SYED AMMAL ENGINEERING COLLEGE

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

EE6352-ELECTRICAL ENGINEERING AND INSTRUMENTATION

UNIT – I D.C. MACHINES

1. What is prime mover?

The basic source of mechanical power which drives the armature of the generator is called prime mover.

2. Give the materials used in machine manufacturing?

There are three main materials used in m/c manufacturing they are steel to conduct magnetic flux copper to conduct electric current insulation.

3. What are factors on which hysteresis loss?

It depends on magnetic flux density, frequency & volume of the material.

4. What is core loss? What is its significance in electric machines?

When a magnetic material undergoes cyclic magnetization, two kinds of power losses occur on it. Hysteresis and eddy current losses are called as core loss. It is important in determining heating, temperature rise, rating & efficiency of transformers, machines & other A.C run magnetic devices.

5. What is eddy current loss?

When a magnetic core carries a time varying flux, voltages are induced in all possible path enclosing flux. Resulting is the production of circulating flux in core. These circulating current do no useful work are known as eddy current and have power loss known as eddy current loss.

6. How hysteresis and eddy current losses are minimized?

Hysteresis loss can be minimized by selecting materials for core such as silicon steel & steel alloys with low hysteresis co-efficient and electrical resistivity. Eddy current losses are minimized by laminating the core.

7. How will you find the direction of emf using Fleming's right hand rule?

The thumb, forefinger & middle finger of right hand are held so that these fingers are mutually perpendicular to each other, then forefinger gives the direction of the lines of flux, thumb gives the direction of the relative motion of conductor and middle finger gives the direction of the emf induced.

8. How will you find the direction of force produced using Fleming‟s left hand rule?

The thumb, forefinger & middle finger of left hand are held so that these fingers are mutually perpendicular to each other, then forefinger gives the direction of magnetic field, middle finger gives the direction of the current and thumb gives the direction of the force experienced by the conductor.

9. What is the purpose of yoke in d.c machine?

1. It acts as a protecting cover for the whole machine and provides mechanical support for the poles.

2. It carries magnetic flux produced by the poles

10. What are the types of armature winding?

1. Lap winding A=P
2. Wave winding , A=2 .

11. How are armatures windings are classified based on placement of coil inside the armature slots?

Single and double layer winding.

12. Write down the emf equation for d.c.generator?

E=(ΦNZ/60)(P/A)V. p= no of poles, Z=Total no of conductor, Φ=-flux per pole N=speed in rpm.

13. Why the armature core in d.c machines is constructed with laminated steel sheets instead of solid steel sheets?

Lamination highly reduces the eddy current loss and steel sheets provide low reluctance path to magnetic field.

14. Why commutator is employed in d.c.machines?

Conduct electricity between rotating armature and fixed brushes, convert alternating emf into unidirectional emf(mechanical rectifier).

15. Distinguish between shunt and series field coil construction?

Shunt field coils are wound with wires of small section and have more no of turns. Series field coils are wound with wires of larger cross section and have less no of turns.

16. How does d.c. motor differ from d.c. generator in construction?

Generators are normally placed in closed room and accessed by skilled operators only. Therefore on ventilation point of view they may be constructed with large opening in the frame. Motors have to be installed right in the place of use which may have dust, dampness, inflammable gases, chemical etc. to protect the motors against these elements the motor frames are used partially closed or totally closed or flame proof.

17. How will you change the direction of rotation of d.c.motor?

Either the field direction or direction of current through armature conductor is reversed.

18. What is back emf in d.c. motor?

As the motor armature rotates, the system of conductor come across alternate north and south pole magnetic fields causing an emf induced in the conductors. The direction of the emf induced in the conductor is in opposite to current. As this emf always opposes the flow of current in motor operation it is called as back emf.

19. What is the function of no-voltage release coil in d.c. motor starter?

As long as the supply voltage is on healthy condition the current through the NVR coil produce enough magnetic force of attraction and retain the starter handle in ON position against spring force. When the supply voltage fails or becomes lower than a prescribed value then electromagnet may not have enough force to retain so handle will come back to OFF position due to spring force automatically.

