

Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13. <u>RSM POLY</u> Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.

Subject: - Maintenance of Electrical Equipment (22625)



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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



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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

			Course
Q.1	Attempt any FOUR	4*2=8Marks	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
1			



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

		Course
0.1	Attempt on FOUD	Outcome
Q.1	Attempt any FOUR 4+2=8Marks	(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 THREE3*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



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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.

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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.

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- 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	gned in order to tackle a class F fire.	
	a)Carbon Dioxide	c)Foam	
	b)Wet Chemical	d)Water	
5.	If there is a black coloured band above the fire	e extinguisher; what does the colour of	f the
ba	nd tell you?	-	
	a)That this extinguisher is a wet chemical fire	extinguisher	
	b)That this extinguisher is a carbon dioxide	e fire extinguisher	
	c)That this extinguisher is broken and should	not be used	
	d)That this extinguisher contains flammable n	naterials	
6.	Titanium and aluminium materials can be class	sified under which of the following	
cat	tegories?		
	a)Category A	c)Category D	
	b)Category C	d)Category B	
7.	Which of the following colours allows you to	identify a foam fire extinguisher?	
	a) Blue	c)Yellow	
	b)Red	d)Cream	
8.	Which of the following colours can be found it	n a band above a wet chemical fire	
ex	tinguisher?		
	a) Yellow	c)Blue	
	b) Cream	d)Red	
9.	You should avoid using	fire extinguishers when extinguishing	g a
fir	e in a confined space.		
	a) Dry Powder Fire Extinguishers	c) Foam Fire Extinguishers	
	b) Water Fire Extinguishers	d) Wet Chemical Fire Extinguishe	rs
1(). Which of the following fire extinguishers we	ould you use in order to extinguish an	
ele	ectrical fire?		
	a) Water Fire Extinguisher	c) Wet Chemical Fire Extinguishe	r
	b) Foam Fire Extinguisher	d)Carbon Dioxide Fire Extingui	sher
11	1. While you are using a fire extinguisher conta	ining to carbon dioxide; what happen	s to
the	e nozzle?		
	a) It becomes extremely hot	c) It becomes slightly cold	
	b) It becomes warm	d) It becomes extremely cold	
12	2.A dry powder fire extinguisher can be found	with a band above	it.
	a) Yellow	c) Black	
	b) Blue	d) Cream	
13	3. Which of the following types of fire extinguis	shers have a yellow band above it?	
	a) Foam	c) Wet Chemical	
	b) Water	d) Carbon Dioxide	
14	4. Class A materials do not include which of the	following?	
	a) Wood Materials	c) Plastic Materials	
	b) Propane Materials	d) Paper Materials	
15	5.A dry powder fire extinguisher has a	band located above it.	
	a) Cream	b) Blue	
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c) Yellow

d) Red

16. The fire assembly point can be best described as:

a) Where the fire extinguishers are stored

b) An area that has a high risk for fires to occur

c) An area where you are required to assemble in the event of a fire

- d) An area you are required to avoid in the event of a fire
- 17. When you see a fire on the worksite, what is the first thing you should do

a) Sound the fire alarm

b) Tell you, manager

- c) Try and put the fire out
- d) Grab your tools and quickly exit the area

18. Which of the following types of materials is responsible for fueling a Class A fire?

- a) Oils that you typically cook with
- b) Flammable liquids

c) Electrical Equipment

d) Wood, plastic, paper, and other kinds of solid materials

19. Where should you go if you hear the fire alarm going off?

a) To the supervisor's office in order to inform him what is happening

b) To the fire assembly point

- c) To the break room to make sure everyone got out
- d) Home, the work day is over

20. Fires that are fueled by ______ require you to use water fire extinguishers in order to fight them.

a) Live electricity

b) Gasoline, kerosene, and other flammable liquids

c) Solid materials; such as wood, paper, and textile

d) Propane, butane, and other flammable gases

21. What is the main purpose of hazard identification?

a) To minimize the effect of a consequence

b) For better risk management

c) To characterize adverse effect of toxins

d) To reduce probability of occurrence

22. The ______ process determines whether exposure to a chemical can increase the incidence of adverse health effect.

a) Hazard identification

c) Toxicity assessment

b) Exposure assessment

- d) Risk characterization

23. Which of the following data is not required for hazard identification? a) Land use

c) Affected population

b) Contaminant levels

- d) Estimation of risk
- 24. Hazard is defined as the probability of suffering harm or loss. a) True **b)** False
- 25. Why does site history have to be considered for hazard identification?

