KINGSTON
ENGINEERING COLLEGE

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

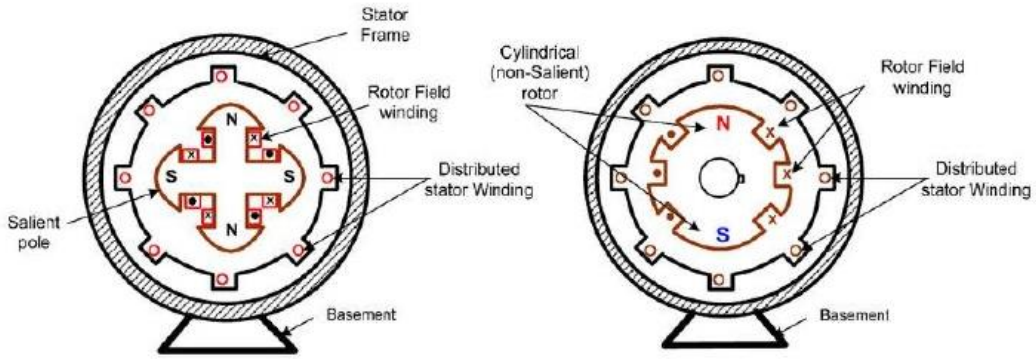
INNOVATIONS BY THE FACULTY IN TEACHING AND LEARNING

Puzzles

Name of the subject: Electrical Machines –II.

Objective : To enhance the interest towards the subject.

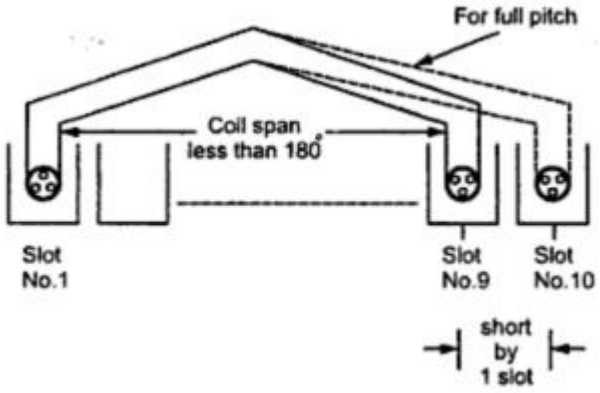
1. Identify the type of the alternator shown below marked as (a) and (b),



(a) (b)

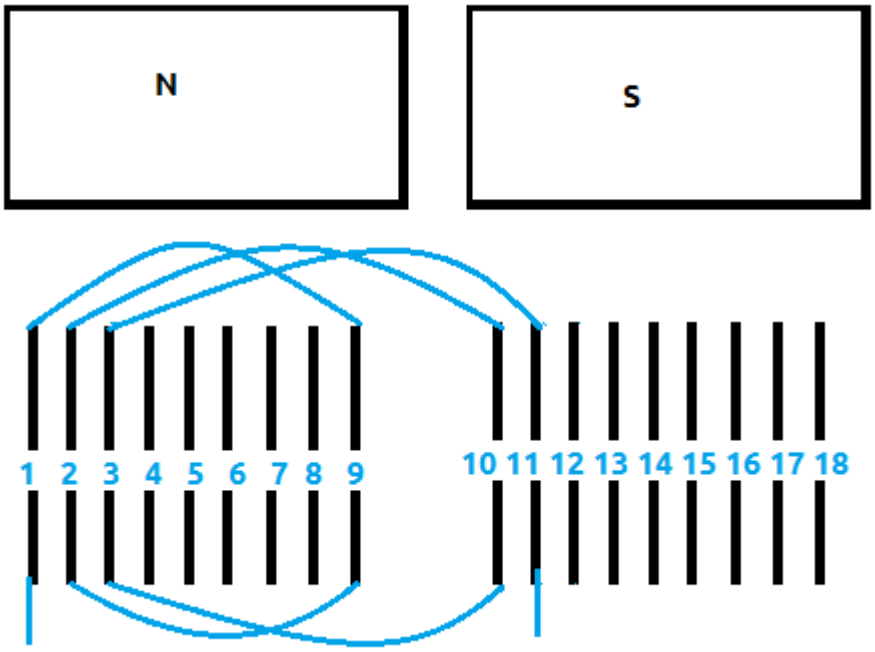
Ans: (a) Salient pole type alternator
(b) Non-salient pole type alternator

