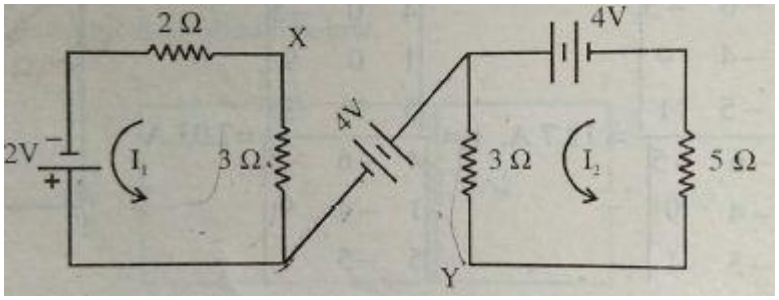
11.Using Kirchhoff's law , find the current flowing through the galvanometer G in the wheat – stone bridge network shown below



12.Obtain the potential difference V_{xy} in the circuit shown below

.i using Kirchhoff's law

.ii ohm's law



CHAPTER 2 FUNDAMENTALS OF AC CIRCUITS

1) Define the following terms

.i Instantaneous value

.ii Waveform

.iii cycle

.iv Time period

.v frequency

.vi Amplitude or peak value

.vii Time period

.viii angular frequency (w)

2. Prove that the average / mean value of full –wave rectified current is 0.637 Im

3 Prove that the average / mean value of half –wave rectified current is 0.318 Im

4 Prove that the effective / RMS value of full –wave rectified current is 0.707 Im

5 Prove that the effective / RMS value of half –wave rectified current is 0.5 Im

6 The alternating current i = 60 sin(314t + 30)A find its maximum value , RMS value , Average value , phase angle , frequency , time period , form factor , peak factor

7 The alternating voltage e = 141.4 sin (314 - 60)V , calculate its maximum value , frequency , RMS value , Average value , form factor

8 Find the sum of e.m.f if e1 = 30sinwt , e2 = 20 sin(wt. + $\pi/3$) , e3 = 15coswt , e4 = 10 sin (wt - $\pi/3$) , e5 = 20cos(wt. + $2\pi/3$). Express the result in the form e = Em sin(wt +/- ∅) and also find its i) Em ii) Erms iii) Eavg iv) Kf v) Kp

9 Find the sum of e.m.f if i_1 = 141 sin(wt + $\pi/4$) , i_2 = 30 sin (wt + $\pi/3$) , i_3 = 20 sin(wt - $\pi/6$) , i_4 = 40 cos wt , i_5 = 15 cos (wt + $2\pi/3$) . Express the result in the form of i = Im sin(wt +/- ∅) and also find its i) Im ii) Irms iii) Iavg iv) Kf V) Kp

MODULE 2

CHAPTER -1 SINGLE PHASE AC CIRCUITS

1) Derive the expression for average power in pure resistor?
2) Derive the expression for power in inductive circuit?
3) Derive the expression for the average power in pure capacitive circuit?
4) Derive the expression for average power series RL circuit?
5) Derive the expression for average power series RC circuit?
6) Derive the expression for phase angle and impedance in series RL circuit?
7) Derive the expression for phase angle and impedance in series RC circuit?
8) Derive the expression for expression for power in series RLC circuit if $X_L > X_C$ or $V_L > V_C$
9) Derive the expression for for power in series RLC circuit if $X_L < X_C$ or $V_L < V_C$
10) Derive the expression for phase and impedance in RLC circuit if i) $X_L > X_C$ or $V_L > V_C$, ii) $X_L < X_C$ or $V_L < V_C$
11) Define i) conductance ii) Admittance iii) susceptance iv) Impedance
12) A circuit consists of resistance of 20 ohm and inductance of 0.05 H connected in series. A supply of 230V, 50Hz is connected across the circuit. Find i) Impedance , ii) Current , iii) Phase angle , iV) P.F , v) power and vector diagram
13) Circuit consists of a resistance of 25 ohm and capacitance of 100μF connected in series across a supply of 200V , 50Hz , find i) Z , ii) I , iii) $\emptyset$ iv) P.F , P and vector diagram
14) A series circuit with R = 10ohm , L = 0.2H and C = 40 μF supplied with a 100V supplied at 50Hz , find current , power and P.F

