Subject: Electric Motor & Transformer (22418)

SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	**Introduction to Electric Motors**	**06**
2	**DC Machines**	**14**
3	**Single Phase Transformer**	**21**
4	**Three Phase Transformer**	**19**
5	**Special Purpose Transformer**	**10**
	Total Marks :-	**70**

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BOARD THEORY
PAPER PATTERN

Q.1		Attempt any FIVE 5*2=10
	a)	State the principle of the dc motor.
	b)	Name the parts of the motors that are built of electromagnetic stampings.
	c)	State the role played by the winding insulation of transformers.
	d)	State the function of the breather in large transformers.
	e)	Define the term polarity related to transformers
	f)	State the function of the isolation transformer.
	g)	Define an instrument transformer
Q.2		**Attempt any THREE 3*4=12**
	a)	Suggest the materials for the following parts of motors: i) armature windings, ii) Commutator, iii) Brushes and iv) Outermost body/frame.
	b)	Explain the principle of working of an induction motor.
	c)	Describe with relevant figures (sketches) the flux variation method for speed control of the DC shunt motors.
	d)	Justify using the relevant labeled torque-speed characteristics the use of DC series motors in traction systems.
Q.3		**Attempt any THREE 3*4=12**
	a)	Explain with simple sketch the working of the brushless DC motor.
	b)	Derive the EMF equation for the single phase transformer. State the clearly the terms/symbols used therein
	c)	Draw the labeled phasor diagram of the single phase transformer supplying load at leading power factor
	d)	Draw the labeled equivalent circuit of the single phase transformer supplying a load consisting of a series connection of resistance and inductive reactance.
Q.4		**Attempt any FOUR 3*4=12**
	a)	Compare the distribution and power transformers on any four points.
	b)	Give the criteria for selection of distribution transformer as per IS:10028(part-I).
	c)	Explain with neat circuit diagram only the Scott connection scheme for conversion of three phase supply to two phase supply. Name one application of the same.

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	e)	Describe with simple circuit diagram the working of the single phase welding transformer
Q.5		**Attempt any TWO** **2*6=12**
	a)	A dc series motor draws a current of 44 A at 220 V running at 820 RPM. The armature and field resistances are 0.2 ohm and 0.1 ohm respectively. The total of iron and friction losses at this load condition is 0.5 kW. Determine the armature torque and efficiency of the motor.
	b)	Describe with neat labeled circuit diagrams the tests carried out on three phase transformers to identify the corresponding phase winding terminals on primary and secondary sides along with their polarities.
	c)	A 600kVA, distribution transformer have copper and iron losses of 5.6 kW and 3.2 kW respectively on full load. The transformer is loaded as shown below **Loading (kW) Power factor(lag) No. of hours** | Loading (kW)	Power factor(lag)	No. of hours | |---|---|---| | 500 | 0.9 | 08 | | 400 | 0.8 | 10 | | 50 | 0.75 | 04 | | No load | -- | 02 | Calculate the all-day efficiency.
Q.6		**Attempt any FOUR** **2*6=12**
	a)	A single phase 2200/440V transformer has the following winding resistances and reactances (referred to respective sides): $R_1 = 0.7\Omega$, $R_2 = 0.011\Omega$, $X_1 = 3.6\Omega$, $X_2 = 0.045\Omega$. The secondary is connected to coil having resistance of 6 Ω and inductive reactance 4 Ω. Calculate secondary terminal voltage and power consumed by the coil.
	b)	Justify the need for parallel operation of transformers. State the conditions for successful parallel operation of three phase transformers
	c)	A 40 kVA, single phase transformer with a ratio of 2000 V / 250 V has a primary resistance of 1.15Ω and a secondary resistance of 0.01555Ω. If the transformer is designed for maximum efficiency at 85% of full load. Find its efficiency when delivering full load at 0.9 power factor lag.

CLASS TEST -1
PAPER PATTERN

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
1	**Introduction to Electric Motors**	**CO-418.1**
2	**DC Machines**	**CO-418.2**

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Define an electric motor.	**CO-418.1**
b)	Name two materials used for construction of stator cores of motors.	**CO-418.2**
c)	State the function of the magnetic poles in DC machines	**CO-418.2**
d)	State Fleming's left hand rule.	**CO-418.1**
e)	Write the voltage equation for the DC motor.	**CO-418.2**
f)	Suggest the DC motor for traction applications with justification.	**CO-418.2**
Q.2	**Attempt any THREE 3*4=12 Marks**	
a)	Explain the significance of back emf for proper working of the DC motors	**CO-418.2**
b)	Justify the need for starters for DC series and shunt motors.	**CO-418.2**
c)	Explain the function of the commutator in DC generators and motors. Draw a simple sketch showing its components	**CO-418.1**
d)	State the materials used for the following parts of motors: terminal plates, terminal box, yoke and eye bolt.	**CO-418.1**
e)	Describe with diagram the armature voltage variation method for speed control of DC motor.	**CO-418.2**

CLASS TEST -1
PAPER PATTERN

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
3	Single Phase Transformer	CO-418.3
4	Three Phase Transformer	CO-418.4
5	Special Purpose Transformer	CO-418.5

		Course Outcome (CO)
Q.1	**Attempt any FOUR** **4*2=8Marks**	
a)	Name two materials used for the cores of transformers.	CO-418.3
b)	State the reason for the transformer rating to be mentioned in kVA.	CO-418.3
c)	Justify need for cooling of transformers	CO-418.4
d)	Write the need for parallel operation of transformers	CO-418.4
e)	Justify the need for using isolation transformers in some applications	CO-418.5
f)	Write in brief (4 sentences) the effects of harmonics on operation of transformers.	CO-418.5
Q.2	**Attempt any THREE** **3*4=12 Marks**	
a)	A 3300/230V, 50Hz single phase transformer is to be operated at a maximum flux density of $1.2 Wb/m^2$ in the core. The effective cross sectional area of the transformer is $150 cm^2$. Calculate suitable values of primary and secondary turns.	CO-418.3
b)	Draw the phasor diagram of a single phase transformer loaded at leading power factor	CO-418.3
c)	Explain with diagrams the polarity and phasing out tests on three phase transformers	CO-418.4
d)	State the criteria for selection of power transformers.	CO-418.4
e)	Explain the working of the pulse transformer and name two applications for the same	CO-418.5

COURSE OUTCOME (CO)

COURSE: - Electric Motors & Transformer (CNE-22CO-418)
PROGRAMME: - Electrical Engineering.