20. Enumerate the factors on which speed of a d.c.motor depends?

$N= (V-IaRa)/\Phi$

so speed depends on voltage applied to armature, flux perpole, resistance of armature.

21. Under what circumstances does a dc shunt generator fails to generate?

Absence of residual flux, initial flux setup by field may be opposite in direction to residual flux, shunt field circuit resistance may be higher than its critical field resistance, load circuit resistance may be less than its critical load resistance.

22. Define critical field resistance of dc shunt generator?

Critical field resistance is defined as the resistance of the field circuit which will cause the shunt generator just to build up its emf at a specified field

23. Why is the emf not zero when the field current is reduced to zero in dc generator?

Even after the field current is reduced to zero, the machine is left out with some flux as residue so emf is available due to residual flux.

24. On what occasion dc generator may not have residual flux?

The generator may be put for its operation after its construction, in previous operation, the generator would have been fully demagnetized.

25. What are the conditions to be fulfilled by for a dc shunt generator to build back emf?

The generator should have residual flux, the field winding should be connected in such a manner that the flux setup by field in same direction as residual flux, the field resistance should be less than critical field resistance, load circuit resistance should be above critical resistance.

26. Define armature reaction in dc machines?

The interaction between the main flux and armature flux cause disturbance called as armature reaction.

27. What are two unwanted effects of armature reactions?

Cross magnetizing effect & demagnetizing effect.

28. What is the function of carbon brush used in dc generators?

The function of the carbon brush is to collect current from commutator and supply to external load circuit and to load.

29. What is the principle of generator?

When the armature conductor cuts the magnetic flux emf is induced in the conductor.

30. What is the principle of motor?

When a current carrying conductor is placed in a magnetic field it experiences a force tending to move it.

31. What are different methods of speed control in D.C shunt motor?

1. Armature control

2. Flux or field control

3. Applied voltage control

32. When is a four point DC starter required in DC motors?

A four point DC starter is required for dc motor under field control

33. If speed is decreased in a dc motor, what happens to the back emf decreases and armature current?

If speed is decreased in a dc motor, the back emf decreases and armature current increases.

34. How does a series motor develop high starting torque?

A dc series motor is always started with some load. Therefore the motor armature current increases. Due to this, series motor develops high starting torque.

35. What is the necessity of starter in dc motors?

When a dc motor is directly switched on, at the time of starting, the motor back emf is zero. Due to this, the armature current is very high. Due to the very high current, the motor gets damaged. To reduce the starting current of the motor a starter is used.

36. Mention the types of braking of dc motor?

1. Regenerative braking

2. Dynamic braking

3. Plugging

37. What are the losses in dc motor?

1. Copper losses

2. Iron losses

3. Mechanical losses

38. Name any 2 non-loading method of testing dc machines?

1. Swinburne‟s test

2. Hopkinson test

UNIT – II TRANSFORMERS

1. Define a transformer?

A transformer is a static device which changes the alternating voltage from one level to another.

2. What is the turns ratio and transformer ratio of transformer?

Turns ratio = N2/ N1

Transformer = E2/E1 = I1/ I2 =K

3. Mention the difference between core and shell type transformers?

In core type, the windings surround the core considerably and in shell type the core surrounds the windings i.e winding is placed inside the core.

4. What is the purpose of laminating the core in a transformer?

In order to minimise eddy current loss.

5. Give the emf equation of a transformer and define each term?

Emf induced in primary coil E1= 4.44fΦmN1 volt

Emf induced in secondary Coil E2 =4.44

fΦmN2. f----» freq of AC input

Φ----»maximum value of flux in the core

N1, N2----»Number of primary & secondary turns.

6. Does transformer draw any current when secondary is open? Why?

Yes, it(primary) will draw the current from the main supply in order to magnetize the core and to supply for iron and copper losses on no load. There will not be any current in the secondary since secondary is open.

7. Define voltage regulation of a transformer?

The change in secondary terminal voltage from no load to full load expressed as a percentage of no load or full load voltage is termed as regulation.

%regulation down=(V2noload- V2full load)*100/ V2noload,

%regulation up=(V2noload-V2F.L)*100/V2F.L

8. Define all day efficiency of a transformer?

It is computed on the basis of energy consumed during a certain period, usually a day of 24 hrs. all day efficiency=output in kWh/input in kWh for 24 hrs.