15) Two impedance of (2+3j) & (8+6j) are connected in parallel. find the total impedance

16) Two circuits A & B connected in parallel circuit across 200V , 50Hz supply , circuit A consist of 10ohm resistance , 0.12H inductance in series , while calculate current in each branch , supplied current , total P.F

17) Given V = 200sin (377t) & i = 8sin (377t - 30). Determine i) P.F ii) Apparent power iii) true power iv) reactive power

CHAPTER 2 THREE PHASE CIRCUITS

1) What are the advantages of 3-phase circuits system over single – phase system
2) Derive the expression for balanced star/y connected load
3) Derive the expression for balanced Delta /mesh connected load
4) Explain the measurement of 3 – phase power by two wattmeter method
5) Explain the effect of P.F on wattmeter readings W1 &W2
6) A balanced star connected load [8 + i6] ohm is connected to a 3-phase, 230V supply. Find the line current , P.F, Power , reactive voltmeter and total – voltmeters
7) 2-Wattmeter are connected to measure the input of a 15H.P, 50Hz, 3-phase induction motor at full-load. The full-load efficiency and P.F are 0.9 and 0.8 lagging respectively .Find the readings of the two – wattmeter's
8) Each of the two wattmeter are connected to measure the input to 3-phase circuit , reads 20 KW what does each instrument reads ,

when the loads P.F is 0.866 lagging with the total 3-phase power remaining unchanged in the altered condition

9) Estimate the power factor in each of the following cases of two-wattmeter method of measuring 3-phase power i) wattmeter readings are equal ii) wattmeter readings are equal and opposite iii) wattmeter readings are in the ratio 1:2 iv) one-wattmeter method reads zero

10) Power is measured in a 3-phase balanced load using 2-wattmeter. The line voltage is 400V. The load and its P.F is so adjusted that the line current is always 10A. Find the readings of the wattmeter when the P.F is i) unity ii) 0.866 iii) 0.5 iv) zero

11) When three balanced impedances are connected in star, across a three phase 415V, 50 Hz supply, the line current drawn is 20A, at a lagging p.f. of 0.4. Determine the parameters of the impedance in each case

12) A star connected load consists of 6 ohm resistance and 8 ohm inductive reactance in each phase. A supply of 440V at 50 Hz is applied to the load. Find the line current, power consumed and power factor.

13) A delta connected load consists of resistance of 10 ohm and a capacitance of 100 μF in each phase. A supply of 410V at 50 Hz is applied to the load. Find the line current, power factor and power consumed by the load.

14) Three coils each having a resistance of 10 ohm and an inductance of 0.2 H are connected across 440V, 50 Hz, 3 phase supply. Calculate the line current and total power consumed.

15) Three 100 ohm resistors are connected in (i) star and (ii) delta across a 415 V, 50 Hz, 3 phase supply. Calculate the line and phase current and the power consumed in each phase.

16) A three phase y connected supply with a phase voltage of 230V is supplying a balanced delta load. The load draws 15kw at 0.8 p.f. lagging. Find the line current and current in each phase of the load. What is the load impedance per phase?

