



Maratha Vidya Prasarak Samaj's

Rajarshi Shahu Maharaj Polytechnic, Nashik

Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.

Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.

*Subject: - Maintenance of Electrical
Equipment (22625)*



SYLLABUS

Chapter No.	Name of chapter	Marks Without Option
1	Safety and prevention of accidents	10
2	Maintenance schedules	10
3	Testing and maintenance of rotating machines	20
4	Testing and troubleshooting of transformer	20
5	Maintenance of electrical machine insulation	10
Total Marks :-		70



BOARD THEORY

PAPER PATTERN

Q.1	Attempt any FIVE	Course Outcome (CO)
	a) Safety and prevention of accidents	CO-625.01
	b) Maintenance schedules	CO-625.02
	c) Maintenance schedules	CO-625.02
	d) Testing and maintenance of rotating machines	CO-625.03
	e) Testing and troubleshooting of transformer	CO-625.04
	f) Testing and troubleshooting of transformer	CO-625.04
	g) Maintenance of electrical machine insulation	CO-625.05
Q.2	Attempt any THREE	
	a) Safety and prevention of accidents	CO-625.01
	b) Maintenance schedules	CO-625.02
	c) Testing and maintenance of rotating machines	CO-625.03
	d) Testing and troubleshooting of transformer	CO-625.04
Q.3	Attempt any THREE	
	a) Safety and prevention of accidents	CO-625.01
	b) Maintenance schedules	CO-625.02
	c) Testing and maintenance of rotating machines	CO-625.03
	d) Testing and troubleshooting of transformer	CO-625.04
Q.4	Attempt any THREE	
	a) Safety and prevention of accidents	CO-625.01
	b) Testing and maintenance of rotating machines	CO-625.03
	c) Testing and troubleshooting of transformer	CO-625.04
	d) Maintenance of electrical machine insulation	CO-625.05
	e) Testing and troubleshooting of transformer	CO-625.04
Q.5	Attempt any TWO	
	a) Testing and maintenance of rotating machines	CO-625.03
	b) Testing and troubleshooting of transformer	CO-625.04
	c) Maintenance of electrical machine insulation	CO-625.05
Q.6	Attempt any TWO	
	a) Testing and maintenance of rotating machines	CO-625.03
	b) Testing and troubleshooting of transformer	CO-625.04
	c) Maintenance of electrical machine insulation	CO-625.05



CLASS TEST - I PAPER PATTERN

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
1	Safety and prevention of accidents	CO-625.01
2	Maintenance schedules	CO-625.02

Q.1	Attempt any FOUR	4*2=8Marks	Course Outcome (CO)
a)	Safety and prevention of accidents		CO-625.01
b)	Maintenance schedules		CO-625.02
c)	Safety and prevention of accidents		CO-625.01
d)	Safety and prevention of accidents		CO-625.01
e)	Maintenance schedules		CO-625.02
f)	Maintenance schedules		CO-625.02
Q.2	Attempt any THREE	3*4=12 Marks	
a)	Maintenance schedules		CO-625.02
b)	Maintenance schedules		CO-625.02
c)	Safety and prevention of accidents		CO-625.01
d)	Safety and prevention of accidents		CO-625.01
e)	Maintenance schedules		CO-625.02

CLASS TEST - II PAPER PATTERN

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
3	Testing and maintenance of rotating machines	CO-625.03
4	Testing and troubleshooting of transformer	CO-625.04
5	Maintenance of electrical machine insulation	CO-625.05

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Testing and maintenance of rotating machines	CO-625.03
b)	Testing and troubleshooting of transformer	CO-625.04
c)	Maintenance of electrical machine insulation	CO-625.05
d)	Testing and troubleshooting of transformer	CO-625.04
e)	Maintenance of electrical machine insulation	CO-625.05
f)	Maintenance of electrical machine insulation	CO-625.05
Q.2	Attempt any THREE 3*4=12 Marks	
a)	Testing and maintenance of rotating machines	CO-625.03
b)	Testing and troubleshooting of transformer	CO-625.04
c)	Testing and troubleshooting of transformer	CO-625.04
d)	Maintenance of electrical machine insulation	CO-625.05
e)	Maintenance of electrical machine insulation	CO-625.05



COURSE

OUTCOME (CO)

COURSE: - MAINTENANCE OF ELECTRICAL EQUIPMENT (22625)

PROGRAMME: - ELECTRICAL ENGINEERING.

