



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.

***Subject: -Fundamental of Electrical
Engineering(22212)***



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SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Basic Electrical Parameter	18
2	DC Circuits	20
3	Capacitors	18
4	Magnetic Circuits	22
5	Electromagnetic Induction	26
Total Marks: -		104



BOARD THEORY PAPER PATTERN FOR FEE (22212)

Q.1		Attempt any FIVE	5*2=10
	a)	Basic Electrical Parameter	
	b)	DC Circuits	
	c)	Capacitors	
	d)	Magnetic Circuits	
	e)	Magnetic Circuits	
	f)	Electromagnetic Induction	
	g)	Electromagnetic Induction	
Q.2		Attempt any THREE	3*4=12
	a)	Basic Electrical Parameter	
	b)	DC Circuits	
	c)	Capacitors	
	d)	Electromagnetic Induction	



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Q.3		Attempt any THREE	3*4=12
	a)	Basic Electrical Parameter	
	b)	Basic Electrical Parameter	
	c)	DC Circuits	
	d)	Capacitors	
Q.4		Attempt any THREE	3*4=12
	a)	Basic Electrical Parameter	
	b)	DC Circuits	
	c)	DC Circuits	
	d)	Capacitors	
	e)	Capacitors	
Q.5		Attempt any TWO	2*6=12
	a)	Magnetic Circuits	
	b)	Magnetic Circuits	
	c)	Electromagnetic Induction	
Q.6		Attempt any TWO	2*6=12
	a)	Magnetic Circuits	
	b)	Electromagnetic Induction	
	c)	Electromagnetic Induction	



CLASS TEST - I

PAPER PATTERN

COURSE: -fundamental of electrical engineering (22212)

PROGRAMME: -Electrical Engineering

Unit No.	Name of the Unit	Course Outcome (CO)
1	Basic Electrical Parameter	CO-212.01
2	DC Circuits	CO-212.02
3	Capacitors	CO-212.03

Q.1	Attempt any FOUR4*2=8Marks	Course Outcome(CO)
a)	Basic Electrical Parameter	CO-212.01
b)	Basic Electrical Parameter	CO-212.01
c)	DC Circuits	CO-212.02
d)	DC Circuits	CO-212.02
e)	Capacitors	CO-212.03
f)	Capacitors	CO-212.03
Q.2	Attempt any THREE3*4=12 Marks	
a)	Basic Electrical Parameter	CO-212.01
b)	Basic Electrical Parameter	CO-212.01
c)	DC Circuits	CO-212.02
d)	DC Circuits	CO-212.02
e)	Capacitors	CO-212.03
f)	Capacitors	CO-212.03



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CLASS TEST - II

PAPER PATTERN

COURSE: - fundamental of electrical engineering (22212)

PROGRAMME: -Electrical Engineering

Unit No.	Name of the Unit	Course Outcome (CO)
4	Magnetic Circuits	CO-212.04
5	Electromagnetic Induction	CO-212.05

Q.1	Attempt any FOUR	4*2=8Marks	Course Outcome (CO)
a)	Magnetic Circuits		CO-212.04
b)	Magnetic Circuits		CO-212.04
c)	Magnetic Circuits		CO-212.04
d)	Electromagnetic Induction		CO-212.05
e)	Electromagnetic Induction		CO-212.05
f)	Electromagnetic Induction		CO-212.05
Q.2	Attempt any THREE	3*4=12 Marks	
a)	Magnetic Circuits		CO-212.04
b)	Magnetic Circuits		CO-212.04
c)	Magnetic Circuits		CO-212.04
d)	Electromagnetic Induction		CO-212.05
e)	Electromagnetic Induction		CO-212.05
f)	Electromagnetic Induction		CO-212.05



COURSE OUTCOME

(CO)

COURSE: - Fundamental of Electrical Engineering (22212)

PROGRAMME: -Electrical Engineering

CO.NO.	Course Outcome
CO-212.01	Determine various parameter used in electric circuits
CO-212.02	Used of basic laws of electric engineering
CO-212.03	Make the used of Capacitor in different condition
CO-212.04	Used principle of Magnetism
CO-212.05	Used principle of Electromagnetism



1. Basic Electrical Parameter

Position in Question Paper

Total Marks-12

Q.2. a) 4-Marks.

Q.3. b) 4-Marks.

Q.4. a) 4-Marks.

Descriptive Question

1. Write any two differences between direct current and alternating current
2. Define power and energy.
3. State KCL and KVL
4. State the various effects of electric current and explain any one of them.
5. The field coil of a generator has 14.1Ω at 250°C and 18.2Ω at 320°C . Find the temperature coefficient of resistance at 00°C and resistance at 00°C .
6. Describe the effect of temperature on resistance.
7. Define EMF, Electric Potential.
8. Explain the type of resistor
9. Explain Magnetic Effect.
10. Explain Chemical Effect.
11. Explain Ideal Voltage Source and Practical Voltage Source
12. Define Resistivity, Conductivity, Resistance
13. List any two effects of electric current. Give one example of each.