CO.NO	Course Outcome
CO-418.1	Use different types of electric motor
CO-418.2	Use DC motor
CO-418.3	Use 1 Ph. Transformer for different application
CO-418.4	Use 3 Ph. Transformer for different application
CO-418.5	Use relevant special purpose. Transformer for different application

1. INTRODUCTION TO ELECTRIC MOTORS

Position in Question Paper   **Total Marks-06**
   Q.1. a) 2-Marks.
   Q.3. a) 4-Marks.

Descriptive Question

1. Introduction to electric motors
2. State the principle of capacitor motor
3. State and explain working principle of induction motor with advantage
4. Define synchronous speed
5. State different types of induction motors and explain any one
6. Explain construction and working of servomotor
7. State the principle of alternator
8. Explain the construction and working of permanent magnet stepper motor
9. state the type of stepper motor
10. state principle of operation of dc motor

MCQ Question

(Total number of Question=Marks*3=6*3=18)

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

1. What will happen if DC shunt motor is connected across AC supply?
   a) Will run at normal speed
   b) Will not run
   c) Will Run at lower speed
   d) **Burn due to heat produced in the field winding**
2. What will happen if the back emf of a DC motor vanishes suddenly?
   a) The motor will stop   c) **The armature may burn**
   b) The motor will continue to run   d) The motor will run noisy
3. What will happen, with the increase in speed of a DC motor?
   a) **Back emf increase but line current falls.**
   b) Back emf falls and line current increase.
   c) Both back emf as well as line current increase.
   d) Both back emf as well as line current fall.
4. Which part will surely tell that given motor is DC motor and not an AC type?

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a) Winding   c) **Commutator**

b) Shaft   d) Stator

5. In DC motor, which of the following part can sustain the maximum Temperature rise?

a) **Field winding**   c) Slip rings

b) Commutator   d) Armature winding

6. Direction of rotation of motor is determined by _____

a) Faraday's law   c) Coulomb's law

b) Lenz's law   d) **Fleming's left-hand rule**

7. The current drawn by the armature of DC motor is directly proportional to _____

a) **Torque**

b) Speed

c) The voltage across the terminals

d) cannot be determined

8. Which power is mentioned on a name plate of a motor?

a) Gross power

b) Power drawn in kVA

c) Power drawn in kW

d) **Output power available at the shaft**

9. An electric motor is having constant output power. So, motor will have a torque speed characteristic _____

a) Circle about the origin.

b) Straight line parallel to the speed axis.

c) Straight line through the origin.

d) **Rectangular hyperbola**

10. Which of the following quantity will decrease if supply voltage is increased?

a) Starting torque   c) **Full-load current**

b) Operating speed   d) cannot be determined

11. In which of the following case we will get maximum power?

a) E_a = 2 x supply voltage   c) **Supply voltage = 2 x E_a**

b) E_a = supply voltage   d) supply voltage = 4 x E_a

12. Sometimes motor has to be de-rated.

a) **True**

b) False

13. The armature shaft of a DC motor must be able to withstand _____

a) Bending moment due to weight of the armature.

b) Any unbalanced magnetic pull on the armature core.

c) Twisting stains due to transmission of torque.

d) **Bending moment, unbalanced magnetic pull and twisting stains**

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14. In DC machines the residual magnetism is present. The order of residual magnetism is _____

    a) **2 to 3 per cent**   c) 20 to 25 per cent

    b) 10 to 15 per cent   d) 50 to 75 per cent

15. Sparking is discouraged in a DC motor.

    a) True   b) **False**

16. Which power is mentioned on a name plate of a motor?

    a) Gross power

    b) Power drawn in kVA

    c) Power drawn in kW

    d) **Output power available at the shaft**

17. An electric motor is having constant output power. So, motor will have a torque speed characteristic _____

    a) Circle about the origin.

    b) Straight line parallel to the speed axis.

    c) Straight line through the origin.

    d) **Rectangular hyperbola**

18. Which of the following quantity will decrease if supply voltage is increased?

    a) Starting torque   c) **Full-load current**

    b) Operating speed   d) cannot be determined

2. DC MACHINE

Position in Question Paper   **Total Marks-14**
    Q.1. a) 2-Marks.
    Q.2. a) 4-Marks.
          b) 4-Mark.
    Q.3. a) 4-Marks.

Descriptive Question

1. Explain the necessity of starter for DC motor. State various types of DC motor starter

2. Describe Ta-Ia characteristics for DC series and DC shunt motor
3. State at least one function and the material used for the following parts of dc generator:
4. What is back emf? Also explain its significance in DC motor.