CO. NO	Course Outcome
CO-625.01	Follow safe practices to prevent accident while using electrical equipment.
CO-625.02	Prepare maintenance schedule for electrical equipment.
CO-625.03	Maintain rotating electrical machines.
CO-625.04	Maintain single phase and three phase transformers.
CO-625.05	Maintain insulation systems of electrical equipment.



1. SAFETY AND PREVENTION OF ACCIDENTS

Position in Question Paper

Total Marks-10

Q.1. a) 2-Marks.

Q.2. a) 4-Mark.

Q.3. a) 4-Marks.

Descriptive Question

1. Draw any two safety symbols used in industry and also write what the symbols stand for.
2. List out any four precautions to be taken to avoid fire caused by electrical reasons.
3. State the type of fire extinguisher used on live electrical circuit.
4. Why is CCl₄ not recommended to be used as a fire extinguisher in less ventilated spaces?
5. Describe the operation of fire extinguisher briefly.
6. State and explain any four circumstances under which the competent authority should not issue the 'permit to work' card?
7. Discuss in detail any four factors affecting preventive maintenance schedule.

MCQ Question

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

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

1. If a cream coloured band is located over the fire extinguisher, it indicates that the fire extinguisher is which of the following?

a)Water

b)Dry Powder

c)Foam

d)Carbon Dioxide

2. Which type of fire extinguish do you use to fight an electrical fire if a carbon dioxide extinguisher is unavailable?

a)Water

b)Wet Chemical

c)Foam

d)Dry Powder

3. A water fire should be on fires started by which of the following materials?

a)Materials such as gasoline that are highly flammable

b)Materials made up of combustible metals

c)Fires caused by electricity

d)Materials such as paper, textiles, wood and other solid materials.



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4. _____ fire extinguishers are specifically designed in order to tackle a class F fire.
- a) Carbon Dioxide
b) **Wet Chemical**
c) Foam
d) Water
5. If there is a black coloured band above the fire extinguisher; what does the colour of the band tell you?
- a) That this extinguisher is a wet chemical fire extinguisher
b) **That this extinguisher is a carbon dioxide fire extinguisher**
c) That this extinguisher is broken and should not be used
d) That this extinguisher contains flammable materials
6. Titanium and aluminium materials can be classified under which of the following categories?
- a) Category A
b) Category C
c) **Category D**
d) Category B
7. Which of the following colours allows you to identify a foam fire extinguisher?
- a) Blue
b) Red
c) Yellow
d) **Cream**
8. Which of the following colours can be found in a band above a wet chemical fire extinguisher?
- a) **Yellow**
b) Cream
c) Blue
d) Red
9. You should avoid using _____ fire extinguishers when extinguishing a fire in a confined space.
- a) **Dry Powder Fire Extinguishers**
b) Water Fire Extinguishers
c) Foam Fire Extinguishers
d) Wet Chemical Fire Extinguishers
10. Which of the following fire extinguishers would you use in order to extinguish an electrical fire?
- a) Water Fire Extinguisher
b) Foam Fire Extinguisher
c) Wet Chemical Fire Extinguisher
d) **Carbon Dioxide Fire Extinguisher**
11. While you are using a fire extinguisher containing carbon dioxide; what happens to the nozzle?
- a) It becomes extremely hot
b) It becomes warm
c) It becomes slightly cold
d) **It becomes extremely cold**
12. A dry powder fire extinguisher can be found with a _____ band above it.
- a) Yellow
b) **Blue**
c) Black
d) Cream
13. Which of the following types of fire extinguishers have a yellow band above it?
- a) Foam
b) Water
c) **Wet Chemical**
d) Carbon Dioxide
14. Class A materials do not include which of the following?
- a) Wood Materials
b) **Propane Materials**
c) Plastic Materials
d) Paper Materials
15. A dry powder fire extinguisher has a _____ band located above it.
- a) Cream
b) **Blue**