2. What is your comment about the given figure below?



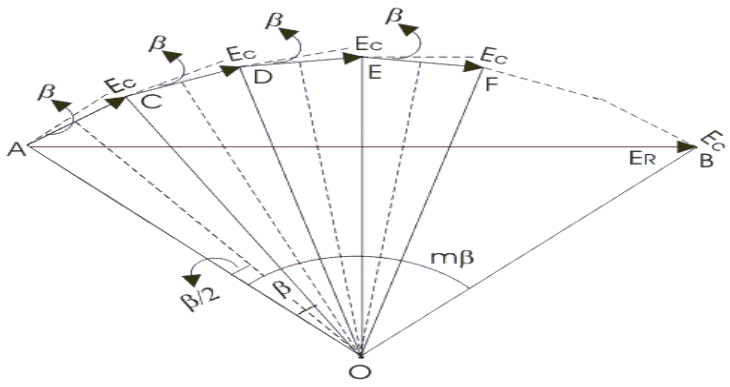
Ans: To have full pitch coil, the coil span should be 180^0 electrical but in the above given figure, the coil span is less than 180^0 which is short pitched by 1 slot. Hence the above given figure is short pitch coil.

3. Calculate the pitch factor of the winding of the alternator shown below,



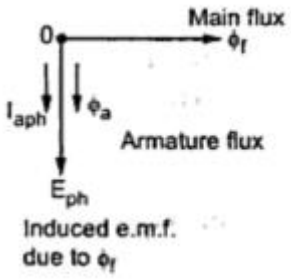
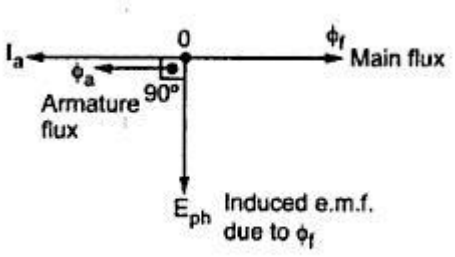
Ans: $K_c = \cos(\alpha/2) = \cos(20/2) = 0.9848$

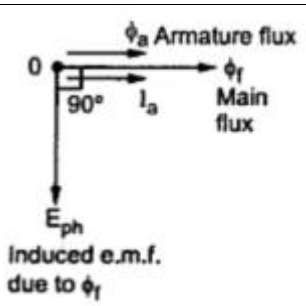
4. Write the expression of distribution factor for the given figure below,



Ans: $K_d = \sin(m\beta/2)/m \sin(\beta/2)$
where, "K_d" is distribution factor, "m" is slots per pole per phase, "β" is slot angle.

5. Match "A" and "B" of the tabulation given below,

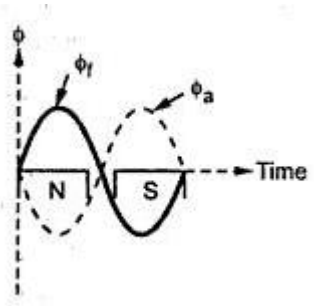
A	B
(i) Zero leading power factor load	 (a)
(ii) Unity power factor load	 (b)

(iii) Zero lagging power factor load	 (c)

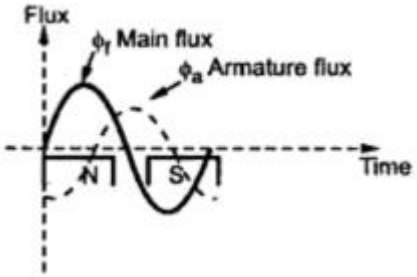
Ans:

A	B
(i)	(c)
(ii)	(a)
(iii)	(b)

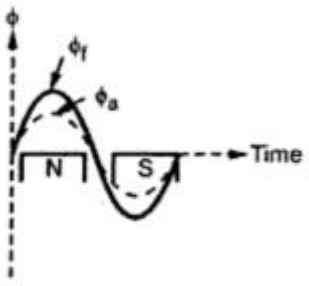
6. Find the type of the effect of armature reaction by the given indications,



(a)



(b)



(c)

Cross magnetising Demagnetising

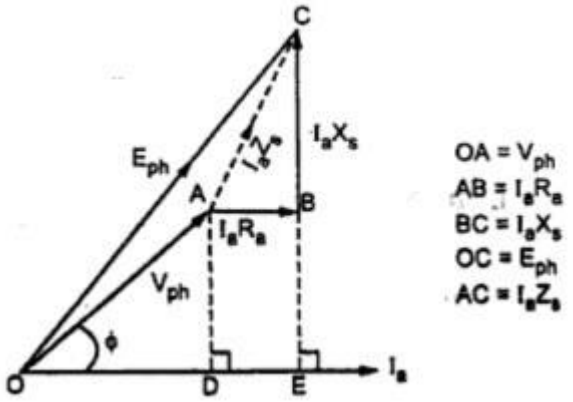
Magnetising

Ans: (a) - Demagnetising effect
(b) - Cross magnetising effect

(c) - Magnetising effect

7. State whether true or false.

The given diagram is phasor representation of leading power factor load. (True/ False)



Ans: False. The given diagram is phasor representation of lagging power factor load.

