Subject: -Elements of Electrical Engineering (22215)

SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Magnetic Circuits	14
2	AC Fundamentals	16
3	Poly phase AC circuit	12
4	Transformer and DC Motor	22
5	Fractional horse Power motors	20
6	devices and switchgear	18
	Total Marks: -	**104**

BOARD THEORY PAPER PATTERN FOR EEC (22215)

Q.1		**Attempt any FIVE** **5*2=10**
	a)	Magnetic Circuits
	b)	AC Fundamentals
	c)	Poly phase AC circuits
	d)	Transformer and DC Motor
	e)	Transformer and DC Motor
	f)	Fractional horse Power motors
	g)	Protective devise and switchgear
Q.2		**Attempt any THREE** **3*4=12**
	a)	Magnetic Circuits
	b)	AC Fundamentals
	c)	Poly phase AC circuits
	d)	Transformer and DC Motor
Q.3		**Attempt any THREE** **3*4=12**
	a)	Magnetic Circuits

	b)	Transformer and DC Motor
	c)	Fractional horse Power motors
	d)	Protective devise and switchgear
Q.4		**Attempt any Three** **3*4=12**
	a)	Magnetic Circuits
	b)	Transformer and DC Motor
	c)	Fractional horse Power motors
	d)	Fractional horse Power motors
	e)	AC Fundamentals
Q.5		**Attempt any TWO** **2*6=12**
	a)	AC Fundamentals
	b)	Poly phase AC circuits
	c)	Transformer and DC Motor
Q.6		**Attempt any TWO** **2*6=12**
	a)	Fractional horse Power motors
	b)	Protective devise and switchgear
	c)	Protective devise and switchgear

CLASS TEST - I

PAPER PATTERN

COURSE: -Elements of Electrical Engineering (22215)

PROGRAMME: -Electrical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
1	**Magnetic Circuits**	**CO-215.01**
2	**AC Fundamentals**	**CO-215.02**
3	**Poly phase AC circuits**	**CO-215.03**

Q.1	Attempt any FOUR4*2=8Marks	Course Outcome (CO)
a)	Magnetic Circuits	**CO.215.1**
b)	AC Fundamentals	**CO.215.2**
c)	Poly phase AC circuits	**CO.215.3**
d)	Magnetic Circuits	**CO.215.1**
e)	AC Fundamentals	**CO.215.2**
f)	Poly phase AC circuits	**CO.215.3**
Q.2	**Attempt any THREE3*4=12 Marks**	
a)	Magnetic Circuits	**CO.215.1**
b)	AC Fundamentals	**CO.215.2**
c)	Poly phase AC circuits	**CO.215.3**
d)	AC Fundamentals	**CO.215.2**

CLASS TEST - II

PAPER PATTERN

COURSE: - Elements of Electrical Engineering (22215)

PROGRAMME: -Electrical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
4	**Transformer and DC Motor**	**CO-215.04**
5	**Fractional horse Power motors**	**CO-215.05**
6	**Protective devise and switchgear**	**CO-215.06**

Q.1	**Attempt any FOUR** **4*2=8Marks**	Course Outcome (CO)
a)	Transformer and DC Motor	**CO.215.4**
b)	Fractional horse Power motors	**CO.215.5**
c)	Protective devise and switchgear	**CO.215.6**
d)	Transformer and DC Motor	**CO.215.4**
e)	Fractional horse Power motors	**CO.215.5**
f)	Protective devise and switchgear	**CO.215.6**
Q.2	**Attempt any THREE** **3*4=12 Marks**	
a)	Transformer and DC Motor	**CO.215.4**
b)	Fractional horse Power motors	**CO.215.5**
c)	Protective devise and switchgear	**CO.215.6**
d)	Transformer and DC Motor	**CO.215.4**

COURSE OUTCOME

(CO)

COURSE: - Elements of Electrical Engineering (22215)

PROGRAMME: -Electrical Engineering

CO.NO.	Course Outcome
CO-215.01	Use principles of magnetic circuits
CO-215.02	Use single phase AC supply for electrical and electronics equipment
CO-215.03	Use three phase AC supply for industrial equipment and machines
CO-215.04	Connect transformer and DC motors for specific requirements
CO-215.05	Use FHP motors for diversified applications.
CO-215.06	Use relevant protective devices/switchgear for different requirements.

1. Magneric Circuits

Position in Question Paper **Total Marks-10**

Q.1. a) 2-Marks.
Q.3. a) 4-Marks.
Q.4. a) 4-Marks.

Descriptive Question

1. Define Reluctance. What are its units?
2. Explain self-induced emf and mutually induced emf with neat sketch
3. Compare magnetic circuit and electric circuit on any four points.
4. Explain B-H curve and draw with all parameters.
5. Explain with neat diagram series and parallel magnetic circuits.
6. State Fleming's right hand rule
7. Define Faraday's first law of electromagnetic induction.
8. Compare electric and magnetic circuit on any four points.
9. Define Electromagnetism, Magnetic Flux, and MMF with their units.
10. Explain the terms 1. Statically induced EMF 2. Dynamically induced EMF
11. State and Explain Lenz Law.

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold.**

1. An air gap is usually inserted in a magnetic circuits to
   a) Increase m.m.f.
   b) Increase the flux
   c) **Prevent saturation**
   d) None of the above
2. Permeability in a magnetic circuit corresponds to .....in an electric circuit
   a) Resistance
   b) Resistivity
   c) Conductivity
   d) Conductance
3. Those magnetic materials are best suited for making armature and transform cores which have .....permeability and .....hysteresis loss
   a) High, high
   b) Low, high