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- 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

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2. MAINTENANCE SCHEDULES

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Total Marks-10

Position in Question Paper 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?

J J I	J 1
a) 5	c) 2
b) 10	d) Many
. Ingress of air into the oil tank can b	be avoided by using
a) relays	c) metal coatings
b) plastic coatings	d) fuses

- 3. When tripping of the transformer from the main circuit is required?
 - a) Local overheating c) Core-bolt insulation failure

d) Puncture of bushings

- b) Short-circuited core laminations 4. Transformers used generally don't belong to type "construct and forget."
 - a) True

2

- 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

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c) To minimise the risk of premature and unexpected failure d) Maximum efficiency, life, minimum temperature 6. Stored oil should be checked continuously for c) oil moisture content a) impurities in the oil b) oil levels 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 c) 8 places b) 5 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? c) 4 a) 2 d) Can't tell **b**) 3 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 c) 1400rpm b) 1410rpm 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 c) 4.6 kW b) 5.3 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 Maratha Vidya Prasarak Samaj's

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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

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

a) π÷39 b) $2\pi \div 5$

d) $2\pi \div 4$

c) π ÷74

c) 3

d) 1

- 18. Calculate the moment of inertia of the disc having a mass of 54 kg and diameter of 91 cm.
 - a) 5.512 kgm^2 b) 5.589 kgm²

c) 5.487 kgm² d) 5.018 kgm^2

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

c) 1.38 kgm² d) 1.48 kgm²

b) 1.47 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

21. The frame of an induction motor is made of

- a) Aluminum
- b) Silicon 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 c) .3543 Ω
- b) .3608 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

c) 60 revolution per minute

b) 40 revolution per minute

- d) 50 revolution per minute

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

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c) 0.05, 1.95 d) 0.05, 0.02

c) Cast iron

d) Stainless steel

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a) 2482 W	c) 4565 W	
b) 1545 W	d) 0 W	
$\frac{1}{10} \frac{1}{10} \frac$	\mathbf{u} , \mathbf{v} \mathbf{v}	
26. Calculate the active power in a 788ω resistor w	1th 1/8 A current flowing through it.	
a) 24.96 MW	c) 24.12 MW	
b) 24.44 MW	d) 26.18 MW	
27. Increased transformer insulation stresses are due	e to	
a) third harmonic currents	c) fifth harmonic currents	
b) third harmonic voltages	d) fifth harmonic voltages	
28. Overheating of transformer windings and of loa	d are due to	
a) third harmonic currents	c) fifth harmonic currents	
b) third harmonic voltages	d) fifth harmonic voltages	
29. Operation other than rated power will lead to		
a) increase in temperature	c) short circuit	
b) decrease in temperature	d) open circuit	
30. Time required for an insulation to reach at end is given by		
a) Kirchhoff	c) Ampere	
b) Joule	d) Arrhenius	

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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.

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MCQ Question

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

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 p	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	5	
d) Cannot be determined		
5. Transformers windings are generally made	e 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 b	est 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		

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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 pa	rt of transformer installation?	
a) Conservator	c) Buchholz relay	
b) Breather	d) Exciter	
13. The insulating material that can w	ithstand 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 statement	s 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 trequency contain core made of	

Maratha Vidya Prasarak Samaj's Rajarshi Shahu Maharaj Polytechnic, Nashik Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13. RSM POLY Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai. 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 c) W/O core transformer a) Iron 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 _____ c) Can be any of the above a) Core type 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 _____ c) High voltage a) Large size 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?