8. Using the clue given below, find the missing letters and form the words.

Clue: Regulation of three phase alternator is predetermined by EMF method.

__N___ON_U_ I_P_DA_C_

Ans: SYNCHRONOUS IMPEDANCE

9. Solve the given cross word.

1				
2				5
	3			
	4			

Top to bottom:

2. One of the test to predetermine the regulation of three phase alternator.

Left to right:

1. Pessimistic method.
3. Short form of a ratio.
4. Magnetic _____

Right to left:

5. _____ is shared between two alternators.

Ans:

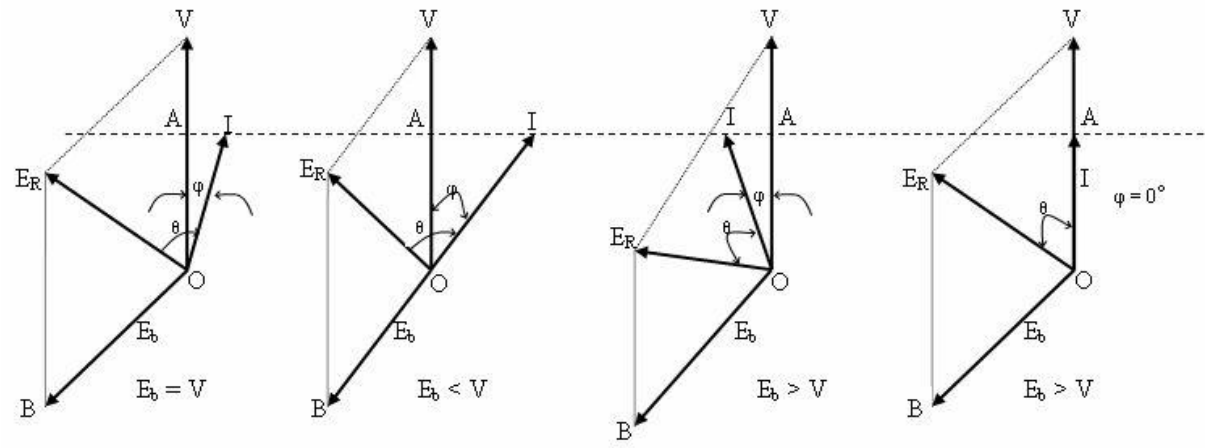
1 E	M	F		
2 O	D	A	O	L 5
C	3 S	C	R	
	4 F	L	U	X

10. Find the odd word.

(i) EMF (ii)MMF (iii)Stator (iv)ZPF

Ans: (iii) Stator

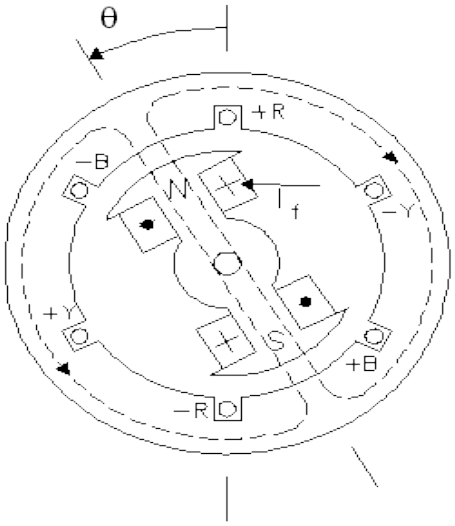
11. Identify the type of excitation of synchronous motor for the phasor diagrams shown below.