5. Draw and explain the following characteristics of DC shunt motor:

   i) Torque vs Armature current (ii) Speed vs Torque

6. f) Explain with the help of neat diagram the following methods of speed control for DC series motor: (i) Field diverter method (ii) Tapped field method

MCQ Question

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

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

1. Where is field winding mounted in a DC machine?
    a) Stator   c) Absent
    b) Rotor   d) Anywhere on stator or rotor
2. What are the materials used for brushes in dc machines?
    a) Iron   c) Aluminum
    b) Carbon   d) Steel
3. Function of yoke is to provide the return path for magnetic flux.
    a) True   b) false
4. The angle (electrical) made by brushes with axes of adjoining filed poles is _____

a) 450   **c) 900**
b) 1800   d) 300

5. In a DC machine, rectification process is carried out in order to get unidirectional output (DC). This rectification process is carried out by _____

    a) Half wave rectifier   **c) Mechanical rectification**
    b) Full wave rectifier   d) Centre tapped rectifier

6. Which of the following part is used in construction of DC machine but not in AC machine?

    a) Armature Winding   **c) Commutator**
    b) Field winding   d) Shaft

7. In a DC machine fractional pitch winding is used to _____

    a) To improve cooling   c) To reduce copper losses
    b) To reduce sparking   d) To increase generated EMF

8. In normal dc machines operating at full-load conditions, the most powerful electromagnet is _____

    a) Field winding
    b) Interpole Winding
    c) Interpole and compensating winding together
    d) Armature winding

9. If a DC motor is connected to AC supply what will happen then?

    a) Not run   c) Run at normal speed
    b) Burn   d) Run at extremely low speed

10. The armature of DC motor is laminated to _____

    a) To reduce mass   **c) To reduce eddy current loss**
    b) To reduce hysteresis loss   d) To reduce inductance

11. Armature winding is mounted on a _____

    a) Stator
    b) Rotor
    c) Can be mounted anywhere on stator or rotor
    d) Not required

12. In a DC machine, how coil-side emf varies towards the outer side of poles?

    a) Decreases   c) Increases
    b) remains same   d) First increases the decreases

13. Commutator performs rectification so that output of the machine is unidirectional.

    a) True   b) False

14. What is the difference of DC voltages in the adjoining Brushes?

    a) Depends on the Shaft speed   d) Depends on the various other
    b) Zero   parameters
    c) Non-zero

15. What is the effect of armature coils at points where brushes are located?

a) Induces positive emf   **c) Induces zero emf**

b) Induces negative emf   d) Depends on the speed of rotor

16. As the armature rotates, the number of coils in series tapped by the brush pairs_____

    a) Remains same

    b) Increases

    c) Decreases

    d) Depends on rotor speed and direction of torque

17. Coil span for 4-pole, 12-slot armature winding is_____

    a) 24   c) 8

    b) 48   **d) 3**

18. What is the nature of the coils when Y_{CS} value is non-integral?

    a) Long-pitched

    b) Medium-pitched

    c) Short-pitched

    d) Can't be determined by Y_{CS} value

19. For a 2-pole DC machine with coil span equal to 6, what are the number of commutator segments?

    a) 3   c) 4

    b) 12   d) 8

20. When coil sides are pole pitch apart, the DC armature winding is called as _____

    a) Multiplex   **c) Full-pitch**

    b) Fractional-pitch   d) Pole-pitch

21. In which mode machine is operating, given that conductor current is in the same direction of conductor emf?

    a) Motoring

    b) Generating

    c) Can't be determined using directions

    d) In both modes for different cycles

22. Nature of the flux density wave in the air gap is(for armature current equal to 0)

    a) Flat topped with quarter wave symmetry

    b) Point topped with quarter wave symmetry

    c) Flat topped with half wave symmetry

    d) Point topped with half wave symmetry

23. In a DC machine, average energy stored in the magnetic field remains constant independent of the armature rotation.

    a) True   b) False

24. Emf produced by DC machine, for zero armature current (E1) and non-zero armature current (E2) can be related as_____

a) **E1 = E2**
c) E1 < E2

b) E1 > E2
d) Can't be determined

25. Average coil emf for 20 coil turns (E1) and 40 coil turns (E2), will have ratio E1/E2=____ (assuming all other parameters same for both machines).

a) **1/2**
c) 1/4

b) 2/1
d) 4/1

26. What is the average coil emf generated in a 4-pole DC machine having flux/pole equal to 0.1 wb rotating at 1500 rpm? (No. of coil sides = 100)

a) **19 kV**
c) 190 V

b) 1.9 kV
d) 19 V

27. Emf and torque produced in a DC machine are proportional to _____ and _____ respectively.

a) Armature speed and armature emf

b) Armature emf and armature speed

c) Armature current and armature emf

d) **Armature speed and armature current**

28. What is the value of Np in an average coil emf equation, for 10 armature conductors with 2 parallel paths?

a) 2
c) **2.5**

b) 3
d) 4

29. What is the torque equation in terms of B, Ic, l, Zr (r= mean air gap radius)?

a) **Bav*Ic*l*Zr**
c) Bav*Ic*Zr/l

b) Bav*Ic*l/Zr
d) Can't be expressed

30. What is the value of pole pitch (in SI unit) for mean air gap radius= 0.5mm and P=4?

a) $0.785* 10^{-6}$
c) $0.785* 10^{-2}$

b) **$0.785* 10^{-3}$**
d) $0.785* 10^{-4}$

31. Why are the DC motors preferred for traction applications?

a) Torque and speed are inversely proportional to armature current

b) Torque is proportional to armature current

c) Torque is proportional to square root of armature current

d) **The speed is inversely proportional to the torque and the torque is proportional to square of armature current**