- a) To estimate the risk
 - b) To calculate carcinogenic exposure
 - c) To know the probable source and causes of contamination on site**
 - d) For determination of remedial actions
26. What is the main objective of risk assessment?
- a) To evaluate hazard and minimize the risks**
 - b) Remediation of contaminated sites
 - c) Hazard management
 - d) To know source of pollutants
27. What is the first stage of risk assessment?
- a) Exposure assessment
 - b) Hazard identification**
 - c) Toxicity study
 - d) Risk characterization
28. An incident can be called hazardous only when?
- a) Stressor has the potential to cause harm to humans and ecological systems**
 - b) Poses threat to surrounding
 - c) Monitoring is failed
 - d) Outburst of chemicals
29. The purpose of risk management is to identify potential problems before they occur so that risk-handling activities may be planned.
- a) False
 - b) True**
30. Hazard identification mainly focus on _____
- a) Chemical source and concentration**
 - b) Chemical exposure
 - c) Chemical analysis
 - d) Chemical pathway



2. MAINTENANCE SCHEDULES

Position in Question Paper

Total Marks-10

Q.1. b) 2-Marks.

Q.2. b) 4-Mark.

Q.3. b) 4-Marks.

Descriptive Question

1. State the types of maintenance to be undertaken for electrical machines.
2. Explain in brief the purpose of any two types of maintenance.
3. Discuss in detail any four factors affecting preventive maintenance schedule.
4. State any one application of the following tools:
 - a. Earth tester (ii) Megger (iii) Dial test indicator (iv) Spirit level.
5. State the importance of Electrical maintenance.
6. What are the external causes for the abnormal operation of electrical equipment's?
7. What safety precautions are necessary when working with electrical installations?
8. List the Mechanical, Magnetic and electrical faults in the electrical machines.

MCQ Question

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

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

1. In how many types transformers can be used with relay protection system?
 - a) 5
 - b) 10
 - c) 2**
 - d) Many
2. Ingress of air into the oil tank can be avoided by using _____
 - a) relays**
 - b) plastic coatings
 - c) metal coatings
 - d) fuses
3. When tripping of the transformer from the main circuit is required?
 - a) Local overheating
 - b) Short-circuited core laminations
 - c) Core-bolt insulation failure
 - d) Puncture of bushings**
4. Transformers used generally don't belong to type "construct and forget."
 - a) True
 - b) False**
5. Which of the following is the reason relating to the maintenance while operation?
 - a) To obtain the maximum practicable operating efficiency
 - b) To obtain optimum life



- c) To minimise the risk of premature and unexpected failure
d) Maximum efficiency, life, minimum temperature
6. Stored oil should be checked continuously for _____
a) impurities in the oil
b) oil levels
c) **oil moisture content**
d) oil reactions
7. Dissolved gas contents are need to be observed because _____
a) dissolved oxygen
b) dissolved gases from outside air
c) **dissolved gases from arcs occurring in the transformer**
d) all dissolved gases
8. How many places of arcing can possible?
a) **4 places**
b) 5 places
c) 8 places
d) 2 places
9. What is the advantage of gas-monitor?
a) Time delay
b) **Alarms at presence of a particular gas**
c) Less efficiency
d) Requires high power
10. For high reliability of transformer action, how many fundamental checks should be done?
a) 2
b) **3**
c) 4
d) Can't tell
11. Circle diagram of an induction motor is graphical representation of _____
a) **its equivalent circuit**
b) its rotor equivalent
c) its stator equivalent
d) its stationary equivalent circuit
12. Circle diagram depicts the relation between _____
a) **stator current and the slip variation**
b) rotor current and stator current
c) slip variation and the power factor
d) slip variation and the losses of the machine
13. A 10kW, 50 Hz, 3-phase induction motor develops the rated torque at 1440rpm. If the load torque is reduced to half, then the motor speed is?
a) **1470rpm**
b) 1410rpm
c) 1400rpm
d) 1444rpm
14. A 10kW, 50 Hz, 3-phase induction motor develops the rated torque at 1440rpm. If the load torque is reduced to half, then the power output that can now be obtained is?
a) **5 kW**
b) 5.3 KW
c) 4.6 kW
d) 8 k
15. A three-phase slip ring induction motor is fed from the rotor side with the stator winding short-circuited. The frequency of the current flowing in the short-circuited stator is