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

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

- Which of the following equation shows the relation between Voltage, current and resistance.
 - $V=IR$
 - $V=I/R$
 - $R=V/I$
 - Both A and C**
- If current increases than voltage _____.
 - increases**
 - decreases
 - stable
 - All of the above
- Which one is the unit of resistance?
 - Ω /ohm**
 - Ampere
 - volt
 - watt
- Amphere is the SI unit of _____.
 - Voltage
 - Current**
 - Resistance
 - Power
- _____ is the ability for electric charge to flow in a certain path.
 - Resistance
 - Electrical conductance**
 - Current
 - Voltage
- What is the relation between electric conductance and electric resistance?
 - $C=1/R$**
 - $R=C$
 - $C=V/R$
 - None of the above
- The conductance of an 8 ohm resistance is _____.
 - 0.5 mho
 - 0.15 mho
 - 0.125 mho**
 - 0.25 mho
- What is the relation between electric charge, current and time?
 - $Q=It$**
 - $Q=I/t$
 - $t=QI$
 - None of the above
- If there is 6 A of current flows through the filament of a lamp than the how many coulombs of charge move through the filament in 1.75 s?
 - 10.5 C**
 - 105 C
 - 3.4 C
 - 34 C
- An inductor is a _____ that stores energy in a magnetic field when electric current flows through it.



- a) **passive two-terminal electrical component**
b) active two-terminal electrical component
c) passive one-terminal electrical component
d) passive one-terminal electrical component
11. The opposing capacity of materials against the current flow is
a) Conductance
b) Inductance
c) Susceptance
d) **Resistance**
12. The Relation between power, resistance and current is _____.
a) $P=I^2/R$
b) **$P=I^2R$**
c) $P=VI^2$
d) None of the above
13. A voltmeter is an instrument used for measuring _____ difference between two points in an electric circuit.
a) **electric potential**
b) electric current
c) Voltage
d) None of the above
- 14.15. A neutral atom with an atomic number of five has how many electrons?
a) 1
b) **5**
c) 4
d) 3
15. The outermost regions of the atom are called electron shells and It contains the _____.
a) **electrons**
b) protons
c) neutrons
d) None of the above
16. An ammeter is an electrical instrument used to measure _____.
a) Voltage
b) **Current**
c) Resistance
d) Power
17. A wiper is the sliding contact in a _____.
a) Switch
b) Photoconductive cell
c) Thermistor
d) **Potentiometer**
18. Which of the following is not a type of energy source?
a) Battery
b) Solar cell
c) **Rheo**
d) Generator
19. The unit of electrical charge is the _____.
a) Volt
b) Ampere
c) Joule
d) **Coulomb**
20. What should be the core of an electromagnet?
a) **soft iron**
b) hard iron



- c) rusted iron
21. What should be the core of an electromagnet?
a) soft iron
b) hard iron
c) rusted iron
d) **none of above**
22. Who has stated the Right hand Thumb Rule?
a) Orsted
b) Fleming
c) **Einstein**
d) Maxwell
23. In all the electrical appliances, the switches are put in the
a) live wire
b) earth wire
c) neutral wire
d) **all of above**
24. What is the condition of an electromagnetic induction?
a) there must be a relative motion between the coil of wire and galvanometer
b) **there must be a relative motion between the galvanometer and a magnet**
c) there must be a relative motion between galvanometer and generator
d) there must be a relative motion between the coil of wire and a magnet
25. No force acts on a current carrying conductor when it is placed-
a) **perpendicular to the magnetic field**
b) parallel to the magnetic field
c) far away from the magnetic field
d) inside a magnetic field
26. What is that instrument which can detect the presence of electric current in a circuit?
a) **galvanometer**
b) motor
c) generator
d) none of above
27. Which device produces the electric current?
a) generator
b) **galvanometer**
c) ammeter
d) motor .
28. What is electromagnetic induction?
a) the process of charging a body
b) The process of rotating a coil of an electric motor.
c) **producing induced current in a coil due to relative motion between a magnet and the coil**
d) The process of generating magnetic field due to a current passing through a coil.
29. What happens to the current in short circuit?
a) reduces substantially
b) does not change
c) **increases heavily**
d) vary continuously
30. An alpha particle is diverted towards west is deflected towards north by a field. The field is magnetic. What will be the direction of field?
a) Towards south
b) towards east
c) **downward**
d) upward



31. The magnetic field is the strongest at
- a) middle of the magnet.
 - b) north pole.
 - c) south pole.
 - d) **both poles.**
32. Magnetic lines of force inside current carrying solenoid are
- a) perpendicular to axis.
 - b) along the axis and are parallel to each other
 - c) **parallel inside the solenoid and circular at the ends.**
 - d) circular.
33. A soft iron bar is introduced inside a current carrying solenoid. The magnetic field inside the solenoid
- a) will become zero.
 - b) **will increase.**
 - c) will decrease.
 - d) will remain unaffected.
34. An electric generator actually acts as
- a) a source of electric charge.
 - b) a source of neat energy.
 - c) **an electromagnet.**
 - d) a converter of energy
35. A magnetic field directed in north direction acts on an electron moving in east direction. The magnetic force on the electron will act
- a) vertically upwards.
 - b) towards east.
 - c) vertically downwards.
 - d) **towards north.**
36. The direction of force on a current carrying conductor in a magnetic field is given by
- a) **Fleming's left hand rule**
 - b) Fleming's right hand rule.
 - c) Right hand thumb rule.
 - d) Left hand thumb rule.



2.DC Circuits

Position in Question Paper

Total Marks-12

Q.2. b) 2-Marks.

Q.3. c) 4-Marks.

Q.4. b) 6-Marks.