MODULE 3

CHAPTER – 1 SINGLE PHASE TRANSFORMER

1) Explain the working principle of transformers
2) Obtain the e.m.f equation for a transformer
3) Derive the expression for transformation ratio
4) Explain the types of transformers
5) Explain the different types of losses occurs in a transformers Obtain the condition for the maximum efficiency of the transformer
6) Applications of transformer
7) Explain the necessity of transformer
8) Explain the principle of operation of a transformer
9) Explain the working principle of a single phase transformer

10)Derive e.m.f equation of a transformer

11)Explain the types of single phase transformer

.Explain different losses occurring in transformer

12) A single – phase transformer has 400 primary and 1000 secondary turns. The net cross sectional area of the core is 60 cm^2. The supply is 500V , 50Hz. Calculate i) Value of flux density ii) Voltage induced in the secondary iii) No of secondary turns to induce a voltage of 2500V

13)A secondary winding of a transformer is connected to a 240V, 50Hz supply .The secondary winding has 1500 turns. If the maximum value of the core flux is 0.00207 wb , determine i) secondary induced e.m.f ii) Secondary induced e.m.f ii) no of turns in the primary iii) area of cross sectional if the flux density has a maximum value of 0.465 tesla.

14) A 50KVA transformer has N_1: N_2 = 300:20. The primary winding is connected to a 2200V, 50 Hz supply. calculate i) Secondary voltage on no load ii) Approximate values of primary and secondary currents on full load iii) the maximum value of flux.

15) Single –phase transformer has 1000 turns on its primary and 400 turns on the secondary side. Voltage of 1250, 50Hz is applied to its primary side with the secondary open circuited. Calculate

i) Secondary e.m.f ii) Maximum value of flux density , given that the effective cross sectional area of core is 60cm^2

16) In 25KVA, 2000/200V transformer, the iron and full load copper losses are 350 w and 400W respectively, calculate the efficiency at u.p.f at half and 3/4th full load.

17) The maximum efficiency at full load and u.p.f of a single-phase 25KVA 500/1000V, 50Hz, transformer is 98%, determine its efficiency at i) 75% load, 0.9 P.F ii) 50% load, 0.8P.F.

18) A 500KVA transformer as an efficiency of 92% of full load, upf at half, and at half full load, 0.9 pf. Determine its efficiency at 80% of full load and 0.95 pf

19) A transformer at u.p.f has an efficiency of 90% at both one half load and at the full load of 500w. Determine the efficiency at 75% of full load.

20) A 1KVA transformer has a core loss of 15W and F.L copper loss of 20W. calculate the efficiency at i) F.L , 0.9 P.F lag ii) half – full load unity P.F iii) ¾ full load , 0.707 P.F

21) A 40KVA transformer has a core loss of 450 W full load copper loss of 850W .If the load power factor is 0.8 , calculate i) efficiency at full load ii) load at which copper loss is equal to iron loss iii) efficiency at this load

22)A single phase, 20KVA transformer has 1000primary turns and 2500 secondary turns. The net cross sectional area of the core is 100cm2. When the primary winding is connected to 500v , 50 Hz supply , calculate

1- The maximum value of flux density in the core

2 – The voltage induced in the secondary winding

3 – The primary and secondary full load currents

23)Find the number of turns on the primary and secondary side of a 440/230 V , 50Hz , single phase transformer , if the net area of a cross section of the core is 30cm2 and the maximum value of flux density is 1 Wb/m2

24)The primary winding of a 25KVA transformer has 200 turns and is connected to 230V, 50 Hz supply. The secondary turns are 50. Calculate

1- No load secondary induced e.m.f

2 – Full load primary and secondary currents

3 – The flux density in the core, if the cross section of the core is 60 cm2

25).A 100 KVA, 50 Hz single phase transformer has a turn's ratio of 1000/250. The primary winding is connected to 500V, 50 Hz supply. Fund the secondary open circuit voltage and the maximum value of the flux in the core.

26).The secondary winding of transformer is connected to 240V, 50Hz supply. The secondary winding has 1500 turns. If the maximum value of the core flux is 0.00207 wb , determine

Secondary induced e.m.f

Number of turns in primary winding

Area of cross section if the flux density has a maximum value of 0.465 tesla

27)Single phase transformer has 1000 turns on its primary and 400 turns on the secondary side voltage of 1250v , 50Hz is applied to its primary side with the secondary open circuited , calculate

i) Secondary e.m.f

ii) Maximum value of flux density given the effective cross section area of core is 60cm2

28).In 25 KVA, 2000/200V transformer the iron and full load copper losses are 350w and 400w respectively. Calculate the efficiency at u p f at half and $3/4^{th}$ full load.