- a) Slip frequency
- b) Supply frequency
- c) The frequency corresponding to rotor speed
- d) Zero

16. An 8-pole, 3-phase, 50 Hz induction motor is operating at a speed of 720 rpm. The frequency of the rotor current of the motor in Hz is _____

- a) 2
- b) 4
- c) 3
- d) 1

17. Calculate the phase angle of the sinusoidal waveform $z(t)=78\sin(456\pi t+2\pi\div 78)$.

- a) $\pi\div 39$
- b) $2\pi\div 5$
- c) $\pi\div 74$
- d) $2\pi\div 4$

18. Calculate the moment of inertia of the disc having a mass of 54 kg and diameter of 91 cm.

- a) **5.512 kgm²**
- b) 5.589 kgm²
- c) 5.487 kgm²
- d) 5.018 kgm²

19. Calculate the moment of inertia of the thin spherical shell having a mass of 73 kg and diameter of 36 cm.

- a) **1.56 kgm²**
- b) 1.47 kgm²
- c) 1.38 kgm²
- d) 1.48 kgm²

20. A 50 Hz, 4poles, a single phase induction motor is rotating in the clockwise direction at a speed of 1425 rpm. The slip of motor in the direction of rotation & opposite direction of the motor will be respectively.

- a) 0.05, 0.95
- b) 0.04, 1.96
- c) **0.05, 1.95**
- d) 0.05, 0.02

21. The frame of an induction motor is made of _____

- a) Aluminum
- b) Silicon steel
- c) **Cast iron**
- d) Stainless steel

22. The slope of the V-I curve is 5°. Calculate the value of resistance. Assume the relationship between voltage and current is a straight line.

- a) .3254 Ω
- b) .3608 Ω
- c) .3543 Ω
- d) **.3443 Ω**

23. In an induction motor, when the number of stator slots is equal to an integral number of rotor slots _____

- a) There may be a discontinuity in torque slip characteristics
- b) A high starting torque will be available
- c) The maximum torque will be high
- d) **The machine may fail to start**

24. A 3-phase induction motor runs at almost 1000 rpm at no load and 950 rpm at full load when supplied with power from a 50 Hz, 3-phase supply. What is the corresponding speed of the rotor field with respect to the rotor?

- a) 30 revolution per minute
- b) 40 revolution per minute
- c) 60 revolution per minute
- d) **50 revolution per minute**

25. Calculate the active power in a 487 H inductor.



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- a) 2482 W
b) 1545 W
- c) 4565 W
d) 0 W
26. Calculate the active power in a 788ω resistor with 178 A current flowing through it.
a) **24.96 MW**
b) 24.44 MW
c) 24.12 MW
d) 26.18 MW
27. Increased transformer insulation stresses are due to _____
a) third harmonic currents
b) **third harmonic voltages**
c) fifth harmonic currents
d) fifth harmonic voltages
28. Overheating of transformer windings and of load are due to _____
a) **third harmonic currents**
b) third harmonic voltages
c) fifth harmonic currents
d) fifth harmonic voltages
29. Operation other than rated power will lead to _____
a) **increase in temperature**
b) decrease in temperature
c) short circuit
d) open circuit
30. Time required for an insulation to reach at end is given by _____
a) Kirchhoff
b) Joule
c) Ampere
d) **Arrhenius**

3. TESTING AND MAINTENANCE OF ROTATING MACHINES

Position in Question Paper

Total Marks-20

Q.1. c) 2-Marks.

d) 2-Marks.