Descriptive Question

1. Define unilateral and bilateral circuit
2. Why the emf of a cell is always greater than its terminal voltage?
3. Define the following terms related to electric circuits - (i) Node (ii) Branch (iii) Loop (iv) Mesh
4. List any four types of resistors. Give one application of each.
5. State and explain Ohm's law.
6. Define – resistance and resistivity. State relation between them. Give one material having high resistivity.
7. Define following networks. (i) Active (ii) Passive (iii) Unilateral (iv) Bilateral
8. State the concept of internal voltage drop.
9. Define: (i) Linear Network and (ii) Non-linear Network
10. The rating of electric geyser is 250 V, 3 kW. How much current does it take and what is its hot resistance? Also calculate the energy consumed by it in one hour.
11. Write the expression for 'equivalent resistance' and 'voltage division' when 3 resistance are connected in series.
12. Compare unilateral and bi-lateral circuit
13. State Kirchoff's laws & explain sign convention adopted for it
14. Write the expression for 'equivalent resistance' and 'voltage division' when 3 resistance are connected in parallel.



MCQ Question

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

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

- The correct statement of Ohm's law:
 - Voltage is inversely proportional to the power
 - Current is inversely proportional to the applied voltage
 - Power is a product of resistance times voltage
 - d) Increase in resistance decreases current for constant voltage**
- The voltage divider is applied in:
 - Parallel circuits
 - b) Series circuits**
 - None of these
 - All the above
- $P = VI$ is a statement of:
 - Ohm's law
 - b) Joule's law**
 - KCL
 - KVL
- Power dissipated by a 20Ω resistor connected to 20 V source:
 - 1 watt
 - b) 20 watts**
 - 400 watts
 - 1600 watts
- KVL is valid for:
 - Parallel circuits
 - b) Series circuits**
 - None of these
 - All the above
- The current divider rule is applied to:
 - a) Parallel circuits**
 - Series circuits
 - None of these
 - All the above
- KCL is valid for:
 - a) Parallel circuits**
 - Series circuits
 - None of these
 - All the above
- In designing a sleeve and cotter joint, the outside diameter of the sleeve is taken as____
 - 1.5 d
 - b) 2.5 d**
 - 3 d
 - 4 d
- The statement: Energy can neither be created nor destroyed belongs to:
 - Kelvin law
 - Neil law
 - c) Law of conversation of Energy**
 - Energy Creation Destruction theory

10. A circuit with various parallel voltage sources is solved using:
- a) Superposition theorem
 - b) Norton theorem
 - c) Kelvin law
 - d) **Millman's theorem**
11. The circuit with multiple independent current sources is solved using:
- a) Kirchhoff's current law
 - b) Substitution theorem
 - c) **Superposition theorem**
 - d) Norton theorem
12. Reciprocity theorem should be applied to:
- a) **Single source circuits**
 - b) Multiple source circuits
 - c) 2, 4, 6, or 8 source
 - d) None of these
13. Delta network is also known as:
- a) Tee
 - b) **Pi**
 - c) Wye
 - d) None
14. Thevenin theorem provides:
- a) Current source with parallel resistor
 - b) Current source with series resistor
 - c) Voltage source with parallel resistor
 - d) **Voltage source with series resistor**
15. Tee network is also known as:
- a) Delta
 - b) Pi
 - c) **Wye**
 - d) None
16. Branch current analysis involves:
- a) KCL
 - b) KVL
 - c) Linear equations
 - d) **All of these**
17. Two unequal series sources:
- a) Can be solved using KCL
 - b) **Violate KCL**
 - c) Follow KVL
 - d) None of these
18. Mesh analysis requires:
- a) KCL only
 - b) **KVL only**
 - c) Both
 - d) None
19. Multiple current sources in parallel can be reduced to:
- a) **Single current source**
 - b) Single voltage source
 - c) Single resistance
 - d) None of these
20. Norton theorem cannot be applied to:
- a) Resistor
 - b) **Diodes**
 - c) Linear bilateral networks
 - d) All of above
21. Norton theorem provides:
- a) **Current source with parallel resistor**
 - b) Current source with series resistor
 - c) Voltage source with parallel resistor



- d) Voltage source with series resistor
22. The circuit having some properties in either direction is known ascircuit
- a) **Bilateral** c) Irreversible
b) Unilateral d) Reversible
23. In nodal analysis, if there are N nodes in the circuit then how many equations will be written to solve the network ?
- a) **N - 1** c) N
b) N + 1 d) N - 2
24. Maxwell's loop current method of solving electrical networks
- a) Uses branch currents
b) **Utilizes Kirchhoff's voltage law**
c) Is confined to single-loop circuits
d) Is a network reduction method
25. Kirchhoff's laws are valid for
- a) Linear circuits only
b) Passive time invariant circuits
c) Nonlinear circuits only
d) **Both the linear and nonlinear circuits only**
26. Which of the following theorems can be applied to any network linear or non-linear, active or passive, time variant or time-invariant?
- a) Thevenin Theorem c) **Tellegen Theorem**
b) Norton Theorem d) Superposition Theorem
27. The theorem that enables a number of voltage (or current) sources to be combined directly into a single voltage (or current) source is thetheorem
- a) Compensation c) Milliman's
b) Reciprocity d) **Maxwell's**
28. Which of the following theorems is applicable for both linear and nonlinear circuits?
- a) Superposition c) Norton's
b) Thevenin's d) **None of these**
29. Three equal resistances are connected in star. If this star is converted into equivalent delta, the resistance of both the networks will be.....
- a) **Equal** c) Vive-versa
b) Zero d) None of the above
30. Two ideal voltage sources of unequal output voltages cannot be placed in.....
- a) Series c) Both series and parallel
b) **Parallel** d) None of the above
31. Kirchhoff's laws are not applicable to circuits with
- a) **Distributed parameters** c) Passive elements
b) Lumped parameters d) Non-linear resistances