c) High, low d) Low, low

4. In a magnetic material hysteresis loss takes place primarily due to
   a) Rapid reversals of its magnetisation
   b) Flux density lagging behind the magnetising force
   c) Molecular friction
   d) **It high retentivity**
5. The property of a material which opposes the creation of magnetic flux in it is known
   a) Reluctivity c) Permeance
   b) Magnetomotive force **d) Reluctance**
6. The area of his hysteresis loss is a measure of
   a) Permittivity **c) Energy loss per cycle**
   b) Permeance d) Magnetic flux
7. In order to minimise hysteresis loss, the magnetic material should have
   a) High resistivity c) Large B - H loop area
   b) Low hysteresis co-efficient d) High retentivity
8. Hysteresis loss least depends on
   a) Volume of material
   b) Frequency
   c) Steinmetz co-efficient of material
   d) Ambient temperature
9. The hysteresis loss is caused by
   a) Structural non-homogeneity
   b) Work required for the magnetising the material
   c) Potential work function
   d) None of the above
10. According to Steinmetz hysteresis law, hysteresis loss in a material is proportional to
   a) $B^{3.6}$ c) $B^{1.2}$
   b) $B^{1.6}$ d) $B^{2.}$
11. The unit of magnetic flux is
   a) Henry c) Ampere-turn/weber
   b) **Weber** d) Ampere/meter
12. The unit of reluctance is
   a) Meter/henry c) Henry
   b) Henry/meter d) **1/henry**
13. Reciprocal of reluctance is
   a) Reluctivity c) Permiability
   b) Permeance d) Susceptibility
14. The unit of retentivity is
   a) Weber c) Ampere turn/metre
   b) Weber/sq. meter d) Ampere turn
15. Silicon steel is used in electrical machines because it has

a) Low co-ercivity
b) Low retentivity
c) Low hysteresis loss
d) High co-ercivity

16.Conductivity is analogous to
a) Retentivity
b) Resistivity
c) Permeability
d) Inductance

17.Conductance is analogous to
a) Permeance
b) Reluctance
c) Flux
d) Inductance

18.Material for good magnetic memory should have
a) Low hysteresis loss
b) High permeability
c) Low retentivity
d) High retentivity

19.Hard steel is suitable for making permanent magnets because
a) **It has good residual magnetism**
b) Its hysteresis loop has large area
c) Its mechanical strength is high
d) Its mechanical strength is low

20.Permanent magnets are normally made of
a) **Alnico alloys**
b) Aluminium
c) Cast iron
d) Wrought iron

21.How is mutual inductance between two coils decreased?
a) By using a common core
b) By moving the coils closer
c) By moving the coils apart
d) By increasing the number of turns of either coil

22.A magnetic field is
a) The current flow through space around a permanent magnet
b) **The force set up when current flows through a conductor**
c) The force that drives current through a resistor
d) The force between the plates of a charged capacitor

23.Ohm's law can be used only to a _____ circuit or component.
a) Unilateral
b) Exponential
c) Trivalent
d) **Linear**

24.the current flows, the magnetic field conductor is in what direction?
a) The same as the current direction
b) Opposite the current direction
c) Omnidirectional
d) In the direction determined by the left hand rule

25.The magnetic field around the conductor is determined by the
a) Size of the conductor
b) Amount of current
c) Current divided by the resistance

d) Resistance divided by the current

26. Back emf refers to the
   a) Current equal to the applied emf
   b) Opposing emf
   c) Current opposing the applied emf
   d) Voltage opposing the applied emf

27. The magnetic flux through a coil changes. This results to the induced emf acting in a direction as to
   a) Oppose the change
   b) Aid the change
   c) Either oppose or aid the change
   d) Neither oppose nor aid the change

28. A magnetic flux of 2.5 x 10^4 Wb through an area of 5 x 10^4 square meters results
   a) Wb
   b) Tesla of flux density
   c) 5 x 10^-5 Wb of flux
   d) 5000 Tesla of flux density

29. If a 20 V potential is applied across a relay coil with 50 turns having 1 **Ω** of resistance, the total magnetomotive producing magnetic flux in the circuit is
   a) 10 Wb
   b) 50 T
   c) 1000 A t/m
   d) 1000 A.t

30. What is the reluctance of a magnetic path having a length of 2 x 10^-3 m and cross-sectional area of 2.5 x 10^-3 m^2?
   a) 6366 A.t/Wb
   b) 6000 A.t/Wb
   c) 8 x 10^-3 A.t/Wb
   d) 0.8 A.t/Wb

2. AC Fundamental

Position in Question Paper **Total Marks-10**

Q.1. b) 2-Marks.
Q.2. b) 4-Marks.
Q.4. a) 4-Marks.

Descriptive Question

1. Define - frequency. State its relation with time period.
2. If maximum value of a sine wave is 25A. Calculate its average value.
3. Draw a power triangle and state the relation between its sides.
4. State the range of phase angle and hence pf for a series RC circuit.
5. In a series RL circuit V_R = 100V and V_L = 150V. Find equivalent voltage across the circuit.
6. An alternating current is given by i = 20 sin (314t). Find –Current at t = 0.0025 sec at first instant. Time required to reach at 12A for first time.
7. A series circuit has a leading pf. Express it with circuit, waveform and phasor diagram.
8. In RLC series circuit R = 8W, L = 0.42 H with an unknown capacitor. If the circuit is connected across 230V, 50 Hz, 1φ AC. Calculate value of capacitor so that circuit resonates at supply frequency. Also calculate current and pf at this instant.
9. Define peak factor and form factor. State value of each for a pure sine wave.
10. Define - frequency. State its relation with time period.
11. If maximum value of a sine wave is 25A. Calculate its average value.
12. Draw a power triangle and state the relation between its sides.
13. State the range of phase angle and hence pf for a series RC circuit.
14. In a series RL circuit V_R = 100V and V_L = 150V. Find equivalent voltage across the circuit.
15. An alternating current is given by i = 20 sin (314t). Find –
    1) Current at t = 0.0025 sec at first instant.
    2) Time required to reach at 12A for first time.
16. A series circuit has a leading pf. Express it with circuit, waveform and phasor diagram.

17. In RLC series circuit R = 8W, L = 0.42 H with an unknown capacitor. If the circuit is connected across 230V, 50 Hz, 1φ AC. Calculate value of capacitor so that circuit resonates at supply frequency. Also calculate current and pf at this instant.

18. Define peak factor and form factor. State value of each for a pure sine wave.

19. A series RLC circuit consists of R = 20W, L = 1H and C = 2500 μf. If it is connected across 230V, 1φ AC. Calculate Q factor and resonant frequency.