32. Which of the following load application normally needs starting torque more than the rated torque?

a) Blowers
c) Air compressors

b) **Conveyors**
d) Centrifugal pumps

33. Which of the following motors can be used to drive the rotary compressor?

a) DC shunt motor
c) Universal motor

b) DC series motor
d) **Synchronous motor**

34. Which DC motor is used with flywheel for intermittent light and heavy loads?

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a) Series motor

b) Shunt motor

c) Cumulatively compounded motor

d) differentially compounded motor

35. Separately excited DC generators are still used in _____

   a) Thermal power plants

   b) Ward Leonard speed control system

   c) Hydro power plant

   d) In all fields

36. In world today, around 25% of the motors are manufactured are DC motors.

   a) True   b) False

37. Maximum torque in a DC machine is limited by _____

   a) Commutation   c) Losses other than heating

   b) Heating   d) Stability

38. Which of the following motor can replace DC series motor?

   a) DC shunt motor

   b) Cumulative compound motor

   c) Wound-rotor induction motor

   d) Synchronous motor

39. Which motor has almost replaced DC shunt motor from its applications?

   a) Wound-rotor induction motor

   b) Differential compound motor

   c) Air motor

   d) Squirrel caged induction motor

40. DC shunt motor is still used instead of synchronous motor in _____

   a) High speed applications

   b) Low speed applications

   c) Medium and high-speed applications

   d) Everywhere

41. Which type motors are preferred for lathes?

   a) DC shunt motors

   b) Squirrel Cage induction motor

   c) Synchronous motor

   d) DC Shunt Motors or Squirrel cage induction motor

42. When an electric train is moving down a hill, the DC motor will operate as _____

   a) DC series motor   c) DC shunt motor

   b) DC series generator   d) DC shunt generator

3. SINGLE PHASE TRANSFORMER

Position in Question Paper   **Total Marks-21**
       Q.2. a) 4-Marks.
           b) 4-Mark.
       Q.3. a) 4-Marks.
           b) 4-Marks.
       Q.5. b) 6-Marks.

Descriptive Question

1. Mention the differences between core and shell type transformers

2. Give the EMF equation of a transformer and define each term

3. What types of cores are used for transformers?

4. Discuss about losses in a transformer

5. Discuss all day efficiency

6. Derive the EMF equation of transformer? Hence derive the voltage ratio

7. What is the efficiency of transformer? How the efficiency of transformer can be calculated

8. Discuss about parallel operation of transformers for unequal voltages ratios.

9. List the advantages of OC and SC test (any four)

10. Derive the condition for maximum efficiency of transformer.

MCQ Question

(Total number of Question=Marks*3=21*3=63)

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

1. The majority of power transformers in use throughout the world are oil filled using a mineral oil.
   a) True   b) False
2. Dielectric mineral oil is used in _____
   a) Small transformers   **c) Large transformers**
   b) Medium transformers   d) In all transformers
3. The purpose of the transformer core is to provide _____

a) High reluctance path   c) High inductive path

b) Low reluctance path   d) High capacitive path

4. Transformer core is designed to reduce _____

    a) Hysteresis loss

    b) Eddy current loss

    c) Hysteresis loss and Eddy current loss

    d) Cannot be determined

5. Transformers windings are generally made of _____

    a) Steel   **c) Copper**

    b) Iron   d) Steel iron alloy

6. Before using oil in transformers, insulation material was _____

    a) Asbestos   c) Low grade pressboard in air

    b) Cotton   **d) Kraft paper**

7. Which transformer insulation material is best compare to Kraft paper?

    a) Oil   c) Low grade pressboard

    b) Asbestos   d) Cotton

8. Which of the following is not the property of oil that should be fulfilled before using in transformer?

    a) Low viscosity   **c) Low electrical strength**

    b) High flash point   d) High chemical stability

9. Transformer ratings are given in _____

    a) kW   c) HP

    b) kVAR   **d) kVA**

10. Function of transformer is to _____

    a) Convert AC to DC

    b) Convert DC to AC

    c) Step down or up the DC voltages and currents

    d) Step down or up the AC voltages and currents

11. What is the dielectric strength of a transformer oil?

    a) 1 kV   c) 100 kV

    b) 35 kV   d) 330 kV

12. Which of the following is not a part of transformer installation?

    a) Conservator   c) Buchholz relay

    b) Breather   **d) Exciter**

13. The insulating material that can withstand the highest temperature safely is _____

    a) Cellulose   **c) Mica**

    b) Asbestos   d) Glass fibre

14. The part of a transformer which is visible from outside _____

    a) Bushings   c) Primary winding

    b) Core   d) Secondary winding

15. Transformer core is generally made of _____

a) Single block of core material

b) By stacking large number of sheets together

c) Can be made with any of the above method

d) Cannot be determined

16. Transformer core is constructed for _____

a) Providing least effective magnetic linkage between two windings

b) providing isolation between magnetic linkages of one coil from another

c) Providing most effective magnetic linkage between two windings

d) cannot be determined

17. Which of the following statements is/are correct?

a) High frequency power supplies are light weight

b) Transformer size gets reduced at high frequency

c) Transformer size is more at higher frequency

d) High frequency power supplies are light weight and transformer size gets reduced at high frequency

18. Transformer operating at 25-400 Hz frequency contain core made of _____

a) Highly permeable iron

b) Steel alloy

c) Air core

d) Highly permeable iron and Steel alloy

19. In various radio devices and testing instruments we use _____

a) Iron core transformer   c) W/O core transformer

b) Air core transformer   d) Any transformer can be used

20. Which type of flux does transformer action need?

a) Constant magnetic flux   **c) Alternating magnetic lux**

b) Increasing magnetic flux   d) Alternating electric flux

21. Different core construction is required for core type and shell type transformer.

a) True   b) False

22. There is only one magnetic flux path in the circuit. The transformer is definitely _____

a) Core type   c) Can be any of the above

b) Shell type   d) Depends on other parameters

23. Which of the following is correct statement?

a) Core type transformer has more output than shell type

b) Core type transformer has higher efficiency compare to shell type

c) Core type transformer has lower efficiency than shell type

d) Can't predict

24. Core type transformer is with _____

a) Large size   c) High voltage

b) Small size   d) Everywhere

25. Which of the following is the correct statement?
    a) Shell type has more mechanical protection
    b) Cooling is more in shell type
    c) In core type sandwiched wiring is used
    d) In core type concentric winding is used

26. What is the purpose of providing an iron core in a transformer?
    a) Provide support to windings
    b) Reduce hysteresis loss
    c) Decrease the reluctance of the magnetic path
    d) Reduce eddy current losses