32. Which of the following theorems can be applied to any network linear or non-linear, active or passive, time variant or time-invariant?
- a) Thevenin Theorem
 - b) Norton Theorem
 - c) **Tellegen Theorem**
 - d) Superposition Theorem
33. Which of the following is an active element in a circuit?
- a) **Current source**
 - b) Resistance
 - c) Inductance
 - d) Capacitance
34. Which of the following is not a bilateral element ?
- a) **Constant current source**
 - b) Resistor
 - c) Inductor
 - d) capacitor
35. The elements which are not capable of delivering energy by its own are known as
- a) Unilateral elements
 - b) Nonlinear elements
 - c) **Passive elements**
 - d) Active elements
36. Kirchhoff's laws are not applicable to circuits with
- a) **Distributed parameters**
 - b) Lumped parameters
 - c) Passive elements
 - d) Non-linear

3.Capacitors

Position in Question Paper

Total Marks-12

Q.2. c) 4-Marks.

Q.3. d) 4-Marks.

Q.4. d) 4-Marks.

Descriptive Question

1. Define Capacitor.
2. State the term Di-electric strength
3. Derive the expression for energy stored in capacitor with the help of neat diagram.
4. Three capacitors having capacitance of $4 \mu\text{F}$, $6 \mu\text{F}$ and $8 \mu\text{F}$ respectively. Find the equivalent capacitance when they are connected in (i) series and (ii) Parallel.
5. Three capacitors A, B, C have capacitances 10, 50 and 25 F respectively. Calculate (a) charge on each when connected in parallel to a 250 V supply (b) total capacitance..
6. Explain any one constant voltage charging method.
7. Derive the expression for energy stored in capacitor with the help of neat diagram.
8. Explain charging and discharging of capacitor.
9. State the types of capacitor and give one application of each
10. List any three types of capacitor. Give one application of any one type.
11. State and explain Ohm's law.
12. Three capacitors 15 mf, 18 mf and 12 mf are connected in a circuit. Find equivalent capacitance when they are connected in - (i) series (ii) parallel
13. Draw a practical set-up to plot charging and discharging curves of a capacitor through a resistor. Draw the curves.
14. Define dielectric strength for a capacitor.
15. Describe the working of capacitor with a neat sketch
16. Three capacitors $1 \mu\text{F}$, $2 \mu\text{F}$ and $3 \mu\text{F}$ respectively are connected in a circuit. Determine the equivalent capacitance when they are connected in - (i) Series (ii) Parallel

MCQ Question

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

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

- The correct statement of Ohm's law:
 - Voltage is inversely proportional to the power
 - Current is inversely proportional to the applied voltage
 - Power is a product of resistance times voltage
 - Increase in resistance decreases current for constant voltage**
- The effective capacitance of a capacitor is reduced when capacitors are connected in
 - series
 - parallel
 - series-parallel combination**
 - none of the above
- As the capacitor in the RC circuit above reaches its maximum charge:
 - the rate at which the current changes decreases and the rate at which the charge changes increase**
 - the rate at which the current changes increases and the rate at which the charge changes increases.
 - both rates decrease.
 - both rates increase.
- As the capacitor in the RC circuit above reaches its maximum charge, which of the following statements is FALSE:
 - the voltage across the capacitor is at its maximum.
 - the voltage across the resistor is zero.
 - the sum of the voltages across the capacitor and resistor is equal to the initial voltage across the resistor.**
 - the sum of the voltages across the capacitor and resistor is equal to the initial voltage across the capacitor
- You have a 1 mF capacitor with Q's worth of charge on it. A dielectric whose dielectric constant is 5 is carefully slipped between the plate of the capacitor. Which statement is FALSE.
 - the new capacitance will equal 5C.
 - the new charge on the plates is 5Q.**
 - the new voltage across the plates is a fifth what it was.
 - the new electric field between the plates is a fifth what it was.
- Capacitance is:
 - measure in farads.



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- b) the ratio of the magnitude of the charge on either conductor of a capacitor to the magnitude of the potential difference between the conductors.
- c) constant for a parallel plate capacitor.
- d) **all three choices.**
7. In a circuit, a capacitor has potential difference ΔV , charge Q , and capacitance C . The potential difference is doubled. The capacitance:
- a) changes in ways impossible to predict with the given information.
- b) doubles.
- c) **does not change.**
- d) is divided in half.
8. To increase the capacitance of a parallel-plate capacitor, you can:
- a) **increase the area of the plates.**
- b) increase the distance between the plates.
- c) all of these choices.
- d) none of these choices.
9. Given a set of capacitors $C_1 + C_2 + \dots + C_n$, where n is greater than 1, will a greater equivalent capacitance result by adding them in parallel or in series?
- a) in series.
- b) **in parallel.**
- c) they will be the same.
- d) This cannot be determine without know the value of each capacitor and number of capacitors in the system.
10. Given n capacitors with charge Q and capacitance C , will you get the greatest energy stored:
- a) in series.
- b) in parallel.
- c) **They will be the same.**
- d) This cannot be determine without knowing more about the situation.
11. Select the option that best describes a dielectric.
- a) **A dielectric is a non-conducting material.**
- b) A dielectric is the material when placed between the plates of a capacitor will increase the electric field.
- c) A dielectric is something that when placed between the plates decreases the capacitance of the capacitor.
- d) All of these choices are true.
12. Bakelite has a dielectric constant approximately twice that of silicone oil. The bakelite in a capacitor with capacitance C is replaced with silicone oil. What will the new capacitance be, approximately?
- a) $2C$
- b) $C/2$.
- c) **C .**
- d) None the above