20. Derive the condition for resonance in an RLC series circuit. Also derive the equation for Q factor.

21. State nature of pf for any two conditions in RLC series circuit. Draw phasor diagram for each.

22. Write any two advantages of AC over DC

23. Explain the concept of lagging and leading phase angle by waveform.

24. Define: (i) Form factor (ii) Peak factor

25. State value of power factor for purely resistive and purely capacitive circuit.

26. Explain the generation of single phase AC supply by an elementary alternator with neat sketch.

27. An alternating current given by equation i = 142.14 sin 628 t. find –
(i)Maximum value (ii) Time period(iii) RMS value (iv) Average value (v) Form factor (vi) Peak factor

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold**

1. Instantaneous voltage is the product of resistance and _____ current in **a resistive circuit.**
   a) Instantaneous c) RMS
   b) Average d) Peak
2. .Find the value of the instantaneous voltage if the resistance is 2 ohm and the instantaneous current in the circuit is 5A.
   a) 5V c) 10V
   b) 2V d) 2.5
3. The power for a purely resistive circuit is zero when?

a) Current is zero
b) Voltage is zero
c) Both current and voltage are zero
d) Either current or voltage is zero

4. The correct expression for the instantaneous current if instantaneous voltage is Vm(sint) in a resistive circuit is?
a) 1A
c) 3A
b) 2A
d) 4A

5. Calculate the resistance in the circuit if the rms voltage is 20V and the rms current is 2A**.**
a) 2 ohm
c) 10 ohm
b) 5 ohm
d) 20 ohm

6 The correct expression for the instantaneous current in a resistive circuit is?
a) i=Vm(sint)/R
c) i=V(sint)/R
b) i=Vm(cost)/R
d) i=V(cost)/R

7 Can ohm's law be applied in an ac circuit?
a) Yes
c) Depends on the rms current
b) No
d) Depends on the rms voltage

8 The correct expression for the instantaneous current if instantaneous voltage is Vm(sint) in an inductive circuit is?
a) $i = Vm(sint)/X_L$
c) $i = -Vm(sint)/X_L$
b) $i = Vm(cost)/X_L$
d) **$i = -Vm(cost)/X_L$**

9 Inductor does not allow sudden changes in?
a) Voltage
c) Resistance
b) Current
d) Inductance

10 Inductance is _____ to number of turns in the coil
a) **directly proportional**
c) equal
b) inversely proportional
d) not related

11.Choke involve use of _____
a) Resistor
c) **Inductor**
b) Capacitor
d) Transistor

12.What is the value of current in an inductive circuit when there is no applied voltage?
a) Minimum
c) Zero
b) Maximum
d) Cannot be determined

13. What is the current in an inductive circuit when the applied voltage is maximum?
a) Infinity
c) Zero
b) Maximum
d) Cannot be determined

14. In an inductive circuit, the voltage_____ the current?
a) Leads
b) Lags

c) Is greater than
d) Is less than

15.In an inductive circuit, the current_____ the voltage?
a) Leads
c) Is greater than
b) **Lags**
d) Is less than

16.In which device inductor cannot be used?
a) filter circuit
c) choke
b) transformer
d) dielectric

17. A resistance of 7 ohm is connected in series with an inductance of 31.8mH. The circuit is connected to a 100V 50Hz sinusoidal supply. Calculate the current in the circuit.
a) 2.2A
c) 6.2A
b) 4.2A
d) **8.2**

18 **.** A resistance of 7 ohm is connected in series with an inductance of 31.8mH. The circuit is connected to a 100V 50Hz sinusoidal supply. Calculate the phase difference.
a) -55.1
c) 6
b) 55.1
d) -66.1

19 A resistance of 7 ohm is connected in series with an inductance of 31.8mH. The circuit is connected to a 100V 50Hz sinusoidal supply. Calculate the voltage across the resistor.
a) 31.8V
c) 67.3V
b) **57.4V**
d) 78.2

20 A resistance of 7 ohm is connected in series with an inductance of 31.8mH. The circuit is connected to a 100V 50Hz sinusoidal supply. Calculate the voltage across the inductor**.**
a) 52V
c) 65V
b) 82V
d) 76V

21 A resistance of 7 ohm is connected in series with an inductance of 31.8mH. The circuit is connected to a x V 50Hz sinusoidal supply. The current in the circuit is 8.2A. Calculate the value of x.
a) 10V
c) 100V
b) 50V
d) 120

22 Which, among the following, is the correct expression for φ.
a) $\varphi=\tan^{-1}(XL/R)$
c) $\varphi=\tan^{-1}(XL*R)$
b) $\varphi=\tan^{-1}(R/XL)$
d) $\varphi=\cos^{-1}(XL/R)$

23 For an RL circuit, the phase angle is always _____
Positive
b) 0
a) Negative
c) 90

24 What is φ in terms of voltage?

a) $\varphi=\cos^{-1}V/VR$
c) $\varphi=\cos^{-1}VR/V$
b) $\varphi=\cos^{-1}V*VR$
d) $\varphi=\tan^{-1}V/VR$

25 What is sinϕ from impedance triangle?

a) X_L/R
c) R/Z
b) X_L/Z
d) Z/R

26 What is the resonance frequency of ac circuit?

a) $1/\sqrt{LC}$
c) $\sqrt{LC}$
b) $\sqrt{(L/C)}$
d) LC

27.What is impedance at resonance?

a) maximum
c) zero
b) minimum
d) cannot be determined

28.What is the value of impedance at resonance?

a) X_L
c) R
b) X_C
d) 0

29.What is φ in terms of voltage?

a) $\varphi=\cos^{-1}V/V_R$
c) $\varphi=\cos^{-1}V_R/V$
b) $\varphi=\cos^{-1}V*V_R$
d) $\varphi=\tan^{-1}V/V_R$

30.What is tanϕ for RC circuit?

a) X_C/R
c) R/Z
b) X_L/R
d) Z/R

3. Poly phase AC Circuits

Position in Question Paper **Total Marks-10**

Q.1. c) 2-Marks.
Q.2. c) 4-Marks.
Q.4. b) 4-Marks.