9. Why transformers are rated in kVA?

Copper loss of a transformer depends on current & iron loss on voltage. Hence total losses depend on Volt-Ampere and not on PF. That is why the rating of transformers are in kVA and not in kW.

10. What determines the thickness of the lamination or stampings?

1. Frequency

2. Iron loss

11 What are the typical uses of auto transformer?

To give small boost to a distribution cable to correct for the voltage
1. drop.

2. As induction motor starter.

12. What are the applications of step-up & step-down transformer?

Step-up transformers are used in generating stations. Normally the generated voltage will be either 11kV. This voltage (11kV) is stepped up to110kV or 220kV or 400kV and transmitted through transmission lines (simply called as sending end voltage).

Step-down transformers are used in receiving stations. The voltage are stepped down to 11kV or 22kV are stepped down to 3phase 400V by means of a distribution transformer and made available at consumer premises. The transformers used at generating stations are called power transformers.

13. How transformers are classified according to their construction?

1. Core type

2.shell type.

In core type, the winding (primary and secondary) surround the core

In shell type, the core surround the winding.

14. Explain on the material used for core construction?

The core is constructed by sheet steel laminations assembled to provide a continuous magnetic path with minimum of air gap included. The steel used is of high silicon content sometimes heat treated to produce a high permeability and a low hysteresis loss at the usual operating flux densities. The eddy current loss is minimized by laminating the core, the laminations being used from each other by light coat of core-plate vanish or by oxide

layer on the surface. The thickness of lamination varies from 0.35mm for a frequency of 50Hz and 0.5mm for a frequency of 25Hz.

15. How does change in frequency affect the operation of a given transformer?

With a change in frequency, iron and copper loss, regulation, efficiency & heating varies so the operation of transformer is highly affected.

16. What is the angle by which no-load current will lag the ideal applied voltage?

In an ideal transformer, there are no copper & core loss i.e. loss free core. The no load current is only magnetizing current therefore the no load current lags behind

by angle 900. However the winding possess resistance and leakage reactance and therefore the no load current lags the applied voltage slightly less than 900.

17. List the arrangement of stepped core arrangement in a transformer?

To reduce the space effectively

To obtain reduce length of mean turn of the winding

To reduce I2R loss.

18. Why are breathers used in transformers?

Breathers are used to entrap the atmospheric moisture and thereby not allowing it to pass on to the transformer oil. Also to permit the oil inside the tank to expand and contract as its temperature increases and decreases.

19. What is the function of transformer oil in a transformer?

It provides good insulation Cooling.

20.Can the voltage regulation go –ive? If so under what condition?

Yes, if the load has leading PF.

21.Distinguish power transformers & distribution transformers?

Power transformers have very high rating in the order of MVA. They are used in generating and receiving stations. Sophisticated controls are required. Voltage ranges will be very high. Distribution transformers are used in receiving side. Voltage levels will be medium. Power ranging will be small in order of kVA. Complicated controls are not needed.

22. Name the factors on which hysteresis loss depends?

1. Frequency

2. Volume of the core

3. Maximum flux density

23. Why the open circuit test on a transformer is conducted at rated voltage?

The open circuit on a transformer is conducted at a rated voltage because core loss depends upon the voltage. This open circuit test gives only core loss or iron loss of the transformer.

24. What is the purpose of providing Taps in transformer and where these are provided?

In order to attain the required voltage, taps are provided, normally at high voltages side(low current).

25. What are the necessary tests to determine the equivalent circuit of the transformer?

Open circuit test

Short circuit test

26. Define regulation and efficiency of the transformer?

The regulation of the transformer is defined as the reduction in magnitude of the terminal voltage due to load, with respect to the no-load terminal voltage.

% regulation = (V2 on no-load- V2 when loaded/ V2 on no-load)x 100

Transformer efficiency η= (output power/input power)x 100

UNIT – III INDUCTION MOTORS

1. What are the 2 types of 3phase induction motor?

Squirrel cage and slip ring induction motor.