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13. A capacitor has capacitance C , charge Q , and potential difference with nothing between the plates. While still connected to a battery, a dielectric is inserted with a dielectric constant of 2. How will each change?
- $C_{\text{new}} = 2C, Q_{\text{new}} = Q, \Delta V_{\text{new}} = \Delta V$.
 - $C_{\text{new}} = 2C, Q_{\text{new}} = 2Q, \Delta V_{\text{new}} = 2\Delta V$.**
 - $C_{\text{new}} = 2C, Q_{\text{new}} = Q, \Delta V_{\text{new}} = 2\Delta V$
 - $C_{\text{new}} = 2C, Q_{\text{new}} = 2Q, \Delta V_{\text{new}} = 2\Delta V$
14. A capacitor has capacitance C , charge Q , and potential difference ΔV with nothing between the plates. The capacitor is then disconnected from the battery and a dielectric is inserted with a dielectric constant of 2. How will each of the values C , Q , and V change?
- $C_{\text{new}} = 2C, Q_{\text{new}} = Q, \Delta V_{\text{new}} = \Delta V$**
 - $C_{\text{new}} = 2C, Q_{\text{new}} = 2Q, \Delta V_{\text{new}} = \Delta V/2$
 - $C_{\text{new}} = 2C, Q_{\text{new}} = Q, \Delta V_{\text{new}} = \Delta V/2$.
 - $C_{\text{new}} = 2C, Q_{\text{new}} = 2Q, \Delta V_{\text{new}} = 2\Delta V$
15. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface to 10 V. The potential at the centre of the sphere is
- zero
 - 10 V**
 - the same as that at a point 5 cm away from the surface
 - the same as that at a point 25 cm away from the surface
16. Two equal negative charges $-q$ are fixed at points $(0, a)$ and $(0, -a)$ on the y -axis, A positive charge Q is released from rest at a point $(2a, 0)$ on the x -axis. The charge Q will
- execute simple harmonic motion about the origin
 - move to the origin and remain at rest there
 - move to infinity
 - execute oscillatory but not simple harmonic motion.**
17. Two positive point charges of 12 and 8 microcoulombs respectively are placed 10 cm apart in air. The work done to bring them 4 cm closer is
- zero
 - 3.8 J
 - 4.8 J
 - 5.8 J**
18. One thousand spherical water droplets, each of radius r and each carrying a charge q . coalesce to form a single spherical drop. If v is the electrical potential of each droplet and V that of the bigger drop, then
- $V/v = 1 / 1000$
 - $V/v = 1 / 100$
 - $v/V = 1 / 1000$**
 - $v/V = 1 / 100$
19. An electric dipole placed with its axis in the direction of a uniform electric field experiences
- a force but no torque
 - a torque but no force
 - a force as well as a torque**
 - neither a force nor a torque



20. A parallel plate capacitor of capacitance 100 pF is to be constructed by using paper sheets of 1.0 mm thickness as dielectric. If the dielectric constant of paper is 4.0, the number of circular metal foils of diameter 2.0 cm each required for this purpose is
- a) **10** c) 30
b) 20 d) 40
21. Three capacitors, each of capacitance $C = 3 \text{ MicroF}$, are connected as shown in parallel. The equivalent capacitance between points P and S is
- a) 1 MicroF c) 6 MicroF
b) 3 MicroF d) **9 MicroF**
22. Two parallel plate capacitors of capacitances C and $2C$ are connected in parallel and charged to a potential difference V by a battery. The battery is then disconnected and the space between the plates of capacitor C is completely filled with a material of dielectric constant K . The potential difference across the capacitors now becomes
- a) $V/K + 1$ c) $3V/K + 2$
b) $2V/K + 2$ d) $3V/K + 3$
23. The electric potential V (in volt) varies with x (in metre) according to the relation $F = 5 + 4x^2$
- The force experienced by a negative charge of $2 \times 10^{-6} \text{ C}$ located at $x = 0.5 \text{ m}$ is
- a) $2 \times 10^{-6} \text{ N}$ c) $6 \times 10^{-6} \text{ N}$
b) $4 \times 10^{-6} \text{ N}$ d) **$8 \times 10^{-6} \text{ N}$**
24. A charge q is placed at the centre of the line joining two equal charges Q . The system of the three charges will be in equilibrium if q is equal to
- a) $Q/-2$ c) $Q/2$
b) **$Q/-4$** d) $Q/4$
25. An electric dipole placed with its axis inclined at an angle to the direction of a uniform electric field experiences
- a) a force but no torque c) **a force as well as a torque**
b) a torque but no force d) neither a force nor a torque
26. An electric dipole placed in a non-uniform electric field experiences
- a) a force but no torque c) a force as well as a torque
b) **a torque but no force** d) neither a force nor a torque.
28. A neutral hydrogen molecule has two protons and two electrons. If one of the electrons is removed we get a hydrogen molecular ion (H_2^+). In the ground state of H_2^+ the two protons are separated by roughly 1.5 \AA and the electron is roughly 1 \AA from each proton. What is the potential energy of the system?
- a) -38.4 eV c) -9.6 eV
b) **-19.2 eV** d) zero
29. In a hydrogen atom, the electron and the proton are bound together at a separation of about 0.53 \AA . If the zero of potential energy is taken in an infinite separation of the electron from the proton, the potential energy of the electron-proton system is
- a) -54.4 eV b) **-27.2 eV**