27. What is the thickness of laminations used in a transformer?
    a) 0.1 mm to 0.5 mm   c) 14 mm to 15 mm
    b) 4 mm to 5 mm   d) 25 mm to 40 mm

28. Which of the following is not considered in the standard voltage scale for power supply in India?
    a) 11kV   c) 66kV
    b) 33kV   **d) 122kV**

29. The maximum load that a power transformer can carry is limited because of its _____
    a) temperature rise   **c) voltage ratio**
    b) dielectric strength of oil   d) copper loss

30. The voltage transformation ratio of a transformer is defined as ratio of _____
    a) primary turns to secondary turns
    b) secondary current to primary current
    c) secondary induced emf to primary induced emf
    d) secondary terminal voltage to primary applied voltage

31. If a transformer is made to run on to a voltage which is more than the rated voltage _____
    a) its power factor will deteriorate
    b) its power factor will increase
    c) its power factor will remain unaffected
    d) its power factor will be zero

32. Which of the following equation correctly represents the exact phasor diagram of transformer?
    a) $V_1=E_1+I_1R_1+jI_1X_1$ c) $V_2=E_2+I_1R_1+jI_1X_1$
    b) $V_1=E_1+I_1R_1+jI_2X_2$ d) $V_1=E_1-I_1R_1+jI_1X_1$

33. Approximate phasor diagram of a transformer is based on _____
    a) $V_1=E_1+I_1R_1+jI_1X_1$ **c) $V_1=V_2+I_R+jI_X$**
    b) $V_2=E_2+I_2R_2+jI_2X_2$ d) $V_1=E_1+I_1R_1+jI_1X_2$

34. Hysteresis loss and eddy current loss is directly proportional to _____

a) **f and f²**   c) f and f

b) f² and f   d) f² and f²

35. What will happen to hysteresis loss if voltage is doubled, load is doubled and frequency is halved?

a) Will be twice   **c) Will remain same**

b) Will be halved   d) Will be four times

36. When does transformer breath in?

a) load on it increases   c) load remains constant

b) load on it decreases   d) cannot be determined

37. A transformer transforms _____

a) voltage   **c) power**

b) current   d) frequency

38. Greater the secondary leakage flux _____

a) less will be the secondary induced emf

b) less will be the primary induced emf

c) less will be the primary terminal voltage

d) cannot be determined

39. Which of the following is not the purpose of iron core in a step-up transformer?

a) to provide coupling between primary and secondary

b) to increase the magnitude of mutual flux

c) to decrease the magnitude of magnetizing current

d) to provide all above features

40. In a transformer the tappings are generally provided on

a) Primary side   c) Low voltage side

b) Secondary side   **d) Can be connected to any side**

41. Helical coils can be used at _____

a) low voltage side of high kVA transformers

b) high frequency transformers

c) high voltage side of small capacity transformer

d) high voltage side of high kVA rating transformers

42. In real transformer, primary winding has _____

a) Infinite resistance   **c) Some finite resistance**

b) Zero resistance   d) Cannot say

43. Both resistances and leakage reactances of the transformer windings are _____

a) Series effects   c) Series-parallel effects

b) Parallel effects   d) Cannot say

44. To convert an ideal transformer into a practical transformer we add _____

a) Primary winding resistance and secondary winding resistance

b) Primary winding leakage reactance and secondary winding leakage

reactance

c) Primary winding resistance, leakage and secondary winding leakage reactance

d) Cannot be determined

45. Parallel parameters in a transformer equivalent circuit contains

_____

   a) G_i and B_m   c) R_2 and X_2

   b) R_1 and X_1 d) Cannot be determined

46. When does capacitor is included in equivalent circuit of transformer?

   a) Transformer of very high VA rating

   b) Transformer with very high frequency operation

   c) Transformer with less VA

   d) Never

47. The size of a transformer core will depend on _____

   a) frequency

   b) area of the core

   c) flux density of the core material

   d) frequency and area of the core

48. A single phase transformer has specifications as 250 KVA, 11000 V/415 V, 50 Hz. What are the values of primary and secondary currents?

   a) Primary current = 602.4A, Secondary current = 22.7A

   b) Secondary current = 202.7A, Primary current = 602.4A

   c) Primary current = 22.7A, Secondary current = 602.4A

   d) Primary current = 11.35A, Secondary current = 301.2A

49. A 25 KVA transformer is constructed to a turns ratio of N1/N2 = 10. The impedance of primary winding is 3+j5 ohms and of secondary winding is 0.5+j0.8 ohms. What will be the impedance of transformer when referred to primary?

   a) 53j + 85 ohms   c) 3.5 + 5.8j ohms

   b) 53 + 85j ohms   d) Can't be calculated

50. What is the no-load current drawn by transformer?

   a) 0.2 to 0.5 per cent   c) 12 to 15 per cent

   b) 2 to 5 per cent   d) 20 to 30 per cent

51. Purpose of no-load test on a transformer is _____

   a) Copper loss   **c) Magnetising current and loss**

   b) Magnetising current   d) Efficiency of the transformer

52. No-load current in a transformer _____

   a) Lags behind the voltage by about 75°   c) Lags behind the voltage by about 15°

   b) Leads the voltage by about 75°   d) Leads the voltage by about 15°

53. Which of the following statement is true for no-load current of the transformer?

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a) has high magnitude and low power factor