2. Write two extra features of slip ring induction motor?

Rotor has 3-phase winding. Extra resistance can be added in rotor circuit for improving PF with the help of three slip rings.

3. Why an induction motor is called as rotating transformer?

The rotor receives same electrical power in exactly the same way as the secondary of a two winding transformer receiving its power from primary. That is why induction motor is called as rotating transformer.

4. Why an induction motor never runs at its synchronous speed?

If the motor runs at sync. speed then there would be no relative speed between the two, hence no rotor emf, so no rotor current, then no rotor torque to maintain rotation.

5. What are slip rings?

The slip rings are made of copper alloys and are fixed around the shaft insulating it. Through these slip rings and brushes rotor winding can be connected to external circuit.

6. What are the advantages of cage motor?

Since the rotor has low resistance, the copper loss is low and efficiency is very high. On account of simple construction of rotor it is mechanically robust, initial cost is less, maintenance cost is less, simple starting arrangement.

7. Give the condition for maximum torque for 3phase induction motor, when it is running?

The rotor resistance and reactance should be same for max.torque i.e. R2=Sx2

8. List out the method for speed control of 3phase cage type induction motor?

1 By changing supply frequency
2 By changing no of poles
3 By operating the two motors in cascade

9. Name the two winding of single phase induction motor?

1 Running winding
2 Starting winding.

10. What are methods available for making single phase induction motor a selfstarting?

1 By slitting the single phase
2 By providing shading coil in the poles.

11. What is the function of capacitor in single phase induction motor?

To make phase difference between starting and running winding, to improve PF and to get more torque.

12. State any 4 use of single phase induction motor?

- Fans
- wet grinders
- vacuum cleaner
- small pumps
- compressors
- drills.

13. What kind of motors used in ceiling fan and wet grinders?

Ceiling fan - Capacitor start and capacitor run single phase induction motor, wet grinders - Capacitor start capacitor run single phase induction motor.

14. **What is the application of shaded pole induction motor?**

Because of its small starting torque, it is generally used for small toys, instruments, hair driers, ventilators.etc.

15. In which direction a shaded pole motor runs?

The rotor starts rotation in the direction from unshaded part to the shaded part.

16. Why single phase induction motors have low PF?

The current through the running winding lags behind the supply voltage by large angle so only single phase induction motor have low PF.

17. Differentiate between "capacitor start" & "Capacitor start capacitor run" single
Phase induction motor (IM)?

Capacitor start – capacitor run is connected series with starting winding, but it will be disconnected from supply when motor pick up its speed. Capacitor start capacitor run-starting winding and capacitor will not be disconnected from supply even though motor pickup its speed.

18. Explain why single phase induction motor is not a self starting one?

When motor fed supply from single phase its stator winding produces an alternating flux which doesn't develops any torque.

19. Define slip in an IM?

The slip of an IM is defined as the ratio of difference between sync. speed (Ns) and rotor speed (N) to the sync. speed.

s= (Ns – N)/ Ns

20. Define slip speed in an IM?

The slip speed is defined as the difference in speed between the rotating magnetic field produced by stator (Ns) and rotor speed (N).

21. What is the speed of the rotor field in space?

The speed of the rotor field in space is speed of rotating field. 86. What is sync. speed in 3-phase IM?

Ns = 120f/p

Where

f- supply frequency

P- No of poles on the stator.

22. List the various methods of speed control of 3 phase IM?

Types of stator side control

1. Stator voltage control
2. Stator frequency control
3. v/f control
4. pole changing method

23. In which type of motor can resistance be introduced in the rotor circuit? What is the effect of it?

Slip ring IM. Effects:

1. starting torque increased
2. starting current decreased
3. motor speed can be controlled

24. Why the slots on the IM are usually skewed?

In order to obtain a uniform torque, reduce the magnetic locking of the stator and rotor and reduce the magnetic humming noise while running.

90. What are the types of poly phase IM?

1. Squirrel cage IM

2. Slip ring IM

25. What will be the effect when stator voltage and freq of a IM are reduced proportionally?

1. Motor speed increases

2. Maximum torque is constant

26. What is slip power recovery scheme?

Slip power can be returned to the supply source and can be used to supply an additional motor which is mechanically coupled to the main rotor. This type of drive is known as slip power recovery system and improves overall efficiency of the system.