(a) (b) (c) (d)

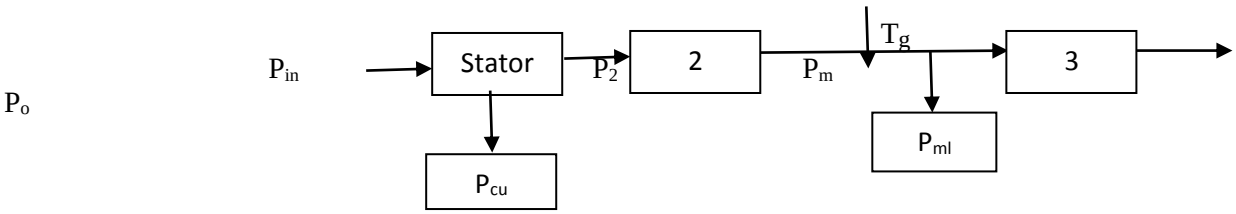
Ans: (a) Normal excitation
(b) Under excitation
(c) Over excitation
(d) Critical excitation

12. What is that you can understand by an angle, "θ" shown in figure below?



Ans: Angle, "θ" is the load angle when suddenly load is changed the rotor falls back to the stator pole axis from its original position as indicated by load angle," θ".

13. Fill the missed stages 2 and 3 of power stages of synchronous motor shown below.



Ans: 2 – Rotor

3 - Load

Outcomes: Students actively solved the puzzles and learnt the concepts.

Activity Based Learning Role Play

Name of the subject: Electrical Machines – II

Topic: Repulsion Motor

Objective: To understand the working principle of repulsion motor through role play by the students.

Description: Repulsion motor works under the principle of repulsion principle. Stator magnetic field and rotor magnetic field makes the motor as two magnets and stator magnetic field provides the repulsion force and torque to the rotor so that rotor rotates. Rotor rotates when the brush poles are kept in between q and d-axis. Rotor does not rotates when the brush poles are kept in d or q-axis.

One student is made to play the role of single phase ac supply, one student is made to play the role of switch, four boys students are made to play the role of stator N - pole, four boys students are made to play the role of stator S – pole, four girls students are made to play the role of rotor and two students are made to play the role of brush poles such as N and S poles.

Position I: Two students such as brush poles are kept in d - axis and the supply is given so the magnetic field is created which is shown by hand movements like wave by the stator N and S pole students which creates induced emf in rotor conductors and there is no induced currents and hence there is no torque is produced so four girl students (rotor) does not rotates.

Position II: Two students such as brush poles are kept in q - axis and the supply is given so the magnetic field is created which is shown by hand movements like wave by the stator N and S pole students which creates induced emf in rotor conductors and there is no induced currents and hence there is no torque is produced so four girl students (rotor) does not rotates.

Position III: Two students such as brush poles are kept in between d and q – axis and the supply is given so the magnetic field is created which is shown by hand movements like wave by the stator N and S pole students which creates induced emf in rotor conductors and induced currents and hence the torque is produced so four girl students (rotor) starts rotating.

Outcomes: Students felt easy to grasp the operation of repulsion motor through this role play.

Analogy

Name of the Subject: Electrical Machines -II

Topic : Single phase induction motor is non self starting. Why?

Objective : Students can relate the real time circumstance with the non self starting behavior of single phase induction motor.

Description : The alternating flux produces equal and opposite torque on the rotor in both clockwise and anticlockwise direction. Hence the resultant torque is zero. So the single phase induction motor is non self starting.

When a person named “A” is pulled by two other persons named “B” & ”C” with equal and opposite force, the person “A” will not make any movement or displacement from his original position.

Outcomes: Students realized the relation between the force experienced by a person and the motor.

Chart

Name of the subject : Electrical Machines -II
Topic : Construction of three phase alternator.

Objective: Students can learn the construction of three phase alternator using the chart.

Description : There are two types of alternators such as salient pole and non-salient pole alternator. In salient pole alternator, the rotor poles are projected type. In salient pole alternator, the air gap is uniform whereas non-uniform in non-salient pole alternator.

Outcomes: Students learnt the construction of three phase alternator.

Quiz

Name of the subject: Electrical Machines - II
Objective: To create the interest about the subject through which they can learn the subject.

Outcomes: Students shown interest and participated actively in answering the questions.

Application Oriented Material

PPT

Name of the subject: Electrical Machines -II
Topic : Shaded pole induction motor.

Objective : Students can understand the construction and working of shaded pole induction motor through this ppt.

Description : Shaded pole induction motor consists of a shaded band which creates rotating magnetic field. Single phase AC supply is given to the stator field winding hence magnetic field is created which induces the current in the shaded band so there is production of magnetic field and phase displacement occurs and rotating magnetic field is created and rotor starts rotating.