Q.2. c) 4-Mark.

Q.3. c) 4-Marks.

Q.4. b) 4-Marks.

Q.5. b) 6-Marks.

Descriptive Question

1. A 3 phase 500 V, squirrel cage IM gave the following test results:
2. No load test: 500 V, 4 A, 750 W
3. Blocked rotor test: 100 V, 16 A, 800 W
4. Draw the circle diagram and determine:
 - (i) Efficiency
 - (ii) p. f. when motor is supplying 25 HP.
5. 2. Write the correct procedure of conducting (i) High voltage test (ii) Quiet running test on a single phase induction motor.
6. 3. Prepare the troubleshooting chart of three phase induction motor. (any 4 faults)
7. 4. Draw and explain the circuit diagram to perform no load and S.C. tests on 3phase induction motor.
8. 5. State four possible causes for each of the following trouble of a 3 phase slip ring induction motor.
 - (i) Motor runs hot
 - (ii) Motor runs slow
 - (iii) Motor fails to start
 - (iv) Excessive sparking between brushes and slip rings.
9. 6. Draw the vector diagram of three phase induction motor and justify that three phase induction motor is a generalized transformer.
10. State any four requirements of foundation of rotating machines.
11. A brake test for a dc motor the effective load on the brake pulley is 265 N. The effective diameter of the pulley is 650 mm. The speed is 750 rpm. The motor takes 37 Amps at 215 volts. Calculate the output power and the efficiency at this load.



- 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
 - b) 35 kV**
 - c) 100 kV
 - d) 330 kV
12. Which of the following is not a part of transformer installation?
- a) Conservator
 - b) Breather
 - c) Buchholz relay
 - d) Exciter**
13. The insulating material that can withstand the highest temperature safely is _____
- a) Cellulose
 - b) Asbestos
 - c) Mica**
 - d) Glass fibre
14. The part of a transformer which is visible from outside _____
- a) Bushings**
 - b) Core
 - c) Primary winding
 - 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 flux**
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) Every where
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) Will be twice
b) Will be halved
36. When does transformer breath in?
a) load on it increases
b) load on it decreases
c) load remains constant
d) cannot be determined
37. A transformer transforms _____
a) voltage
b) current
c) power
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
b) Secondary side
c) Low voltage 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
b) Zero resistance
c) Some finite resistance
d) Cannot say
43. Both resistances and leakage reactances of the transformer windings are _____
a) Series effects
b) Parallel effects
c) Series-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



a) 0.2 to 0.5 per cent

b) 2 to 5 per cent

c) 12 to 15 per cent

d) 20 to 30 per cent

51. Which type of slots are used in the construction of large size and small size induction motors respectively?

a) open slots and semiclosed slots

b) semiclosed slots and open slots

c) open slots and open slots

d) semiclosed slots and semiclosed slots

52. In which of the following applications, wound rotor type of induction motor is used?

a) where the driven load requires speed control

b) where high starting torque is required

c) when external resistance is to be inserted

d) any of the mentioned

53. For an induction motor, Which of the following statements are correct?

(i) squirrel cage type is simpler and more economical in construction

(ii) wound rotor type requires less maintenance

(iii) squirrel cage type is more rugged and requires less maintenance

(iv) no external resistance can be inserted in the rotor circuit of squirrel cage induction motor

(v) no external resistance can be inserted in the rotor circuit of a wound rotor induction motor

a) (ii), (v), (iii)

b) (ii), (iii), (v)

c) (i), (iii), (iv)

d) (i), (ii), (iv)