29).The maximum efficiency at full load and unity power factor of a single phase 25kva 500/1000v, 50 Hz. Transformer is 98% determine its efficiency at

i) 75% load 0.9 pf

ii) 50% load 0.8 pf

30).A transformer at u.p.f has an efficiency of 90% at both one half load and at the full load of 500w. Determine the efficiency at 75% of full load At full load 0.9 η , p0 = 500w

31)A 40KVA , single phase transformer has core loss of 450w and full load copper loss of 850w .If the power factor of the load is 0.8 , calculate

Full-load efficiency

Maximum efficiency at upf

Load for maximum efficiency

32).A 500KVA transformer as an efficiency of 92% of full load, upf at half, and at half full load, 0.9 pf. Determine its efficiency at 80% of full load and 0.95 pf

33).A 250 KVA transformer has 98.135% efficiency at full load and 0.8pf, the efficiency at half load and 0.8 pf is 97.751% .Calculate the iron loss and full load copper loss.

34).A 600 KVA transformer has an efficiency of 92% both at full load upf and half load 0.9 pf .Determine its efficiency at 75% of full load and 0.9pf.

CHAPTER – 2 DOMESTIC WIRING

1) Explain two way and three way control of lamp.
2) Explain electric shock, causes and precautions to be taken to prevent them
3) What is earthing? Explain different types of earthing with neat diagram?
4) What are the factors affecting the choice of wiring system?
5) Explain the circuit protective devices

MODULE 4

DC MACHINES

1. Explain the construction of dc – generator as a DC-Machine
2. Explain the working principle of DC – machine as a DC-generator
3. Derive the e.m.f equation of a DC-generator
4. Derive the expression for the significance of back e.m.f in a DC-motor
5. Derive an equation for the torque developed in the armature of a DC-motor
6. Application of DC-motor
7. Difference between Lap and wave winding
8. The induced e.m.f in a DC generator running at 1500 r.p.m is 500v
   a. Calculate the induced e.m.f ,when it runs at 1000 r.p.m , the flux remaining constant
   b. Find the percentage increase in flux , so that the induced e.m.f at 1200 r.p.m is 600v.
9. An 8 pole DC generator has 320 conductors and its flux and speed are such, that the average E.m.f generated in each conductor is 2v. The current in each conductor is 100A. Find the total current and generated e.m.f, .if the winding is (a) Lap connected and (b) Wave connected. Also find the total power generated in each case.
10. A shunt generator as no load e.m.f of 150 v and when it is loaded, the terminal voltage decreases to 140v. The armature resistance and field resistance are 0.2 ohm and 100ohm respectively. Find the load current .Ignore armature reaction.
11. A separately excited dc generator , when running at 1200 r.p.m supplies 200 A at 125 V to a circuit of constant resistance .What will be the current when the speed is dropped to 1000 r.p.m , if the field current is unaltered . Voltage drop / brush is one V. Armature resistance is 0.04 ohm Ignore armature reaction