Outcomes: Students understood the construction and working of shaded pole induction motor through this ppt.

Group Discussion

Name of the subject : Electrical Machines -II
Topic : What makes the Special Electrical Machines to be applied for certain specific applications?

Objective : To emphasize the special features of special electrical machines that makes it to be used for certain specific special applications.

Points discussed:

- Special electrical machines are used for certain specific applications because of its special features.
- Types of Special electrical machines are stepper motor, repulsion motor, shaded pole motor, reluctance motor, repulsion motor and AC series motor.
- Stepper motor is a brushless DC motor whose rotor rotates through a fixed angular step so that it can be used for quartz watches, X-Ray machines, electronic type writer and aerospace.
- Hysteresis motor has the ability to drive high inertia loads hence used in electric clocks, timing devices and tape-decks.
- High starting torque can be obtained by AC series motor so it is used in railway systems.
- Reluctance motors operates at synchronous speed hence it can be used in signaling devices, recording instruments and timing devices.

Outcomes: Students understood the features of special electrical machines and its applications through the discussion among themselves.

Peer Group Learning

Name of the subject: Electrical Machines – II
Objective: To improve the performance of slow and average learner students, the peer groups are formed with each group consisting of 9 students in which two are advanced, two are average and five are slow learners.

Outcomes: Slow learner students got cleared their doubts and they felt easy to understand the concept and they shown more interest to study when they are formed with such groups.

Brain storming

Name of the subject: Electrical Machines -II
Topic : How single phase induction motor is made to start?

Objective : To nurture the concept of starting of single phase induction motor.

Points discussed:

- Only one field winding is used and hence there is no phase displacement, so the rotor does not rotate.
- To create phase displacement, an additional winding called auxiliary winding is used.
- Now two currents are flowing which has phase displacement, so the rotor rotates.

Outcomes: Students understood the starting methodology of single phase induction motor.

Multiple Choice Questions

Name of the subject: Electrical Machines -II

Objective : To enhance the knowledge of the subject through multiple choice questions.

Q.1 The two windings of a transformer is
(A) conductively linked.
(B) Inductively linked.
(C) Not linked at all.
(D) Electrically linked.
Ans : B

Q.2 A salient pole synchronous motor is running at no load. Its field current is switched off. The motor will
(A) come to stop.
(B) Continue to run at synchronous speed.
(C) Continue to run at a speed slightly more than the synchronous speed.
(D) Continue to run at a speed slightly less than the synchronous speed.
Ans: B

Q.3 The d.c. series motor should always be started with load because
(A) at no load, it will rotate at dangerously high speed.
(B) It will fail to start.
(C) It will not develop high starting torque.
(D) All are true.
Ans: A

Q.4 The frequency of the rotor current in a 3 phase 50 Hz, 4 pole induction motor at full load speed is about
(A) 50 Hz.
(B) 20 Hz.
(C) 2 Hz.
(D) Zero.
Ans: C

Q.5 In a stepper motor the angular displacement
(A) can be precisely controlled.
(B) It cannot be readily interfaced with micro computer based controller.
(C) The angular displacement cannot be precisely controlled.
(D) It cannot be used for positioning of work tables and tools in NC machines.

Ans: A

Q.6 The power factor of a squirrel cage induction motor is
(A) low at light load only.
(B) Low at heavy load only.
(C) Low at light and heavy load both.
(D) Low at rated load only.
Ans: A

Q.7 The generation voltage is usually
(A) between 11 KV and 33 KV.
(B) between 132 KV and 400 KV.
(C) between 400 KV and 700 KV.
(D) None of the above.
Ans: A

Q.8 When a synchronous motor is running at synchronous speed, the damper winding produces
(A) damping torque.
(B) Eddy current torque.
(C) Torque aiding the developed torque.
(D) No torque.
Ans: D

Q.9 If a transformer primary is energised from a square wave voltage source, its output voltage will be
(A) A square wave.
(B) A sine wave.
(C) A triangular wave.
(D) A pulse wave.
Ans: A

Q.9 If a transformer primary is energised from a square wave voltage source, its output voltage will be
(A) A square wave.
(B) A sine wave.
(C) A triangular wave.
(D) A pulse wave.
Ans: A

Q.10 In a d.c. series motor the electromagnetic torque developed is proportional to
(A) Ia .
(B) 1 2/a
(C)I/a1
Ans: B

Q.11 In a 3 – phase induction motor running at slip ‘s’ the mechanical power developed in terms of air gap power Pg is
(A) (s -1) Pg .
(B) Pg/(1- s)