Descriptive Question

1. Draw phasor diagram for 3φ generated voltages.
2. List any two advantages of 3φ circuits over single phase circuits.
3. List any four observations from the phasor diagram of a 3φ delta connection.
4. Three impedances each of Z = 15 + j18W are connected in star across a 400V,3φ, AC. Calculate $-V_{ph,}$ $I_{ph,}$ $I_{L,}$ Pf
5. Draw the sinusoidal waveform of 3ph emf and also indicate the phase sequence.
6. State relationship between line voltage and phase voltage, line current and phase current in a balanced delta connection. Draw complete phasor diagram of voltages and current.
7. State any four advantages of poly phase circuit over single phase circuit.
8. Draw the waveform representation of a three phase AC supply with neat labels.
9. State four advantages of poly-phase circuit over single phase circuit.
10. Draw delta connected load. Sate relation between: Line voltage and phase voltage, Line current and phase current
11. Draw 3-phase voltage waveform of a.c. supply with respect to time.
12. Write any four advantages of 3f system over 1f system.
13. Write meaning of the term ‘‘balanced load’’ in case of 3f system.
14. Draw phasor diagram for 3φ generated voltages.
15. List any two advantages of 3φ circuits over single phase circuits.
16. List any four observations from the phasor diagram of a 3φ delta connection.
17. Three impedances each of Z = 15 + j18W are connected in star across a 400V, 3φ, AC. Calculate $-V_{ph,}$ $I_{ph,}$ $I_{L,}$ Pf
18. Draw the sinusoidal waveform of 3ph emf and also indicate the phase sequence.

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold**

1 In a balanced three-phase system-delta load, if we assume the line voltage is $V_{RY} = V\angle 0^0$ as a reference phasor. Then the source voltage V_{YB} is?
- a) $V\angle 0^0$
- **b) $V\angle -120^0$**
- c) $V\angle 120^0$
- d) $V\angle 240^0$

2 . In a balanced three-phase system-delta load, if we assume the line voltage is $V_{RY} = V\angle 0^0$ as a reference phasor. Then the source voltage V_{BR} is?
- a) $V\angle 120^0$
- b) $V\angle 240^0$
- **c) $V\angle -240^0$**
- d) $V\angle -120^0$

3 . In a delta-connected load, the relation between line voltage and the phase voltage is?
- a) line voltage > phase voltage
- b) line voltage < phase voltage
- **c) line voltage = phase voltage**
- d) line voltage >= phase voltage

4. If the load impedance is $Z\angle Ø$, the current (I_R) is?
- **a) $(V/Z)\angle -Ø$**
- b) $(V/Z)\angle Ø$
- c) $(V/Z)\angle 90-Ø$
- d) $(V/Z)\angle -90+Ø$

5. If the load impedance is $Z\angle Ø$, the expression obtained for current (I_Y) is?
- a) $(V/Z)\angle -120+Ø$
- b) $(V/Z)\angle 120-Ø$
- c) $(V/Z)\angle 120+Ø$
- **d) $(V/Z)\angle -120-Ø$**

6. If the load impedance is $Z\angle Ø$, the expression obtained for current (Iis?
- a) $(V/Z)\angle -240+Ø$
- **b) $(V/Z)\angle -240-Ø$**
- c) $(V/Z)\angle 240-Ø$
- d) $(V/Z)\angle 240+Ø$

7. A three-phase balanced delta connected load of (4+j8) Ω is connected across a 400V, 3 – Ø balanced supply. Determine the phase current I_R. Assume the phase sequence to be R_{YB}.
- **a) $44.74\angle -63.4^0$A**
- b) $44.74\angle 63.4^0$A
- c) $45.74\angle -63.4^0$A
- d) $45.74\angle 63.4^0$A

8. A three-phase balanced delta connected load of (4+j8) Ω is connected across a 400V, 3 – Ø balanced supply. Determine the phase current I_Y.
- a) $44.74\angle 183.4^0$A
- **c) $44.74\angle 183.4^0$A**
- b) $45.74\angle 183.4^0$A
- d) $45.74\angle -183.4^0$A

9. A three-phase balanced delta connected load of (4+j8) Ω is connected across a 400V, 3 – Ø balanced supply. Determine the phase current I_B.
- a) $44.74\angle 303.4^0$A
- **b) $44.74\angle -303.4^0$A**
- c) $45.74\angle 303.4^0$A
- d) $45.74\angle -303.4^0$A

10.Determine the power (kW) drawn by the load.
- a) 21
- b) 22
- c) 23
- **d) 24**

11. The power generated by a machine increases _____ percent from single phase to two phase.
    a) 40.4
    b) 41.4
    c) 42.4
    d) 43.4
12. The percentage of power increased from single phase to three phase is?
    a) 50
    b) 100
    c) 150
    d) 200
13. When the power factor is _____ the power becomes zero 100 times a second in a 50Hz supply.
    a) 0
    b) 1
    c) 2
    d) 3
14. Which motors are called self-starting motors?
    a) single phase
    b) two phase
    c) three phase
    d) four phase
15. In three phase system, the three voltages (currents) differ in phase by _____electrical degrees from each other in a particular sequence.
    a) 30
    b) 60
    c) 90
    d) 12
16 In a two phase generator, the armature has two distinct windings that are displaced _____ apart.
    a) 45^0
    b) 90^0
    c) 135^0
    d) 180^0
17. In three phase system at any given instant, the algebraic sum of three voltages must be?
    a) 0
    b) 1
    c) 2
    d) 3
18. Phase sequence depends on the _____
    a) Field
    b) rotation of the field
    c) armature
    d) rotation of the armature
19. If RR', YY' and BB' constitutes three phase sequence if $V'_{RR} = V_m \sin\omega t$ its corresponding field magnets are in clockwise direction, then V'_{YY} =?
    a) $V_m \sin\omega t$
    b) $V_m \sin(\omega t+120^0)$
    c) **$V_m \sin(\omega t-120^0)$**
    d) $V_m \sin(\omega t-240^0)$
20. If RR', YY' and BB' constitutes three phase sequence if $V'_{RR} = V_m \sin\omega t$ its corresponding field magnets are in clockwise direction, then the value of V'_{BB} is?
    a) $V_m \sin(\omega t-240^0)$
    b) $V_m \sin(\omega t-120^0)$
    c) $V_m \sin(\omega t+240^0)$
    d) $V_m \sin\omega t$