54. What are the advantages of providing the field winding on rotor and armature winding on the stator?

a) more economical

b) more efficient

c) efficient cooling

d) all of the mentioned

55. The stator frame and end covers in synchronous and induction machines are designed to

a) carry the magnetic flux

b) to serve as a mechanical support

c) to provide cooling or to carry induced EMF

d) any of the mentioned

56. What is the advantage of connecting two coils in parallel?

a) reduce the amount of copper required

b) increase the current per parallel path to double the value

c) increase the voltage capacity

d) all of the mentioned

57. In a synchronous machine, salient pole construction has been found to suit best for

a) low speed prime movers

b) high speed prime movers

c) medium speed prime movers

d) any of the mentioned

58. What is the equation for frequency of generated EMF?



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a) $f = PN/120 \text{ Hz}$

b) $f = 120/PN \text{ Hz}$

c) $f = P/120 \text{ Hz}$

d) $f = N/120 \text{ Hz}$

59. How many poles should the alternators driven by the oil engines and hydraulic turbine prime movers must have, for better operation?

a) fewer number of poles

b) larger number of poles

c) medium number of poles

d) any of the mentioned

60. Large synchronous machines are constructed with armature winding on the stator because stationary armature winding. Which of the following statements are correct?

(i) can be insulated satisfactorily for higher voltages

(ii) can be cooled more efficiently

(iii) would lead to reduced slip ring losses

(iv) would have no slot harmonics

(v) would have reduced armature reactance

a) (i), (ii), (iii), (iv)

b) (i), (ii), (iii), (v)

c) (i), (ii), (iii), (iv), (v)

d) (i), (ii), (iv), (v)



4. TESTING AND TROUBLESHOOTING OF TRANSFORMER

Position in Question Paper

Total Marks-20

Q.1. e) 2-Marks.

Q.2. d) 4-Mark.

Q.3. d) 4-Marks.

Q.5. c) 6-Marks.

Q.6. c) 6-Marks.

Descriptive Question

1. In an industrial sub-station a distribution transformer of rating 750 kVA, 33/11 kV is available. Prepare a complete maintenance schedule chart for the same as per IS 100 28 (Part-III) – 1981.
2. Describe the procedure for conducting polarity test of a single phase transformer with the necessary circuit diagram.
3. State the meaning of the following terms related to transformer oil:
(i) Viscosity (ii) Fire point (iii) Flash point (iv) Purity
4. Explain the procedure of the test to be undertaken for measuring dielectric strength of transformer oil. Draw the necessary circuit set up for the same.

MCQ Question

(Total number of Question=Marks*3=20*3=60)

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

1. Which type of winding is used in 3-phase shell-type transformer?
a) Circular type
b) Sandwich type
c) Cylindrical type
d) Rectangular type
2. 3-phase transformers compare to 1-phase transformers _____
a) **More economical**
b) Easy in construction
c) Easy to construct
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 transformer c) use of 3-phase transformer is avoided
b) **a bank of 3 single phase transformers** d) a single unit or a bank
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** c) Open delta
b) 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 c) Open delta/delta
b) Star/star **d) Delta/delta**
14. When star/star connection is used?
a) **Small HV** c) High HV
b) Small LV d) High LV
15. When delta/delta connection is used?
a) Small HV c) High HV
b) Small LV **d) High LV**
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°** c) 180°
b) 90° d) 27°
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) $e_{aN} = e_a \sin 6\omega t + e_{a3} \sin 3\omega t$



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- 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
b) 00-connection
c) -300-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 $\sqrt{3}x:1$
c) Phase transformation x:1, line transformation 3x:1
d) Can't determine with information available
35. $x/\sqrt{3}:1$ ratio is obtained in _____
a) Star/delta
b) Delta/star
c) Delta/delta
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
b) low reluctance path
c) any reluctance paths
d) independent on reluctance path
38. Suppressing of harmonic fluxes becomes more prominent in _____
a) fifth harmonic currents
b) third harmonic currents
c) fourth harmonic currents
d) second harmonic currents
39. To reduce effect of 5th harmonic current _____