- c) -13.6 eV
d) zero
30. A 2 microfarad capacitor C1 is charged to a voltage 100 V and a 4 microfarad capacitor C2 is charged to a voltage 50 V. The capacitors are then connected in parallel. What is the loss of energy due to parallel connection?
- a) 1.7 J
b) 1.7×10^{-1} J
c) 1.7×10^{-2} J
d) **1.7×10^{-3} J**
31. The electric field due to an extremely short dipole at a distance r from it is proportional to
- a) 1/r
b) 1/r²
c) **1/r³**
d) 1/r⁴
32. The electric potential due to an extremely short dipole at a distance r from it is proportional to
- a) 1/r
b) **1/r²**
c) 1/r³
d) 1/r⁴
33. A soap bubble of radius r is charged to a potential V. If the radius is increased to nr, the potential on the bubble will become
- a) n/V
b) n²V
c) **v/n**
d) V/n²
34. A parallel plate capacitor is made by stacking 10 identical metallic plates equally spaced from one another and having the same dielectric between plates. The alternate plates are then connected. If the capacitor formed by two neighbouring plates has a capacitance C, the total capacitance of the combination will be
- a) C/10
b) C/9
c) **9C**
d) 10C
35. A parallel plate capacitor with air as dielectric is charged to a potential V. It is then connected to an uncharged parallel plate capacitor filled with wax of dielectric constant k. The common potential of both capacitors is
- a) V
b) Kv
c) (1 + K)V
d) **V (1k)**
36. The magnitude of the electric field in the annular region of a charged cylindrical capacitor
- a) is the same throughout
b) is higher near the outer cylinder than near the inner cylinder
c) **varies as 1/r where r is the distance from the axis**
d) (d) varies as 1/r² where r is the distance from the axis.



4.Magnetic Circuits

Position in Question Paper

Total Marks-14

Q.1. d) 2-Marks.

Q.5. a) 6-Marks.

Q.6. a) 6-Marks.

Descriptive Question

1. Define Reluctance. What are its units?
2. Explain self-induced emf and mutually induced emf with neat sketch
3. Compare magnetic circuit and electric circuit on any four points.
4. Explain B-H curve and draw with all parameters.
5. Explain with neat diagram series and parallel magnetic circuits.
6. State Fleming's right hand rule
7. Define Faraday's first law of electromagnetic induction.
8. Compare electric and magnetic circuit on any four points.
9. Define Electromagnetism, Magnetic Flux, and MMF with their units.
10. Explain the terms Statically induced EMF
11. Explain the terms Dynamically induced EMF
12. State and Explain Lenz Law.
13. Draw hysteresis shapes for following materials- (i) permanent magnet (ii) steel alloy (iii) plastic
14. Draw a neat sketch of series magnetic circuit. State value of reluctance for both series and parallel magnetic circuit. Name each term used in them



MCQ Question

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

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

- Which of the following equation shows the relation between Voltage, current and resistance.
 - $V=IR$
 - $V=I/R$
 - $R=V/I$
 - Both A and C**
- An air gap is usually inserted in a magnetic circuits to
 - Increase m.m.f.
 - Increase the flux
 - Prevent saturation**
 - None of the above
- Permeability in a magnetic circuit corresponds toin an electric circuit
 - Resistance
 - Resistivity
 - Conductivity**
 - Conductance
- Those magnetic materials are best suited for making armature and transform cores which havepermeability andhysteresis loss
 - High, high
 - Low, high
 - High, low**
 - Low, low
- In a magnetic material hysteresis loss takes place primarily due to
 - Rapid reversals of its magnetisation
 - Flux density lagging behind the magnetising force
 - Molecular friction
 - It high retentivity**
- The property of a material which opposes the creation of magnetic flux in it is known as
 - Reluctivity
 - Magnetomotive force
 - Permeance
 - Reluctance**
- The area of his hysteresis loss is a measure of
 - Permittivity
 - Permeance
 - Energy loss per cycle**
 - Magnetic flux
- In order to minimise hysteresis loss, the magnetic material should have
 - High resistivity
 - Low hysteresis co-efficient**
 - Large B - H loop area
 - High retentivity
- Hysteresis loss least depends on
 - Volume of material
 - Frequency
 - Steinmetz co-efficient of material