12. A long shunt compound generator delivers a load current of 50A at 500V and has armature series field and shunt field resistance of 0.05 ohm, 0.03 ohm and 250 ohm respectively. Calculate the generated e.m.f and the armature current. Allow 1.0 volt/brush for contact drop
13. In a given DC machine if P=8, Z = 400, N = 300 r.p.m and flux = 100mWB. calculate e.m.f with winding (i) Lap connected (ii) Wave winding
14. A 4 pole generator with wave winding armature has 51 slots each having 24 conductors .The flux per pole is 0.01WB .At what speed must the armature rotates to give an induced e.m.f of 220V what will be the voltage developed if the winding is lap and the armature rotates at the same speed .
15. An 8 pole lap connected armature 960 conductors. A flux of 40mWB per pole and a speed of 400 rpm. Calculate the e.m.f generated .If the armature are wave connected at what speed it must be driven to generated 400V.
16. An 2 pole lap connected armature driven at 400 r.p.m is required to generate 250 V. The useful flux per pole is 0.05 WB if the armature has 150 slots. Calculate a suitable number of conductors per slot.
17. A 6 pole lap wound DC generator has 600 conductors and runs at 1200 r.p.m. If the flux per pole is 30 mWB. What is the induced e.m.f? If the speed is induced to 1600 r. p. m and at the same time the field excitation is reduced such that the flux per pole decreases to 20 mWB. What would be the induced e.m.f?
18. A 110V dc shunt generator delivered a load current of 50A. The armature resistance is 0.2 ohm and the field circuit resistance is 55 ohm. The generator rotating at a speed of 1800 r.p.m. has 6 poles lap wound and has a total of 360 conductors. calculate (i)the no load voltage in the armature (ii)the flux per pole
19. A 4 pole lap wound 750 r.p.m shunt generator has an armature resistance of 0.4 ohm and the field resistance of 200 ohm respectively. The armature has

750 conductors and a flux per pole is $3x10^{-2}$ Wb. If the load resistance is 10 ohm determine the terminal voltage

20. A 4 pole lap wound shunt generator delivers 200V at terminal voltage of 250V. It has a field and armature resistance of 50 ohm and 0.05 ohm respectively. Neglecting a brush drop determine (i)armature current (ii)current armature parallel path (iii)e.m.f. generated (iv)power developed
21. A long shunt compound generator delivers a load current of 50A at 500V. It has armature , series field and shunt field resistance of 0.05 ohm ,0.03 ohm and 250 ohm respectively , Calculate the generated e.m.f
22. A 4 pole 250 V lap wound dc motor has 36 slots, each slot containing 16 conductors. It draws a current of 40A from the supply. The field resistance and armature resistance are 110 ohm and 0.1 ohm respectively. The motor develops an output power of 6KW. The flux per pole is 40mWB. Calculate (i)the speed (ii)the torque developed by the armature (iii)shaft torque
23. A shunt dc machine connected to 250V supply has an armature resistance of 0.12 ohm and a field resistance of 100 ohm. Find the ratio of the speed of the machine as generator and to the speed of the motor. The line current in each case is 80A
24. A 4 pole 500V shunt motor has 720 wave connected conductors and its armature the full load armature current is 60A and the flux/pole is 0.03WB. The armature resistance is 0.2 ohm and the contact drop is 1V/brush .Calculate load speed
25. Find the useful flux/pole on no load of 250V, 6 pole shunt motor having a two circuit wave connected armature winding with 110 turns at normal working temperature the of overall armature resistance including brushes is 0.2 ohm. The armature current is 13.3A at no load speed of 908 r.p.m
26. A 120V dc shunt motor has an armature resistance of 0.2 ohm and a field resistance of 60 ohm. It runs at 1800rpm when it takes a full load current at 40

A .Find the speed of the motor when it is operating with half of full load current?

27. A 250V shunt motor on no load runs at 1000rpm and takes 5 amps. The total armature shunt field resistance are 0.2 ohm and 250 ohm respectively. Calculate the speed when loaded and taking a current of 50A if the armature reaction weakens the field by 3%.

MODULE 5

CHAPTER 1 SYNCHRONOUS GENERATOR OR ALTERNATOR

1. Explain the construction and working principle of alternator
2. With a neat diagram explain salient and non-salient type rotor
3. Define
   I. Slot angle
   II. Angle of short pitch
   III. Pitch factor
   IV. Distribution factor
   V. Winding factor
4. Derive the e.m.f equation of alternator
5. Advantages of alternator
6. A six pole dc generator is running and producing a voltage at a frequency of 60 Hz. Calculate the revolutions per minute of the generator. If the frequency of the generated voltage is required to be decreased to 20 Hz, how many poles would be needed on the generator, if it still runs at same speed?
7. A 4-pole, 3 phase alternator has 36 slots. It has an armature winding which is short-pitched by one slot. Calculate its coil span factor
8. An 8-pole, 3 phase, 120 slots alternator has distributed armature winding. Calculate its distribution factor
9. Determine the distribution factor for a machine having 9 slots per pole for the following cases
   a) A three phase winding with 120 degree phase group
   b) A three phase winding with 60 degree phase group