21. In a three phase alternator, there are _____ independent phase windings or coils.
   a) 1
   c) 3
   b) 2
   d) 4

22. Each coil in three phase alternator has _____ number of terminals.
   a) 2
   c) 6
   b) 4
   d) 8

23. In wye or star connection _____ of the three phases are joined together within the alternator.
   a) similar ends
   d) one opposite end, two opposite ends
   b) opposite ends
   c) one similar end, two opposite ends

24. The voltage between _____and _____is called phase voltage.
   a) line and line
   c) neutral point and reference
   b) line and reference
   d) line and neutral poin

25. The voltage between _____ is called line voltage.
   a) line and neutral point
   c) line and line
   b) line and reference
   d) neutral point and reference

26. In the Delta or Mesh connection, there will be _____ number of common terminals.
   a) 1
   c) 3
   b) 2
   d) **0**

27. The relation between line voltage and phase voltage in Delta or Mesh connection is?
   a) $V_{phase} > V_{line}$
   c) $V_{phase} = V_{line}$
   b) $V_{phase} < V_{line}$
   d) $V_{phase} >= V_{line}$

28. Which of the following voltage is a phase voltage in the delta connection?
   a) V_{RN}
   c) V_{YN}
   b) V_{BR}
   d) V_{BN}

29. A balanced delta-connected load of (2+j3) Ω per phase is connected to a balanced three-phase 440V supply. The phase current is 10A. Find the total active power.
   a) 7.26W
   c) 7260W
   b) 726W
   d) 72.6W

30. A balanced delta-connected load of (2+j3) Ω per phase is connected to a balanced three-phase 440V supply. The phase current is 10A. Find the apparent power.
   a) 10955.67 VAR
   c) 109.5567 VAR
   b) 10.95567 VAR
   d) 1.095567 VAR

4. Transformer and DC Motor

Position in Question Paper **Total Marks-14**

Q.1. c) 2-Marks.
Q.2. d) 4-Marks.
Q.3. b) 4-Marks.
Q.4. b) 4-Marks.

Descriptive Question

1. Define the transformation ratio of a transformer
2. State working principle of transformer.
3. Draw a practical set up to find voltage and current ratio on a 230/115 V, 1KVA, 1f 50Hz transformer. Also write reading of each meter.
4. Compare auto transformer and two winding transformer on any four points
5. Write two applications of D.C. series motor.
6. State function of poles and brushes in DC motors. State material for each.
7. Write principle of operation for a DC motor
8. Draw neat constructional sketch of auto transformer. State its advantages and applications.
9. Draw neat constructional sketch of shell type transformer.
10. A 2000/200 V, single phase, 50 Hz transformer has the maximum flux of 30 mwb. Find out the no. of turns on primary and secondary windings if the cross sectional area of the core is 1.1 cm2
11. Compare two winding transformer and auto transformer. (Any four points)
12. Draw schematic representation of - DC shunt motor
13. Draw schematic representation of DC series motor
14. Draw schematic representation of DC compound motor

MCQ Question

(Total number of Question=Marks*3=14*3=42)

Note: Correct answer is marked with **bold**

1. The main purpose of using core in transformer is to
   a) **Decrease reluctance of the common magnetic circuit**
   b) Decrease iron losses

c) Prevent hysteresis lose
d) Prevent eddy current losses

2. Transformer works on the principle of
   a) **Self induction**
   b) Mutual induction
   c) Faraday's law of electromagnetic induction
   d) Self and mutual induction both
3. If dc voltage is applied to the primary of a transformer it may
   a) Work
   b) **Burn the winding**
   c) Not work
   d) Give lower voltage on the secondary side
4. Which of the following will improve the mutual coupling between primary and secondary of a transformer ?
   a) Transformer oil of high breakdown voltage
   b) Winding material of high resistivity
   c) High reluctance magnetic core
   d) **Low reluctance magnetic core**
5. Which type of core is used for a high-frequency transformer
   a) Open iron core
   b) **Air core**
   c) Closed iron core
   d) None of these
6. Transformer oil used in transformer provides
   a) **Insulation and cooling**
   b) Cooling and lubrication
   c) Lubrication and insulation
   d) Insulation, cooling and lubrication
7. Enamel layer is coated over the lamination of a transformer core to
   a) Attain adhesion between the lamination
   b) Prevent corrosion of laminations
   c) Decrease the hum
   d) **Insulate the lamination from each other**
8. In a transformer, the magnetic coupling between the primary and secondary circuit can be increased by
   a) increasing the number of turns
   b) using soft material for winding
   c) **using magnetic core of low reluc-tance**
   d) using transformer oil better quality

9. If the density in the core of a transformer is increased
   a) **the frequency the secondary winding voltage increases**
   b) wave shape of the secondary winding voltage gets distorted
   c) size of the transformer can be reduced
   d) eddy current losses increase
10. The power factor in a transformer
   a) is always unit
   b) is always leading
   c) is always lagging
   d) **depends on the power factor of load**
11. Which of the following transformer will be largest is size?
   a) 1 kVA, 50 Hz
   b) 1 KVA, 60 Hz
   c) 1KVA, 100Hz
   d) **1KVA, 500 Hz**
12. A transformer transforms
   a) Current
   b) Voltage
   c) Frequency
   d) **Both voltage and current**
13. A transformer does not change the following
   a) Waveform
   b) Frequency
   c) Voltage
   d) **Both frequency and waveform**
14. A transformer provides a path for magnetic flux of
   a) High reluctance
   b) High conductivity
   c) **Low reluctance**
   d) Low conductivity
15. An ordinary transformer works on
   a) **A.C**
   b) D.C
   c) Both a.c. and d.c.
   d) Pulsating d.c.
16. An ideal transformer is one which has
   a) A common core for its primary and secondary winding
   b) Core of stainless steel and winding of pure copper wire
   c) **No losses and magnetic leakage**
   d) Interleaved primary and secondary windings
17. The primary and secondary induced emfs E_1 and E_2 in two-winding transformer are always
   a) Antiphase with each other
   b) **In phase with each other**
   c) Equal in magnitude
   d) Determined by load on transformer secondary

18. An step-up transformer increases
    a) Current
    b) Frequency
    c) **Voltage**
    d) Power

19. Eddy current losses in a transformer core may be reduced by
    a) Reducing the air gap in the magnetic circuit
    b) **Reducing the thickness of lami-nations**
    c) Increasing the thickness of lami-nations
    d) Increasing the gap in the magnetic circuit