SYNCHRONOUS AND SPECIAL MACHINES

1. What are the principal advantages of rotating field type construction?

Relatively small amount of power required for field system can easily supplied to rotating system using slip rings and brushes, more space is available in the stator part of the machine to provide more insulation, it is easy to provide cooling system, stationary system of conductors can easily be braced to prevent deformation.

2. What are the advantages of salient type pole construction used in sync.machines?

They allow better ventilation, the pole faces are so shaped radial air gap length increases from pole center to pole tips so flux distortion in air gap is sinusoidal so emf is also sinusoidal.

3. Which type of sync. generators are used in hydroelectric plants and why?

As the speed of operation is low, for hydro turbines used in hydroelectric plants, salient pole type sync. generator is used because it allows better ventilation also better than smooth cylindrical type rotor

4. Why are alternators rated in KVA and not in KW?

As load increases I2R loss also increases, as the current is directly related to apparent power delivered by generator, the alternator has only their apparent power in VA/KVA/MVA as their power rating.

5. Why the sync. impedance method of estimating voltage regulation is is considered as pessimistic method?

Compared to other method, the value of voltage regulation obtained by this method is always higher than the actual value so it is called as pessimistic method.

6. Why MMF method of estimating voltage regulation is considered as optimistic method?

Compared to EMF method, MMF method involves more no. of complex calculation steps. Further the OCC is referred twice and SCC is referred once while predetermining the voltage regulation for each load condition. Reference of OCC takes core saturation effect. As this method require more effort, final result is very close to actual value, hence this method is called as optimistic method.

7. Define voltage regulation of the alternator?

It is defined as the increase in terminal voltage when full load is thrown off, assuming field current and speed remaining the same.

% reg = $[(E_0 – V)/V]x100$

Where

E_0 = no terminal voltage

V = full load rated terminal voltage

8. How is arm. winding in alternators is different from those used in dc machines?

The arm. winding of the alternator is placed in the stator, but in the case of dc machines the arm winding is placed in the rotor.

9. What is hunting how can it be prevented?

When a sync motor is used for driving a fluctuating load, the rotor starts oscillating about its new position of equilibrium corresponding to the new load. This is called hunting or phase swinging. To prevent hunting dampers are damping grids are employed.

10. What are different torques of a sync motor?

1. Starting torque

2. Running torque

3. Pull-in torque

4. Pull-out torque

11. Define step angle?

It is defined as angle through which the stepper motor shaft rotates for each

command pulse. It is denoted as β,

i)β=[(Ns-Nr)/ Ns.Nr]x360o

Where Ns = no. of stator poles or stator teeth

Nr =no. of rotor poles or rotor teeth

ii) β = 3600/mNr

Where m= no. of stator poles

12. What are different types of stepper motor?

1. Variable reluctance (VR) motor

2. Permanent magnet (PM) stepper motor

3. Hybrid stepper motor

13. What is the advantage in using stepper motor?

1. It can drive open loop without feedback

2. It requires little or no maintenance.

14. Give the applications of stepper motor?

1. Robotics

2. Computer peripherals

3. Facsimile machine

4. Aerospace

15. What are the adv. of reluctance m/c?

1. Motor speed is constant

2. Simple construction

UNIT 4 BASICS OF MEASUREMENT AND INSTRUMENTATION

1. Distinguish between static and dynamic characteristics.

Static characteristics of a measurement system are those that are considered when the system or instrument is used to measure a condition not varying with respect to time

Dynamic characteristics of a measurement system are those that are considered when the system or instrument is used to measure a condition varying with respect to time performance criteria based upon dynamic relation.