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	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			
ро	wer supply in India?		
	a) 11kV	c) 66kV	
	b) 33kV	d) 122kV	
29	29. The maximum load that a power transformer can carry is limited because of		
its			

a) Temperature riseb) dielectric strength of oilc) voltage ratiod) 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) $V_1 = E_1 + I_1 R_1 + j I_1 X_1$	c) $V_2 = E_2 + I_1 R_1 + j I_1 X_1$	
b) $V_1 = E_1 + I_1 R_1 + j I_2 X_2$	d) $V_1 = E_1 - I_1 R_1 + j I_1 X_1$	
33. Approximate phasor diagram of a transformer is based on		
a) $V_1 = E_1 + I_1 R_1 + j I_1 X_1$	c) $V_1 = V_2 + I_R + jI_X$	
b) $V_2 = E_2 + I_2 R_2 + j I_2 X_2$	d) $V_1 = E_1 + I_1 R_1 + j I_1 X_2$	
34. Hysteresis loss and eddy current loss is directly proportional to		
a) f and f ²	c) f and f	
b) f^2 and f	d) f^2 and f^2	
35 What will happen to hysteresis 1	oss if voltage is doubled load is doubled	

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

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b) Primary winding leakage reactance and secondary winding leakage reactance

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RSM POLY Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai. c) Primary winding resistance, leakage and secondary winding leakage reactance d) Cannot be determined 45. Parallel parameters in a transformer equivalent circuit contains c) \mathbf{R}_2 and \mathbf{X}_2 a) G_i and B_m d) Cannot be determined b) R_1 and X_1 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 c) flux density of the core material a) frequency b) area of the core 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 = 22.7Ab) Secondary current = 202.7A, Primary current = 602.4Ac) Primary current = 22.7A, Secondary current = 602.4A d) Primary current = 11.35A, Secondary current = 301.2A49. 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+j0.8ohms. What will be the impedance of transformer when referred to primary? a) 53i + 85 ohms c) 3.5 + 5.8 j ohms b) 53 + 85j ohms d) Can't be calculated 50. What is the no-load current drawn by transformer?

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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. 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)

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

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

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

a) more economical

c) efficient cooling

b) more efficient

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

c) medium speed prime movers

b) high speed prime movers

d) any of the mentioned

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

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

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- a) f = PN/120 Hz
- b) f = 120/PN Hz

c) f = P/120 Hz d) f = N/120 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 polesd) 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)

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4. TESTING AND TROUBLESHOOTING OF

TRANSFORMER

Total Marks-20

- Position in Question Paper 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 c) Cylindrical type
 - b) Sandwich type
- 2. 3-phase transformers compare to 1-phase transformers _____
 - a) More economical

c) Easy to constructd) Easy to handle

d) Rectangular type

- b) Easy in construction
- 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

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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

c) More in space

d) Can't be determined

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 conn	ected and magnetically independent
b) the phases are electrically not conn	lected and magnetically dependent
c) the phases are electrically connec	cted and magnetically independent
d) the phases are electrically connected	ed and magnetically dependent
7. Where the tappings are provided in a t	ransformer?
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 s	ide
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 i	s 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) Cheaper b) Costlier

5. In mines we use _____

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- t
- 7
- 8

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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 whi	ich connection is used?
a) Star/star	c) Delta/star
b) Delta/delta	d) Star/delta
18. Third-harmonic currents have phase diffe	erence 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 follo	wing is different in star/delta or
delta/star compare to delta/delta?	
a) Flux is flat-topped	
b) Impedance offered to third-harmonic cu	urrents in delta is less
c) Impedance offered to third-harmonic cu	urrents 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) $e_{aN} = e_a \sin 6\omega t + e_{a3} \sin 3\omega t$

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- 23. Rate of change of voltage in star/star connection is
 - a)ω
 - b) 2 ω

c) 3 w

d) Can't determine

23. 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

- 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

- 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

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a) 00-connection	c) 1800-connection			
b) 900-connection	d) 00/1800-connection			
31. What is the ratio of transformation of de	ta/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	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 sta	r/delta connection?			
a) Phase transformation x:1, line trans	formation x:1			
b) Phase transformation x:1, line transfor	mation $\sqrt{3}x$:1			
c) Phase transformation x:1, line transform	mation 3x:1			
d) Can't determine with information avai	lable			
35. $x/\sqrt{3:1}$ 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	s 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				

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a) separate path must be provided

- b) no need of separate path
- c) add a resistor in series
- d) add a resistor in parallel