20. The transformer core is generally made of
    a) Alumimium
    b) **Silicon steel**
    c) Copper
    d) Wood

21.22. Which of the following is minimized by laminating the core of a transformer?
    a) Hysteresis loss
    b) Eddy current loss
    c) Heat loss
    d) **All of these**

22.23. Thickness of laminations of trans-former core is usually of the order of
    a) 0.35 mm to 0.5 mm
    b) 3.5 mm to 5 mm
    c) 35 mm to 50 mm
    d) **5mm to 10 mm**

23. The size of transformer core depends on
    a) Area of the core
    b) Flux density of core material
    c) Frequency
    d) **Both (b) and (c)**

24. In power transformers, breather is used to
    a) Provide insulation to the windings
    b) Provide cooling to the windings
    c) Take insulating oil from the con-servator
    d) Extract moisture from the air

25. In a transformer, conservator con-sists of
    a) Drum placed at the bottom of the tank
    b) **An air tight metal drum fixed at the top of the tank**
    c) Overload protection circuit
    d) None of these

26. In a transformer, the resistance between its primary and secondary should be
    a) **Infinite**
    b) Zero
    c) About 1 MΩ
    d) About 100 MΩ

27. For large power transformer, best utilization of available core space can be made by using
    a) Square core section
    b) **Stepped core section**
    c) Rectangular core section
    d) None of these

28. Five limb core construction of transformer has advantage over three limb core construction that
   a) Hysteresis loss is less
   b) Permeability is higher
   c) **Magnetic reluctance of the three phases can be balanced**
   d) Eddy current loss is less

29. A shunt motor is fitted with a field regulator for speed control. For constant torque load, the speed will be minimum when the resistance of the regulator is
   a) **0Ω**
   b) Infinite
   c) About 10Ω
   d) About 100Ω

30. Transformer windings are tapped in the middle because
   a) **It eliminates axial forces on the windings**
   b) It eliminates radial forces on the windings
   c) It reduces insulation requirement
   d) None of these

31. Which of the following materials is used to absorb moisture from air entering the transformer ?
   a) Silica sand
   b) **Silical gel**
   c) Felt pad
   d) Sodium chloride

32. Which of the following acts as a protection against high voltage surges due to lightening and switching?
   a) **Horn gaps**
   b) Thermal overload relays
   c) Conservator
   d) Breather

33. A tap changer is used on a trans-former for
   a) Adjustment in power factor
   b) **Adjustment in secondary voltage**
   c) Adjustment in primary voltage
   d) Adjustments in both primary and secondary voltage

34. Overcurrents in a transformer affect
   a) Insulation life
   b) Temperature rise
   c) Mechanical stress
   d) **All of these**

35. Highest rating transformers are likely to find application in
   a) Generation
   b) Transmission
   c) **Distribution**
   d) Substation

36. Transformer ratings are usually expressed in terms of
   a) Voltage
   b) KVA
   c) **KWh**
   d) KW

37. The noise in transformer due to vibration of laminations set by magnetic forces, is called
   a) Flicker noise
   b) Transit-time noise
   c) Agitation noise
   d) **Humming noise**

38. The maximum load that a power transformer can carry is limited by its
   a) **Voltage ratio**
   b) Copper loss
   c) Temperature noise
   d) Dielectric strength of oil

39. In a three-phase transformer, the phase difference between the primary voltage and the induced secondary winding voltage is
   a) 90°
   b) 120°
   c) **180°**
   d) None of the above

40. In dc motor, the rotor is
   a) Welded to the shaft
   b) **Keyed to the shaft**
   c) Soldered to the shaft
   d) Both to the shaft

41. In a dc motor, pole shoes are fixed to the magnet core by
   a) **Set of screws**
   b) Key
   c) Soldering
   d) Welding

42. Carbon brushes are used in electric motors to
   a) Prevent sparking during commutation
   b) **Provide a path for flow of current**
   c) Brush off carbon deposits on the commutator
   d) None 0f these

5. Fractional Hourse Power Motor

Position in Question Paper **Total Marks-14**

Q.1. f) 2-Marks.
Q.3. c) 4-Marks.
Q.4. c) 4-Marks.
Q.4. d) 4-Marks.

Descriptive Question

1. State the types of single phase induction motors.
2. Draw schematic representation of capacitor. Start capacitor run induction motor. Also state its applications.
3. Draw a neat schematic of shaded pole 1f Induction motor. List any two applications of it.
4. Explain principle of operation of universal motor with neat diagram
5. Write any two applications of following motors - Universal motor (ii) Stepper motor
6. Explain the working principle of stepper motor and explain any one type with neat sketch.
7. Suggest suitable motor for following applications- (i) Food Mixer (ii) Electric Fan
8. List different types of stepper motor. State one application of stepper motor.
9. List any four applications of stepper motor
10. Draw a neat schematic of universal motor. State its principle of operations. Write the method for reversal of direction.
11. Draw a neat sketch of permanent capacitor 1f induction motor. Explain its working

MCQ Question

(Total number of Question=Marks*3=14*3=42)

Note: Correct answer is marked with **bold**

1. At zero in an induction motor
   a) Motor runs as a generator
   b) **Motor does not run**
   c) The motor runs an at synchronous speed
   d) Slip produced is zero
2. In an induction motor, rotor slots are usually not quite parallel to the shaft but are given a slight skew

a) To reduce the magnetic hum
b) To reduce the locking tendency of the rotor
c) **Both (a) and (b) above**
d) To increase the speed of the motor

3. The field of an induction motor rotor rotates relative to the stator at
a) Rotor speed
b) **Synchronous speed**
c) Slip speed
d) Very low speed

4. In an induction motor, rotor runs at a speed
a) Equal to the speed of stator field
b) **Lower than the speed of stator field**
c) Higher than the speed of stator field
d) Having no relation with the speed of stator field

5. Starters are used in induction motor because
a) Its starting torque is high
b) It is run against heavy load
c) It can not run in reverse direction
d) **Its starting current is five times or more than its rated current**

6. When an induction motor runs at rated load and speed, the iron losses are
a) Negligible
b) Very heavy
c) **Independent of supply frequency**
d) Independent of supply voltage