10. A 2-pole, 3-phase alternator running at 3000rpm has 42 slots with 2 conductors per slot. Calculate the flux per pole required to generate line voltage of 2300 v. Assume Kd = 0.952, KP = 0.956.
11. A 3-phase, 16 poles, stars –connected alternator has 144 slots on armature periphery. Each slot contains 10 conductors. It is driven at 375 r.p.m. The line value of e.m.f available across the terminals is observed to be 2.657 KV. Find the frequency of the induced e.m.f and the flux per pole
12. A 3-phase, 6 poles, stars –connected alternator has 90 slots with 8 conductors per slot and rotates at 1000 r.p.m .The flux per pole is 50mWB. Find the induced e.m.f across its lines. Take the winding factor of 0.97.
13. A 12 – pole, 500 r.p.m, star connected alternator has 48 slots with 15 conductors per slot. The flux per pole is 0.02 WB and is distributed sinusoidally. The winding factor is 0.97. Calculate the line e.m.f.
14. A part of alternator winding consists of 6 coils in series, each having an e.m.f of 10V (rms) induced in it. The coils are placed in successive slots and the electrical angle between two consecutive slots is 30 degree .Calculate the net e.m.f induced in six coils in series.
15. A 24 pole turbo alternator has a star connected armature winding with 144 slots and 10 conductors per slot. It is driven by a low speed Kaplan turbine at a speed of 250 revolution / minute. The winding has full pitched coils with a distribution factor of 0.966. The flux per pole is 67.3 mWB. Determine (i) the frequency and the magnitude of the line voltage (ii) the output KVA of the machine, if the total current in each phase is 50 A.

CHAPTER – 2 INDUCTIONS MOTOR

1. Explain the construction and working of 3-phase induction motor
2. With a neat diagram , explain squirrel cage and phase wound /slip ring rotor
3. Explain the concept of rotating magnetic field

4. Define and derive
   I. Slip Speed
   II. Normalized slip speed or slip
   III. Rotor or motor speed
5. Explain frequency of rotor current
6. What is the necessity of starters for 3 –phase induction motor
7. Explain star – delta starter
8. A 3 phase, 4pole, 440 v, 50 Hz induction motor runs with a slip of 4%. Find the rotor speed and frequency of rotor current
9. The frequency of the e.m.f in the stator of a 4 pole induction motor is 50Hz and that in the rotor is 1.5 Hz. What is the slip and at what speed the motor is running?
10. A 12 pole, 3 phase alternator is coupled to an engine running at 500 r.p.m. It supplies and induction motor which as a full load speed of 1440 r.p.m. Find the percentage slip and the number of poles of the motor
11. A 3 phase induction motor with 4 poles is supplied from an alternator having six poles and running at 1000 r.p.m calculate (i) Synchronous speed of the induction motor (ii) its speed when slip is 0.04 (iii) Frequency of the rotor e.m.f when the speed is 600 r.p.m
12. A 3-phase induction motor has 6 poles and runs at 960 r.p.m on full load. It is supplied from an alternator having 4 poles and running at 1500 r.p.m .Calculate the full load slip and the frequency of the rotor currents of the induction motor.
13. A 4 pole, 50 Hz induction motor has a slip of 1% at no load. When operated at full load, the slip is 2.5%. Find the change in speed from no load to full load.
14. A 6-pole induction motor is supplied by a 10-pole alternator which is driven at 600r.p.m .If the motor is running at 970r.p.m, determine the percentage slip.