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

c) 45%

d) 100%

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%
- b) 78%

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 _____

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- c) star-V a) delta-star 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
 - b) Sandwich type
- 49. 3-phase transformers compare to 1-phase transformers _____
 - a) More economical
 - b) Easy in construction

c) Easy to construct

d) Easy to handle

c) Cylindrical type

d) Rectangular type

- 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
 - b) HV side of transformer

- c) Not on any side
- d) On both sides



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- 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

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- 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

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5. MAINTENANCE OF ELECTRICAL MACHINE INSULATION

Total Marks-10

Position in Question Paper 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 babing 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 3. What is the main cause for the failure of overhead line insulators?
 - a) Surges
 - **b)** Flashover

- 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.

- c) Between towers and conductors d) Between conductors and ground
- c) Arching
- d) Grounding

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a) True	b) False
6. How should the properties of strength and	dielectric strength in insulating materials?
a) High strength, low Dielectric strength	
b) Low strength, low Dielectric strength	
c) High strength, high Dielectric streng	th
d) Low strength, high Dielectric strength	
7. What is property of porosity and temperate	ure change in insulating materials?
a) Less, less affected	c) High, highly affected
b) Less, highly affected	d) High, less affected
8. What is the dielectric strength of porcelain	insulators?
a) 60 kV/cm	c) 50 kV/cm
b) 140 kV/cm	d) 40 kV/cm
9. What is the dielectric strength, coefficient	of thermal expansion of glass with respect to
porcelain insulators?	
a) High, high	c) Low, low
b) High. low	d) Low, high
10. Glass has lower tensile strength compare	d to porcelain insulators.
a) True	b) False
11. What is the other name of Polymer Insula	ator?
a) Moisture insulator	c) Composite insulator
b) Core insulator	d) Mixed insulator
12. How many classifications of overhead lin	ne insulators are there?
a) 3	c) 5
b) 4	d) 6
13. How many types of electrical insulators a	are present on the basis of voltage application?
a) 2	c) 4
b) 3	d) 5
14. How many discs are used in suspension i	nsulators for 220kV?
a) 3	c) 8
b) 4	d) 14
15. What is the other name of the shackle ins	ulator?
a) String	c) Spool
b) Hanging	d) Post
16. What is the process of producing electric	dipoles inside the dielectric by an external
electric field?	
a) Polarisation	c) Susceptibility
b) Dipole moment	d) Magnetisation
17. Which of the following easily adapt itself	f to store electrical energy?
a) Passive dielectric	c) Active dielectric
b) Superconductor	d) Polar molecules
18. Which of the following restricts the flow	of electrical energy?
a) Superconductors	c) Polar molecules
b) Passive dielectrics	d) Active dielectric
Prepared By: Prof.P.A.Shinde (Electrical Engineering)	Page 33 of 34

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- 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

c) Space charge polarisation

d) Orientation polarization

c) Electronic polarisation

d) Space charge polarisation

c) At dielectric breakdown

c) Electrochemical breakdown

- 22. Which of the following polarisations is very rapid?
 - a) Electronic polarisation
 - b) Ionic polarisation
- 23. Which of the following is the slowest polarisation method?
 - a) Ionic polarisation
 - b) Orientation polarisation
- 24. When does a dielectric become a conductor?
 - a) At avalanche 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
 - b) Thermal breakdown
- d) Dielectric breakdown

26. When mobility increases, insulation resistance decreases and dielectric becomes conducting. b) False

a) True

- 27. Which of the following materials exhibit Ferro-electricity?
 - a) Iron
 - b) Platinum

c) Hydrogen d) Rochelle salt

c) 7.87 Fm²

c) 2259

d) 5354

- 28. Calculate the electronic polarizability of an argon atom whose $\varepsilon_r = 1.0024$ at NTP and N $= 2.7 \times 10^{25}$ atoms/m³.
 - a) 0.0024 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
- b) 100
- 30. Find the capacitance of layer of A1₂ O₃ that is 0.5 μ m thick and 2000mm² of square area $\varepsilon_r = 8$.
 - a) 1000µF c) 16µF b) 0.283µF d) 2.83µF