7. By synchronous wattage of an induction motor is meant
a) Stator input in watts
b) Rotor output in watts
c) **Rotor input in watts**
d) Shaft output in watts

8. The emf induced in the rotor of an induction motor is proportional to
a) Voltage applied to stator
b) Relative velocity between flux and rotor conductors
c) **Both (a) and (b) above**
d) Slip

9. The synchronous speed of an induction motor is defined as
a) **Natural speed at which a magnetic field rotates**
b) The speed of a synchronous motor
c) The speed of an induction motor at no load
d) None of these

10. The starting torque of an indication motor is maximum when
a) **Rotor resistance equals rotor reactance**

b) Rotor resistance is twice the rotor reactance
c) Rotor resistance is half the rotor reactance
d) Rotor resistance is R_2 times the rotor reactance

11. In a shaded pole motor, the locked rotor current is
a) 10 times the full load current
b) 4 to 5 times the full load current
c) **slightly more than the full load current**
d) less than the full load current**.**

12. A capacitor motor of 1/4 HP needs a condenser of 8 μ F. A similar motor of 3/4 HP will need a condenser of
a) **20 μF** c) 2 μF.
b) 8 μF d) 3 μF

13. The rotor of which motor does not have winding on it ?
a) Universal motor c) Reluctance motor
b) **Hysteresis motor** d) Repulsion motor.

14. Which motor has unsymmetrical rotor ?
a) Universal motor c) Split-phase motor
b) Shaded pole motor d) **Reluctance motor**.

15. If a single phase motor runs slow, the probable case may be
a) overload c) low voltage
b) low frequency d) **any of the above.**

16. A single phase capacitor start motor will take starting current nearly
a) same as full load current
b) **twice the full load current**
c) three times the full load current
d) four the six times the full load current.

17. Which motor will make least noise ?
a) Capacitor motor c) Shaded pole motor
b) Universal motor d) **Hysteresis motor.**

18. Shaded pole motors are not provided with
a) capacitor c) commutator
b) centrifugal switch d) **all of the above.**

19. In a universal motor, normally the ratio of width of brush to the width of commutator segments is
a) 1 : 1 c) **2 : 1**
b) 1: 2 d) 4:1.

20. For a given output and speed, a universal motor as compared to 220 V, 50 Hz supply will require
a) **less voltage at low frequency** c) high voltage at high frequency
b) less voltage at high frequency d) high voltage at low frequency.

21. The short coming of repulsion motor is

a) variation of speed with load
b) low power factor
c) tendency to spark at brushes
d) all of the above.

22..The disadvantage of shaded pole motor is
a) low starting torque'
b) low efficiency
c) very little over load capacity
d) all of the above.

23.. The efficiency of shaded pole motor is in the range
a) 80 to 95 percent
b) 70 to 80 percent
c) 50 to 70 percent
d) 5 to 35 percent.

24.For domestic sewing machine the size of the motor required will be
a) 10-15 watts
b) 15-25 watts
c) 100-150 watts
d) 250 to 750 watts.

25. A ceiling fan of 1400 mm sweep will have motor rating of
a) to 15 watts
b) 50 to 70 watts
c) **120 to 180 watts**
d) 250 to 500 watts.

26. Which of the following applications would need the smallest size of motor
a) Domestic motor
b) Electric clock
c) Table fan
d) Sewing machine.

27.All single phase ac motors are designed to operate usually on
a) 220 V only
b) 220V + 10V
c) 220 ± 0 V
d) 220 ± 10% volts.

28. All single phase ac motors are designed usually to operate on the frequency
a) 50 Hz
b) 50 ± 0.5 Hz
c) 50 ±1 Hz
d) 50. ± 5 Hz.

29. When a dc series motor is connected to ac supply, it will
a) spark excessively
b) give poor efficiency
c) run on poor power factor
d) **all of the above**.

30.The torque-speed characteristic of a repulsion motor resembles that of which of the following dc motor ?
a) separately excited motor
b) shunt motor
c) series is motor
d) compound motor.

31. In a single phase capacitor motor the direction of rotation will be in the opposite direction to the original when
a) electrolytic capacitor is replaced by paper capacitor
b) two capacitors of equal value are used
c) capacitor is replaced by a resistance
d) **capacitor is replaced by an inductor.**

32.In a hysteresis motor, the position of shaded pole with respect to main pole determines
a) speed of motor
b) **direction of rotation**
c) hysteresis loss
d) no load rpm

33. In a shaded pole motor, the direction of rotation is from
a) **main pole to shaded pole**
b) shaded pole to main pole
c) depends on supply line polarity.

d) None of the above

34.Which motor is generally used in tape recorders ?

a) Universal motor
b) Reluctance motor
c) Split phase motor
d) Hysteresis motor.

35. In a shaded pole motor, shading coils are used to

a) reduce windage losses
b) reduce friction losses
c) produce rotating magnetic field
d) to protect against sparking.

36.The type of starting relay used on single phase hermetic motor is

a) hot wire relay
b) timing relay
c) current coil relay
d) voltage coil relay

37.Reluctance motors are

a) doubly excited
b) **singly excited**
c) either doubly excited or singly excited
d) none of the above.

38. Electric motors are generally designed to have maximum efficiency at

a) full load
b) near full load
c) half load
d) near half load.

39. Which of the following is non-reversible motor ?

a) Universal motor
b) Capacitor start split phase motor
c) **Resistance start split phase motor**
d) Permanent split capacitor motor.

40. Which motor is generally used for electric shavers ?

a) Shaded pole motor
b) Hysteresis motor
c) Reluctance motor
d) **Universal motor.**

41. The motor useful for signaling and timing device is

a) Reluctance motor
b) Shaded pole motor
c) Hysteresis motor
d) Two value capacitor motor

42. A motor generally used in toys is

a) Hysteresis motor
b) Shaded pole motor
c) Two value capacitor motor
d) Reluctance motor.

6. Protective Devices and Switchgear

Position in Question Paper **Total Marks-12**

Q.1. g) 2-Marks.
Q.3. d) 4-Marks.
Q.6. c) 6-Marks.