2. **Compare accuracy and procession.**

Accuracy is the closeness with which an instrument reading approaches the true value of the quantity being measured, thus accuracy of the measurement means conformity to the truth

Precession is a measure of the reproducibility of the measurement i.e, given a fixed value of a quantity; precession is the measure of the degree of agreement within group of measurements, the term precise means clearly or sharply defined

3. Define the term resolution.

If the input is slowly increased from some arbitrary input value it will again be found that output does not change at all until a certain increment is exceeded or it is the smallest measurable input change

4. Define static sensitivity of an instrument

It is the ratio of the magnitude of the output signal or response to the magnitude of the input signal or the quantity being measured

5. How linearity of the transducer is being measured?

Linearity is the measure of the maximum deviation of the plotted transducer response from a specified response from a specified straight line. Higher the meter resistance betters the linearity on other hand linearity can be improved by providing low pot resistance but it will affects the sensitivity of the measurement.

29. State any two dynamic characteristics of transducers.

0 Speed of response
1 Measuring lag

2 Fedility
3 Dynamic error

30. State the various types errors.

0 Gross errors
1 Systematic errors
Random errors

8. Give the types of systematic errors.

Instrumental error
Environmental error
Observational error

9. What are the two methods for achieving variations in inductance?

1. Variation of self inductance
2. Variation in mutual inductance.

10.State piezoelectric effect.

A piezoelectric material is one in which an electric potential appears across certain surfaces of a crystal if the dimensions of the crystal are changed by the applications of a mechanical forces, this potential is produced by the displacement of charges the effect is reversible is applied to the proper axis of the crystal. It will change its dimensions of the crystal, thereby deforming it . This effect is known as piezo electric effect

UNIT 5 ANALOG AND DIGITAL INSTRUMENTS

1. Give the applications of measurement systems

1. monitering of processes and operatios
2. control of process and operations
3. experimental engineering analysis

2. What are the different types of DVM

The DVM are broadly classified into

1. non integrating type
2. integrating type

3.Name the list of non integrating types DVM

Potentiometric type

Ramp type

4. Name the list of potentiometric type.

Successive approximation type

Null balance type

5.Name the list of ramp type DVM

1. Linear type
2 stair case type

6. Name the list of integrating type DVM

1.Voltage To Frquency Type

2. potentiometric type

3.dual slope integrating type

7.What are the advantages of succesive approximation typeDVM?

Resolution upto 5 significant digit is possible
Very high speed of order of 100 reading per second is possible
Accuracy is high

8.what are the disadvantages of successive approximation type DVM

The circuit is complex

The input impedence id variable the DAC is also required

9. what is the principle of ramp type digital voltmeter?

The operating principle of ramp type digital voltmeter is to measure the time that a linear ramp voltage takes to change from level of input voltage to zero voltage . this time interval is measured with an electronic time interval counter and the counter is displayed as a number of digits on electronic indicating tubes of the output read out of the voltmeter

10. what are the advantages of ramp type DVM

The circuit is easy to design

The input signal is converted to time , which is easy to digitize by adding external logic ,

The polarity of the input also can be displayed

11. Define the digital multi meter

It is an instrument which is capable of measuring AC voltages DC voltages AC current DC current and resistances over several miles

12 . Name the two different type of storage oscilloscope

24. mesh storage
25. phosphor storage

13 . Define storage oscilloscope

The cathode ray tube has the persistence of the phosphor ranging from the few milli second to several seconds, but sometimes it is necessary to retain the image or much longer periods, upto several hours, it requires storing of a waveform for certain duration independent of phosphor persistence such as retention property helps to display the waveforms of very low frequency

14 . Define bridge circuits.

A bridge circuit is simple form consists of a network of four resistances arms forming a closed circuit. A source of current is applied to two opposite junctions the current detector is connected to other two junctions. the bridge circuit uses the comparison measurement method and operate on null indication principle.

15 . List the DC bridges

Wheat stone bridge and Kelvin bridge

16. List the AC bridge

Capacitance comparison bridge inductance comparison bridge maxwells bridge hay s bridge Andersons bridge Schering bridge Wein bridge

17 . What is meant by wheat stone bridge

It is an instrument for making comparison measurements and operates upon a null indication principle . this means that the indication is independent of the calibration of the null indicating instrument or any of its characteristics

18. What are the applications of wheat stone bridge

The wheat stone bridge is basically a DC bridge and used to measure the resistance in the range 1 Ω to 100 mega ohms

It is used to measure DC resistances of various types of wires for the purpose of quality of control.