d) Ambient temperature

10. The hysteresis loss is caused by
- a) Structural non-homogeneity
 - b) Work required for the magnetising the material**
 - c) Potential work function
 - d) None of the above
11. According to Steinmetz hysteresis law, hysteresis loss in a material is proportional to
- a) $B^{3.6}$
 - b) $B^{1.6}$**
 - c) $B^{1.2}$
 - d) B^2
12. The unit of magnetic flux is
- a) Henry
 - b) Weber**
 - c) Ampere-turn/weber
 - d) Ampere/meter
13. The unit of reluctance is
- a) Meter/henry
 - b) Henry/meter
 - c) Henry
 - d) 1/henry**
14. Reciprocal of reluctance is
- a) Reluctivity
 - b) Permeance**
 - c) Permiability
 - d) Susceptibility
15. The unit of retentivity is
- a) Weber
 - b) Weber/sq. meter**
 - c) Ampere turn/metre
 - d) Ampere turn
16. Silicon steel is used in electrical machines because it has
- a) Low co-ercivity
 - b) Low retentivity
 - c) Low hysteresis loss**
 - d) High co-ercivity
17. Conductivity is analogous to
- a) Retentivity
 - b) Resistivity
 - c) Permeability**
 - d) Inductance
18. Conductance is analogous to
- a) Permeance**
 - b) Reluctance
 - c) Flux
 - d) Inductance
19. Material for good magnetic memory should have
- a) Low hysteresis loss
 - b) High permeability
 - c) Low retentivity
 - d) High retentivity**
20. Hard steel is suitable for making permanent magnets because
- a) It has good residual magnetism**
 - b) Its hysteresis loop has large area
 - c) Its mechanical strength is high
 - d) Its mechanical strength is low
21. Permanent magnets are normally made of
- a) Alnico alloys**
 - b) Aluminium



- a) Reluctivity
b) Magnetomotive force
c) Permeance
d) Reluctance
31. If a 20 V potential is applied across a relay coil with 50 turns having 1Ω of resistance, the total magnetomotive producing magnetic flux in the circuit is
a) 10 Wb
b) 50 T
c) 1000 A t/m
d) 1000 A.t
32. What is the reluctance of a magnetic path having a length of 2×10^{-3} m and cross-sectional area of $2.5 \times 10^{-3} \text{ m}^2$?
a) **6366 A.t/Wb**
b) 6000 A.t/Wb
c) 8×10^{-3} A.t/Wb
d) 0.8 A.t/Wb
33. Calculate the permeability (in T/A. t/m) of a magnetic material that has a relative permeability of 300
a) **3.78×10^{-4}**
b) 3.78×10^{-5}
c) 3.78×10^{-3}
d) 3.78×10^{-6}
34. Calculate the flux density that will be produced by the field intensity of 2000 a. t/m for a permeability of 126×10^{-6} T/A.t/m
a) 0.252 G
b) 0.252×10^{-2} T
c) **0.252 T**
d) 0.252×10^{-2} G
35. 163. How many turns are needed to produce a magnetomotive force of 1000 A.t for a coil with 6 amperes?
a) 6000 turns
b) 600 turns
c) **167 turns**
d) 67
36. A 6- V battery is connected across a solenoid of 100 turns having a resistance of 2Ω , Calculate the number of ampere turns?
a) 100
b) 50
c) **300**
d) 600
37. What determines the atomic number of an element?
a) **The number of protons**
b) The number of electrons
c) The number of neutrons
d) The number of neutrons and protons
38. One of the solid structures in which the position of the atoms or ions are predetermined
a) **Crystalline solid**
b) Amorphous solid
c) Polycrystalline solid
d) Poly- amorphous solid
39. Mmf in a magnetic circuit corresponds to _____ in an electric circuit
a) **Emf**
b) Voltage drop
c) Electric Field Intensity
d) Potential gradient
40. What solid has no defined crystal structure except perhaps in the arrangement of the nearest neighboring atoms or ions?



- a) Crystalline
b) **Amorphous**
41. Amorphous solid is also called
a) Crystalline
b) **Non- crystalline**
c) Polycrystalline
d) Poly- amorphous
42. A principle that states that only two electrons with different spins are allowed to exist in a given orbit
a) Bohr's principle
b) Pauli exclusion principle
c) **Avogadro's principle**
d) Coulomb's principle



5. Electromagnetic Induction

Position in Question Paper

Total Marks-20

Q.1. f) 2-Marks.

Q.1. g) 2-Marks.

Q.2. d) 4-Marks.

Q.5. c) 6-Marks.

Q.6. b) 6-Marks.

Descriptive Question

1. A coil consisting of 100 turns is placed in the magnetic field of 0.3 mwb. Calculate the average emf induced in the coil when it is moved in 0.06 seconds from the given field of 0.1 mwb. If the resistance of coil is 200Ω , find the induced current in the coil.
2. State types of inductor.
3. A magnetic flux of 0.6 mwb is passed through a coil of 1000 turns, is reversed in 0.05 second. Determine the average value of self induced emf.
4. The field winding of a d.c. electromagnet is wound with 960 turns and has resistance of 50Ω when the exciting voltage is 230V, the magnetic flux linking the coil is 0.005 wb. Calculate the self inductance of the coil and the energy stored in magnetic field Define:
5. Related to an inductor state (i) any two types (ii) any two applications (iii) expression for self and mutual inductance
6. Two coils A of 1000 turns and B of 1200 turns are such that 60% of flux produced by A links with B. A current of 4A in coil A produces a flux of 0.05 wb and in coil B of 0.075 wb. Find – (i) L_1 (ii) L_2 (iii) M (iv) K
7. A magnetic flux of 0.6 mwb is passed through a coil of 1000 turns, is reversed in 0.05 second. Determine the average value of self induced emf. c) The field winding of a d.c. electromagnet is wound with 960 turns and has resistance of 50Ω when the exciting voltage is 230V, the magnetic flux linking the coil is 0.005 wb. Calculate the self inductance of the coil and the energy stored in magnetic field.
8. :Explain Inductance in Series