b) has high magnitude and high power factor

c) has small magnitude and high power factor

d) has small magnitude and low power factor

54. In no-load test we keep secondary terminals _____

a) Shorted   **c) Open**

b) Shorted via fixed resistor   d) Shorted via variable resistors

55. Maximum value of flux established in a transformer on load is equal to _____

a) $E_1/ (4.44*f*N_1)$ c) $E_2/ (4.44*f*N_1)$

b) $E_1/ (4.44*f*N_2)$ d) Cannot define

56. Induced emf in the primary of transformer is equal to terminal voltage applied at primary.

a) True   b) False

57. For a linear B-H relationship, which option is correct?

a) The exciting current is equal to core loss current

b) The exciting current is equal to magnetizing current

c) The exciting current is equal to de-magnetizing current

d) The exciting current is equal to cross-magnetizing current

58. Third harmonic current in transformer at no-load is _____

a) 3% of exciting current   c) 25% of exciting current

b) 10% of exciting current   **d) 35% of exciting current**

59. Ii in no-load test is responsible for _____

a) Production of flux   **c) Active power drawn from**

b) Reactive power drawn from   **the supply**

the supply   d) No significance

60. The parallel circuit model is drawn because _____

a) Conductance Gi accounts for core-loss current

b) Inductive susceptance Bm accounts for magnetizing current

c) Gi for core – loss current and Bm for magnetizing current

d) Cannot say

61. There is only one magnetic flux path in the circuit. The transformer is definitely _____

a) Core type   c) Can be any of the above

b) Shell type   d) Depends on other parameters

62. Which of the following is correct statement?

a) Core type transformer has more output than shell type

b) Core type transformer has higher efficiency compare to shell type

c) Core type transformer has lower efficiency than shell type

d) Can't predict

63. Core type transformer is with _____

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a) Large size   c) High voltage
b) Small size   d) Everywhere

4. THREE PHASE TRANSFORMER

Position in Question Paper   **Total Marks-19**

  Q.2. a) 4-Marks.
       b) 4-Mark.
  Q.3. a) 4-Marks.
       b) 4-Marks.
  Q.6. a) 6-Marks.

Descriptive Question

1. State any two advantages of three phase transformer over bank of single phase transformers.

2. State conditions for parallel operation of 3-phase transformer.

3. State the types of cooling used in distribution transformers.

4. State advantages of parallel operation of transformer.

5. List any four parts of 3 phase transformer and state function of each part.

6. Distinguish between distribution transformer and power transformer on the basis of connection, rating, cost and maintenance.

7. State the criteria for selection of distribution transformer as per IS 10028 (part 1) : 1985

8. Why phasing out test and polarity test are carried out on 3-phase transformer?

9. Explain why all day efficiency of distribution transformer is a more reasonable basis for comparison than ordinary efficiency.

10. What is the aim of conducting phasing out test on 3 phase transformer?

MCQ Question

(Total number of Question=Marks*3=19*3=57)

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

1. Which type of winding is used in 3-phase shell-type transformer?
   a) Circular type   c) Cylindrical type
   b) Sandwich type   d) Rectangular type
2. 3-phase transformers compare to 1-phase transformers _____
   a) More economical   c) Easy to construct
   b) Easy in construction   d) Easy to handle

3. How 3-phase transformers are constructed?
   a) A bank of 3 single phase transformers
   b) A single 3-phase transformer with the primary and secondary of each phase wound on three legs of a common core
   c) Single 3-phase transformer or a bank of 3 1-phase transformers
   d) By different method

4. Three phase transformer compare to a bank of 3 single phase transformers is _____

   a) Cheaper   c) More in space
   b) Costlier   d) Can't be determined

5. In mines we use _____
   a) a single unit of 3-phase   c) use of 3-phase transformer is
   transformer   avoided
   b) a bank of 3 single phase   d) a single unit or a bank
   transformers

6. In three phase bank phases are _____
   a) the phases are electrically not connected and magnetically independent
   b) the phases are electrically not connected and magnetically dependent
   c) the phases are electrically connected and magnetically independent
   d) the phases are electrically connected and magnetically dependent

7. Where the tappings are provided in a transformer?
   a) At the phase end of LV side
   b) At the phase end of HV side
   c) At the neutral side end of the HV side
   d) At the middle of HV side

8. Tappings are on _____
   a) LV side of a transformer   c) Not on any side
   b) HV side of transformer   d) On both sides

9. In core type 3-phase transformer flux path chooses how many paths to return?
   a) 2   c) 3
   b) Single   d) Many

10. Why shell type 3-phase transformer is used in large power transforming applications?
    a) Can be made with more height
    b) Can be made with less height
    c) More height and less height flexibility
    d) Due to other reasons