Descriptive Question

1. List the types of Fuses.
2. Explain pipe earthing with a neat labeled diagram.
3. State the function of the fuse and material used for fuse.
4. Explain the need of earthing in electrical systems.
5. State the types of earthing and any two advantages of earthing.
6. Explain with neat diagram, operation of ELCB and two applications.
7. State function of ELCB.
8. List any two factors that affect earthing.
9. Write any four major points related to rewirable fuse
10. With neat sketch explain principle of operation of ELCB. Write any two applications of it.
11. State any three methods of reducing earthing resistance
12. Write any three major points related to IE rules relevant to earthing.
13. State any four abnormal conditions which can develop in power system and state its effect on power system

MCQ Question

(Total number of Question=Marks*3=12*3=36)

Note: Correct answer is marked with **bold**

1. The main function of a fuse isto
   a) protect theline
   b) open thecircuit
   c) protect theappliance
   d) prevent excessivecurrents
2. On which of the following routine tests are conducted?
   a) Oil circuitbreakers
   b) Air blast circuitbreakers
   c) Minimum oil circuitbreakers
   d) All of the above
3. SF6gas
   a) is yellow incolour
   b) is lighter thanair
   c) isnontoxic
   d) has pungentsmall

4. The arcing contacts in a circuit breaker are madeof
   a) copper tungstenalloy
   b) porcelain
   c) electrolyticcopper
   d) aluminium alloy
5. Which of the following medium is employed for extinction of arc in air circuit breaker?
   a) Water
   b) Oil
   c) Air
   d) SF
6. With which of the following, a circuit breaker must be equipped for remote operation?
   (a) Inverse time trip
   (b) Time-delay trip
   (c) Shunt trip
   (d) None of the above
7. Fault diverters are basically
   a) fuses
   b) relays
   c) fastswitches
   d) circuit breakers
8. A thermal protection switch can protect against
   a) short-circuit
   b) temperature
   c) overload
   d) over voltage
9. Arc in a circuit behaves as
   a) a capackivereactance
   b) an inductive reactance
   c) a resistance increasing with voltage rise across the arc
   d) **a resistance decreasing with voltage rise across the arc**
10. Thermal circuit breakerhas
    a) delayed trip action
    b) instantaneous trip action
    c) both of the above
    d) none of the above
11. Overload relays are of type.
    a) induction
    b) solid state
    c) thermal
    d) all above
12. Thermaloverloadrelaysareusedtoprotectthemotoragainstovercurrentdueto
    a) short-circuits
    b) heavy loads
    c) grounds
    d) all of the
13. Magnetic circuit breaker has trip action.

a) delayed
b) instantaneous
c) both of theabove
d) none of the

14. D.C. shunt relays are made of
a) few turns of thin wire
b) few turns of thick wire
c) many turns of thin wire
d) none of these

15. many turns of thick wire The relay operating speed depends upon
a) the spring tension
b) the rate of flux built up
c) armature core air gap
d) all of the above

16. In order that current should flow without causing excessive heating or voltage drop, the relay contacts should
a) have low contact resistance
b) be clean and smooth
c) be of sufficient size and proper shape
d) have all above properties

17. Circuit breakers usually operate under
a) transient state of short-circuit current
b) sub-transient state of short-circuit current
c) steady state of short-circuit current
d) after D.C. component has ceased

18. Circuit breakers are essentially
a) current carrying contacts called electrodes
b) arc extinguishers
c) circuits to break the system
d) transformers to isolate the two systems

19. The current zero interruption, in oil and air blast circuit breakers, is achieved by
a) lengthening of the gap
b) cooling and blast effect
c) both (a) and(b)
d) demonizing the oil with forced air

20.To prevent overload and overheating of wires
a) fuses are used
b) circuit breakers are used
c) **fuses and circuit breakers are used**
d) fuses and resistor are used

21.The magnetic field of the coil and the permanent magnet
a) attract each other
b) repel each other
c) combine with each other
d) stay with each other

22.ELCB is an abbreviation of
a) electrolytic circuit breaker
b) earth locking circuit breaker
c) earth leakage circuit breaker
d) electric leakage circuit breaker

23.Electricity is required to
a) light up homes
b) clean your car
c) flush the toilet
d) change weather

24.A block of impure copper is used as
a) cathode
b) anode
c) posit rode
d) nematode

25.Miniature circuit breaker is a small
a) **fuse**
b) magnetic switch
c) electromagnetic switch
d) two way switch

26.Which of the following circuit breaker can be installed on 400 kV line
a) **Tank type oil circuit breaker**
b) Miniature circuit breaker
c) Vacuum circuit breaker
d) Air blast circuit breaker.

27.Out of the following circuit breakers, which one has the lowest voltage range ?
a) Air-break circuit breaker
b) Tank type oil circuit breaker
c) Air-blast circuit breaker
d) SF_6 circuit breaker.

28. In a vacuum circuit breaker, the vacuum is of the order of
a) 10mm Hg
b) 10^{-2}mmHg
c) $l0^{-6}$ mmHg
d) 10^{-9}mmHg.

29. In modem EHV circuit breakers, the operating time between instant of receiving trip signal and final contact separation is, of the order of
a) 0.001 sec
b) 0.015 sec
c) 0.003 sec
d) **0.03 sec**.

30. In a HRC fuse the time between cut-off and final current zero, is known as

a) total operating time
b) arcing time
c) pre-arcing time
d) any of the above

31 . Low voltage circuit breakers have rated voltage of less than
a) 220 V
b) 400V
c) 1000 V
d) 10,000 V.

32 .The fault clearing time of a circuit breaker is usually
a) few minutes
b) few seconds
c) one second
d) **few cycles of supply voltage**

33 .The medium employed for extinction of arc in air circuit breaker is
a) SF_6
b) Oil
c) **Air**
d) Water.

34 .Which of the following circuit breakers is preferred for EHT application
a) Air blast circuit breakers
b) Minimum oil circuit breakers
c) Bulk oil circuit breakers
d) **SF_6 oil circuit breakers.**

35 .For high voltage, ac circuit breakers, the rated short circuit current is passed for
a) 0.01 sec
b) 0.1 sec
c) **3 seconds**
d) **2**0 seconds

36 .A circuit breaker is
a) power factor correcting device
b) a device to neutralize the effect of transients
c) a waveform correcting device
d) a current interrupting device.