(C) (1- s) Pg .
(D) s × Pg .
Ans: C

Q.12 In a 3 – phase induction motor the maximum torque
(A) is proportional to rotor resistance r2.
(B) Does not depend on r2.
(C) is proportional to root of r2.
(D) is proportional to r2/2
Ans: B

Q.13 In a d.c. machine, the armature mmf is
(A) stationary w.r.t. armature.
(B) Rotating w.r.t. field.
(C) Stationary w.r.t. field.
(D) Rotating w.r.t. brushes.
Ans: C

Q.14 In a transformer the voltage regulation will be zero when it operates at
(A) unity p.f.
(B) leading p.f.
(C) lagging p.f.
D) zero p.f. leading.
Ans: B

Q.15 The maximum power in cylindrical and salient pole machines is obtained respectively at load angles of
Ans: 90 degree<90 degree

Q.16 The primary winding of a 220/6 V, 50 Hz transformer is energised from 110 V, 60 Hz supply. The secondary output voltage will be
(A) 3.6 V.
(B) 2.5 V.
(C) 3.0 V.
(D) 6.0 V.
Ans: C

Q.17 The emf induced in the primary of a transformer
(A) is in phase with the flux.
(B) lags behind the flux by 90 degree.
(C) leads the flux by 90 degree.
(D) is in phase opposition to that of flux.
Ans: C

Q.18 The relative speed between the magnetic fields of stator and rotor under steady state operation is zero for a
(A) dc machine.
(B) 3 phase induction machine.
(C) synchronous machine.
(D) single phase induction machine.

Ans: all options are correct

Q.19 the current from the stator of an alternator is taken out to the external load circuit through
(A) slip rings.
(B) commutator segments.
(C) solid connections.
(D) carbon brushes.
Ans: C

Q.20 A motor which can conveniently be operated at lagging as well as leading power factors is the
(A) squirrel cage induction motor.
(B) Wound rotor induction motor.
(C) Synchronous motor.
(D) DC shunt motor.
Ans: C

Outcomes: Students shown interest in answering the questions and learnt the subject.

BRAIN SPARKERS

1. Another name of salient pole type rotor.
_ _ o _ _ _ _ _ _
2. High speed alternators are called _____ alternators.
_ _ _ b _ Turbo
3. A converter which is capable of direct conversion from AC-AC by using bi-directional fully controlled switches.
_ _ _ _ i _ Matrix
4. One of the types of transformer depends on its application.
_ e _ _ i _ _
5. A system with the help of a machine can send an image on a sheet of paper to another machine over a regular telephone lines.
_ _ c _ _ m _ _ _Facsimile
6. A set of memory elements used to store information.
_ _ _i _ _ _ _ _ registers
7. Another name for optocoupler
_ _ t _ _ s _ _ _ _ _ _ optoisolator
8. A four layer three junction semi-conductor device.
_ _ _ _ i _ _ _ _ Thyristor
9. A circuit used for dv/dt protection.
_ n _ _ _ _ _ Snubber
10. A device used in a DC generator to convert alternating emf to unidirectional emf.
_ _ _ _ u _ _ _ _ _ _ Commuttator
11. A speed control is achieve by changing the armature resistance which changes the voltage applied across the armature.
_ _ e _ _ _ _ _ _ _ rheostatic
12. A frequency changer.
_ _ _ _ 0 _ _ _ _ _ r _ _ _ Cycloconverter
13. A radio frequency oscillator.
_ a _ _ _ _ _ Hartley

14. One of the graphical method used to analyze the frequency response of the system.
_ c _ _ _ _ Nichols
15. A relay that sense the temperature rise produced by the current.
_ _ _ _ m _ _ Thermal
16. An additional device used to alter the system behavior and to meet the desired specifications.
_ _ _ _ e _ _ _ _ _ _ Compensator
17. The factor by which there is a reduction in emf due to distribution of coils.
_ _ _ _ i _ _ _ _ _ _ _ distribution
18. An oscillator is usually preferred for low frequency applications.
_ e _ _ _ r _ _ _ _ Weinbridge
19. A protective device which can absorbs energy contained in a travelling wave.
_ _ _ _ e _ _ _ _ _ _ _ e _ Surge absorber
20. An instrument used for the measurement of surge voltage on the transmission lines due to the lightning.
K _ _ _ _ _ _ _ _ _ _ p _ klydonograph