11. A three-phase transformer generally has the three magnetic circuits interlaced.
    a) True   **b) False**

12. For very high voltage transformers which connection is cheaper on primary side?

a) Star

b) Delta

c) Open delta

d) Can be star/ delta/ open delta

13. In which of the circuit given positive and negative sequence currents will flow in primary?

a) Star/delta

b) Star/star

c) Open delta/delta

d) Delta/delta

14. When star/star connection is used?

a) Small HV

b) Small LV

c) High HV

d) High LV

15. When delta/delta connection is used?

a) Small HV

b) Small LV

c) High HV

d) High LV

16. For using as a step-up transformer which connection is used?

a) Star/star

b) Delta/delta

c) Delta/star

d) Star/delta

17. At distribution level transformer with which connection is used?

a) Star/star

b) Delta/delta

c) Delta/star

d) Star/delta

18. Third-harmonic currents have phase difference of _____

a) 0^0

b) 90^0

c) 180^0

d) 27^0

19. Core flux in the transformer is _____

a) sinusoidal

b) flat-topped

c) square wave

d) triangular

20. In delta/delta connection flux is almost _____

a) sinusoidal

b) flat-topped

c) triangular

d) square wave

21. Apart from connection which of the following is different in star/delta or delta/star compare to delta/delta?

a) Flux is flat-topped

b) Impedance offered to third-harmonic currents in delta is less

c) Impedance offered to third-harmonic currents in delta is constant

d) Impedance offered to third-harmonic currents in delta is more

22. In star/star connection the voltage can be correctly expressed as _____

a) $e_{aN} = e_a \sin 2\omega t + e_{a3} \sin 3\omega t$

b) $e_{aN} = e_a \sin \omega t + e_{a3} \sin 3\omega t$

c) $e_{aN} = e_a \sin 3\omega t + e_{a3} \sin 3\omega t$

d) $e_{aN} = e_a \sin 6\omega t + e_{a3} \sin 3\omega t$

23. Rate of change of voltage in star/star connection is _____

a) ω

b) 2ω

c) 3ω

d) Can't determine

23. Voltage at the neutral point oscillates at frequency of 2ω, this phenomenon is called as _____

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a) **oscillating neutral**

b) doubling voltage

c) doubling current

d) doubling neutral

24. When does star/star transformers work satisfactorily?

    a) Load is unbalanced only

    b) Load is balanced only

    c) On balanced as well as

    unbalanced loads

    d) Independent of load type

25. When does delta/star transformer work satisfactorily?

    a) Load is balanced only

    b) Load is unbalanced only

    c) On balanced as well as unbalanced loads

    d) Independent of load type

26. Scott connections are used in _____

    a) three-phase to single phase transformation

    b) three-phase to two-phase transformation

    c) single phase to three-phase transformation

    d) all phase transformations

27. In a three-phase star – delta transformer, what is the angle difference between primary and secondary phase voltages?

    a) Delta side leads by 300

    b) Delta side lags by 300

    c) Star side leads by 300

    d) Star side lags by 300

28. Which can be also called as 00 /1800 connection?

    a) Star/star

    b) Direct star

    c) Delta/star

    d) Star/delta

29. What is the ratio of transformation of star/star connection?

    a) Phase transformation x:1, line transformation x:1

    b) Phase transformation x:1, line transformation 2x:1

    c) Phase transformation x:1, line transformation x/3:1

    d) Can't say

30. Delta/delta connection is also called as _____

    a) 00-connection

    b) 900-connection

    c) 1800-connection

    d) 00/1800-connection

31. What is the ratio of transformation of delta/delta connection?

    a) Phase transformation x:1, line transformation x:1

    b) Phase transformation x:1, line transformation 2x:1

    c) Phase transformation x:1, line transformation x/3:1

    d) Can't determine

32. Open delta connection has VA rating of _____

    a) $\sqrt{3}$ times delta/delta VA rating

    b) 1/$\sqrt{3}$ times delta/delta VA rating

    c) 3 times delta/delta VA rating

    d) 1/3 times delta/delta VA rating

33. Star/delta connection is also called as _____

a) 300-connection   c) -300-connection

b) 00-connection   **d) 300/-300-connection**

34. What is the ratio of transformation of star/delta connection?

   a) Phase transformation x:1, line transformation x:1

   b) Phase transformation x:1, line transformation √3x:1

   c) Phase transformation x:1, line transformation 3x:1

   d) Can't determine with information available

35. x/√3:1 ratio is obtained in _____

   a) Star/delta   c) Delta/delta

   b) Delta/star   d) Star/star

36. Which both connections have the same line transformation ratios?

   a) Star/star and delta/delta

   b) Star/delta and delta/star

   c) Star/zig-zag star and delta/zig-zag star

   d) Star/star, delta/delta and star/delta, delta/star

37. In three-phase transformer, the harmonic fluxes are suppressed because of _____

   a) high reluctance path   c) any reluctance paths

   b) low reluctance path   d) independent on reluctance path

38. Suppressing of harmonic fluxes becomes more prominent in _____

   a) fifth harmonic currents   c) fourth harmonic currents

   b) third harmonic currents   d) second harmonic currents

39. To reduce effect of 5th harmonic current _____

   a) separate path must be provided   c) add a resistor in series

        d) add a resistor in parallel

   b) no need of separate path

40. For performing back to back test on 3-phase transformer, transformers should be _____

   a) non-identical

   b) identical

   c) they can be identical or non-identical

   d) they should not be identical nor non-identical

41. In back to back test two secondaries are connected _____

   a) in proper phase sequence

   b) in phase opposition

   c) in proper phase sequence and with phase opposition

   d) in opposite phase sequence

42. Auxiliary transformer is not needed in the back to back test.

   a) True   **b) False**

43. Where the auxiliary transformers are connected in back to back test of 3-phase transformer?

a) Primaries
b) Secondaries
c) In the middle
d) Can be connected to primaries or secondaries as well

44. Auxiliary transformer connected to delta/delta transformer is of the type _____

a) single phase transformer   c) two-phase transformers
b) three-phase transformer   d) can be of any type

45. If one of the transformers is removed from the bank of only delta-delta, then it will behave as power delivery transformer of _____
a) 58%   c) 45%
b) 78%   d) 100%

46. Three units of single phase transformers and one single three-phase transformer_____
a) will be same for one rating   c) may be same
b) can never be made same   d) depends on other factors

47. A V-V connected transformer can be connected in parallel to delta-delta connected transformer
but not to _____
a) delta-star   c) star-V
b) star-delta   d) star-delta and star-V both

48. Which type of winding is used in 3-phase shell-type transformer?
a) Circular type   c) Cylindrical type
b) Sandwich type   d) Rectangular type

49. 3-phase transformers compare to 1-phase transformers _____
a) More economical   c) Easy to construct
b) Easy in construction   d) Easy to handle

50. How 3-phase transformers are constructed?
a) A bank of 3 single phase transformers
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51. Three phase transformer compare to a bank of 3 single phase transformers is _____
a) Cheaper   c) More in space
b) Costlier   d) Can't be determined

52. In mines we use _____
a) a single unit of 3-phase transformer
b) a bank of 3 single phase transformers
c) use of 3-phase transformer is avoided
d) a single unit or a bank

53. In three phase bank phases are _____
   a) the phases are electrically not connected and magnetically independent
   b) the phases are electrically not connected and magnetically dependent
   c) the phases are electrically connected and magnetically independent
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56. In core type 3-phase transformer flux path chooses how many paths to return?
   a) 2   c) 3
   b) Single   d) Many

57. Why shell type 3-phase transformer is used in large power transforming applications?
   a) Can be made with more height
   b) Can be made with less height
   c) More height and less height flexibility
   d) Due to other reasons

5. SPECIAL PURPOSE TRANSFORMER

Position in Question Paper   **Total Marks-10**
   Q.2. a) 4-Marks.
       b) 4-Mark.
   Q.3. a) 4-Marks.