- 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
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
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**
d) the phases are electrically connected and magnetically dependent
54. 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**
55. Tappings are on _____
a) LV side of a transformer c) Not on any side
b) **HV side of transformer** d) On both sides



56. In core type 3-phase transformer flux path chooses how many paths to return?

- a) **2**
- b) Single
- c) 3
- 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

58. 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

59. 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

60. 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**



5. MAINTENANCE OF ELECTRICAL MACHINE INSULATION

Position in Question Paper

Total Marks-10

Q.1. c) 2-Marks.

Q.4. d) 4-Marks.

Q.5. a) 6-Marks.

Descriptive Question

1. Draw the dielectric absorption curve. How is it used for interpreting the Condition of insulation?
2. Explain the method of baring of insulation with internal heat in detail.
3. Draw a neat figure of vacuum impregnation plant and write the stepwise procedure of re varnishing the insulation.
4. State the factors on which life of insulation depends.

MCQ Question

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

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

1. What is the property of insulating materials?
 - a) **Prevents the unwanted flow of current**
 - b) Allows the unwanted flow of current
 - c) Increases the unwanted flow of current
 - d) Decreases the unwanted flow of current
2. In the Transmission and Distribution sector, where should the insulators be placed?
 - a) Between towers and poles
 - b) Between towers and ground
 - c) **Between towers and conductors**
 - d) Between conductors and ground
3. What is the main cause for the failure of overhead line insulators?
 - a) Surges
 - b) **Flashover**
 - c) Arching
 - d) Grounding
4. What happens when some serious phenomenon occurs in the insulators?
 - a) **Puncher is produced in the insulator body**
 - b) Insulator body bulges
 - c) Insulator body bursts
 - d) Insulator body tears apart
5. Insulation Resistance should be high in insulators.



19. For non-polar molecules, there is no absorption or emission in the range of infrared.
a) **True** b) False
20. How does ionic polarisation occur?
a) Splitting of ions
b) Passing magnetic field
c) **Displacement of cations and anions**
d) Never occurs
21. Polar molecules have permanent dipole moments even in the absence of an electric field.
a) False b) **True**
22. Which of the following polarisations is very rapid?
a) **Electronic polarisation** c) Space charge polarisation
b) Ionic polarisation d) Orientation polarization
23. Which of the following is the slowest polarisation method?
a) Ionic polarisation c) Electronic polarisation
b) Orientation polarisation d) **Space charge polarisation**
24. When does a dielectric become a conductor?
a) At avalanche breakdown c) **At dielectric breakdown**
b) At high temperature d) In the presence of magnetic field
25. Which of the following breakdowns occur at a higher temperature?
a) Avalanche breakdown c) Electrochemical breakdown
b) **Thermal breakdown** d) Dielectric breakdown
26. When mobility increases, insulation resistance decreases and dielectric becomes conducting.
a) **True** b) False
27. Which of the following materials exhibit Ferro-electricity?
a) Iron c) Hydrogen
b) Platinum d) **Rochelle salt**
28. Calculate the electronic polarizability of an argon atom whose $\epsilon_r = 1.0024$ at NTP and $N = 2.7 \times 10^{25}$ atoms/m³.
a) 0.0024 Fm² c) 7.87 Fm²
b) **7.87×10^{-40} Fm²** d) 1.0024×10^{-40} Fm²
29. Calculate the dielectric constant of a material which when inserted in parallel condenser of area 10mm × 10mm and distance of separation of 2mm, gives a capacitance of 10⁻⁹ F.
a) 8.854×10^{-12} c) **2259**
b) 100 d) 5354
30. Find the capacitance of layer of Al₂ O₃ that is 0.5μm thick and 2000mm² of square area $\epsilon_r = 8$.
a) 1000μF c) 16μF
b) **0.283μF** d) 2.83μF