Descriptive Question

1. Draw a neat circuit diagram of connection of C.T. and P.T. in the power circuit.

2. Describe the features of isolation transformer.
3. List the advantages of instrument transformers.
4. Describe working of welding transformer.
5. Describe the method of converting three phase to two phase transformer by neat diagram.

6. Describe working of isolation transformer.

7. List any four advantages of 1 f Autotransformer.

8. Draw circuit diagram of connected CT and PT in a 1 phase circuit.
9. List special features of welding transformer.
10. Explain with circuit diagram the use of CT and PT for measurement of high current and high voltage.

MCQ Question

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

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

1. Where is field winding mounted in a DC machine?
   a) Stator   c) Absent
   b) Rotor   d) Anywhere on stator or rotor
2. What are the materials used for brushes in dc machines?
   a) Iron   c) Aluminum
   b) Carbon   d) Steel
3. Function of yoke is to provide the return path for magnetic flux.
   a) True   b) false
4. The angle (electrical) made by brushes with axes of adjoining filed poles is
_____
   a) 450   **c) 900**
   b) 1800   d) 300

5. In a DC machine, rectification process is carried out in order to get unidirectional output (DC). This rectification process is carried out by _____

a) Half wave rectifier

b) Full wave rectifier

c) Mechanical rectification

d) Centre tapped rectifier

6. Which of the following part is used in construction of DC machine but not in AC machine?

a) Armature Winding

b) Field winding

c) Commutator

d) Shaft

7. In a DC machine fractional pitch winding is used to _____

a) To improve cooling

b) To reduce sparking

c) To reduce copper losses

d) To increase generated EMF

8. In normal dc machines operating at full-load conditions, the most powerful electromagnet is _____

a) Field winding

b) Interpole Winding

c) Interpole and compensating winding together

d) Armature winding

9. If a DC motor is connected to AC supply what will happen then?

a) Not run

b) Burn

c) Run at normal speed

d) Run at extremely low speed

10. The armature of DC motor is laminated to _____

a) To reduce mass

b) To reduce hysteresis loss

c) To reduce eddy current loss

d) To reduce inductance

11. Armature winding is mounted on a _____

a) Stator

b) Rotor

c) Can be mounted anywhere on stator or rotor

d) Not required

12. In a DC machine, how coil-side emf varies towards the outer side of poles?

a) Decreases

b) Remains same

c) Increases

d) First increases the decreases

13. Commutator performs rectification so that output of the machine is unidirectional.

a) True

b) False

14. What is the difference of DC voltages in the adjoining Brushes?

a) Depends on the Shaft speed

b) Zero

c) Non-zero

d) Depends on the various other parameters

15. What is the effect of armature coils at points where brushes are located?

a) Induces positive emf

b) Induces negative emf

c) Induces zero emf

d) Depends on the speed of rotor

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16. For using as a step-up transformer which connection is used?
    a) Star/star   **c) Delta/star**
    b) Delta/delta   d) Star/delta

17. At distribution level transformer with which connection is used?
    a) Star/star   **c) Delta/star**
    b) Delta/delta   d) Star/delta

18. Third-harmonic currents have phase difference of _____
    a) 0^0   c) 180^0
    b) 90^0 d) 27^0

19. Core flux in the transformer is _____
    a) sinusoidal   c) square wave
    b) flat-topped   d) triangular

20. In delta/delta connection flux is almost _____
    a) sinusoidal   c) triangular
    b) flat-topped   d) square wave

21. Apart from connection which of the following is different in star/delta or delta/star compare to delta/delta?
    a) Flux is flat-topped
    b) Impedance offered to third-harmonic currents in delta is less
    c) Impedance offered to third-harmonic currents in delta is constant
    d) Impedance offered to third-harmonic currents in delta is more

22. In star/star connection the voltage can be correctly expressed as _____
    a) $e_{aN} = e_a \sin 2\omega t + e_{a3} \sin 3\omega t$ c) $e_{aN} = e_a \sin 3\omega t + e_{a3}\sin 3\omega t$
    b) $e_{aN} = e_a \sin \omega t + e_{a3}\sin 3\omega t$ d) $e_{aN} = e_a \sin 6\omega t + e_{a3}\sin 3\omega t$

23. Rate of change of voltage in star/star connection is _____
    a) ω c) 3ω
    b) 2ω   d) Can't determine

24. Voltage at the neutral point oscillates at frequency of 2ω, this phenomenon is called as _____
    a) oscillating neutral   c) doubling current
    b) doubling voltage   d) doubling neutral

25. When does delta/star transformer work satisfactorily?
    a) Load is balanced only
    b) Load is unbalanced only
    c) On balanced as well as unbalanced loads
    d) Independent of load type

26. Scott connections are used in _____
    a) three-phase to single phase transformation
    b) three-phase to two-phase transformation
    c) single phase to three-phase transformation
    d) all phase transformations

27. In a three-phase star – delta transformer, what is the angle difference between primary and secondary phase voltages?

    a) Delta side leads by 300   c) Star side leads by 300

    b) Delta side lags by 300   d) Star side lags by 300

28. Which can be also called as 00 /1800 connection?

    a) Star/star   c) Delta/star

    b) Direct star   d) Star/delta

29. What is the ratio of transformation of star/star connection?

    a) Phase transformation x:1, line transformation x:1

    b) Phase transformation x:1, line transformation 2x:1

    c) Phase transformation x:1, line transformation x/3:1

    d) Can't say

30. Delta/delta connection is also called as _____

    a) 00-connection   c) 1800-connection

    b) 900-connection   **d) 00/1800-connection**