9. Explain Self Inductance and Mutual Inductance
10. Explain Self Induced EMF and Mutually Induced Induced
11. Explain Coefficient of Coupling

MCQ Question

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

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

1. What bond is formed when one or more electrons in the outermost energy orbit of an atom are transferred to another?
 - a) **Ionic**
 - b) Covalent
 - c) Metallic
 - d) Van der Waals
2. In electro-mechanical conversion devices like generators and motors the reason why a small air gap is left between the rotor and stator is to
 - a) **permit mechanical clearance**
 - b) increase flux density in air gap
 - c) decrease the reluctance of magnetic path
 - d) complete the magnetic path
3. What is the coupling coefficient when all the flux of coil 1 links with coil 2?
 - a) 0
 - b) 100
 - c) **1**
 - d) None of the above
4. Why is it that the magnitude of magnetomotive force required for air gap is much greater than that required for iron part of a magnetic circuit?
 - a) Because air is a gas
 - b) Because air has the highest relative permeability
 - c) Because air is a conductor of magnetic flux
 - d) **Because air has the lowest relative permeability**
5. What type of bond is formed when there exists some form of collective interactions between the (negatively charged) electrons and (positively charged) nuclei in a solid?
 - a) Ionic
 - b) Covalent
 - c) **Metallic**
 - d) Van der Waals
6. Permeance of a magnetic circuit is _____ the cross-sectional area of the circuit.
 - a) **directly proportional to**
 - b) inversely proportional to
 - c) dependent of
 - d) independent of
7. Formed when there exist distant electronic interactions between (opposite) charges present in the neighboring atoms or molecules.
 - a) Ionic bond
 - b) Covalent bond



- c) Metallic bond
d) **Van der Waals bond**
8. Defined as the ratio of the volume occupied by the atoms or ions in a unit cell divided by the volume of the unit cell and is used to measure the compactness of a crystal.
a) **Atomic packing factor (APF)**
b) Ionic Packing Ratio (IPR)
c) Atomic compacting factor (ACF)
9. A factor used to correct for the electrostatic forces of the more distant ions in an ionic solid.
a) Avogadro's number
b) Planck's constant
c) Boltzmann's constant
d) **Madelung constant**
10. The conduction of electricity across the surface of a dielectric is called
a) **creepage**
b) skin effect
c) surface effect
d) crosstalk
11. A magnetic circuit carries a flux ϕ_i in the iron part and a flux ϕ_g in the air gap. What is the leakage coefficient?
a) **ϕ_i / ϕ_g**
b) $\phi_i \times \phi_g$
c) $C\phi_g / \phi_i$
d) $\phi_i + \phi_g$
12. A law stating that the magnetic susceptibilities of most paramagnetic substances are inversely proportional to their absolute temperatures.
a) **Curie's Law**
b) Child's Law
c) CR Law
d) Curie-Weiss Law
13. 183. The reluctance of the magnetic circuit is _____ relative permeability of the material comprising the circuit.
a) directly proportional to
b) **inversely proportional to**
c) independent of
d) dependent of
14. A law relating between the magnetic and electric susceptibilities and the absolute temperatures which is followed by ferromagnets, antiferromagnets, non-polar ferroelectrics, antiferroelectrics and some paramagnets.
a) Curie's Law
b) Child's Law
c) CR Law
d) **Curie-Weiss Law**
15. Theory of ferromagnetic phenomena which assumes each atom is a permanent magnet which can turn freely about its center under the influence of applied field and other magnets.
a) **Ewing's theory of ferromagnetism**
b) Oersted's ferromagnetism theory
c) Maxwell's magnetic theory
d) Ampere's circuital law
16. The reluctance of a magnetic circuit varies with
a) length \times area
b) area \div length
c) **length \div area**
d) length + area



17. A theorem which states that an electric current flowing in a circuit produces a magnetic field at external points equivalent to that due to a magnetic shell whose bounding edge is the conductor and whose strength of the current.
- a) Joule's law
 - b) Faraday's law
 - c) Volta's theorem
 - d) Ampere's theorem**
18. What is the usual value of leakage coefficient for electrical machines?
- a) 0.5 to 1
 - b) 1 to 5
 - c) 5 to 10
 - d) 1.15 to 1.25**
19. The science of adapting electronics to aerospace flight.
- a) Avionics
 - b) Aerotronics
 - c) Aerodynamics
 - d) Astrionics**
20. The reluctance of a magnetic circuit is not dependent on which of the following?
- a) Number of turns of coil
 - b) Magnetomotive force
 - c) **Flux density in the circuit**
 - d) Current in the coil
21. Another term for corona discharge.
- a) Lightning
 - b) Sparking
 - c) **Aurora**
 - d) Corona Effect
22. The B-H curve for _____ is a straight line passing through the origin.
- a) cobalt
 - b) **air**
 - c) hardened steel
 - d) soft iron
23. The phenomenon that when an electric current passes through an anisotropic crystal, there is an absorption or liberation of heat due to the non-uniformity in current distribution.
- a) **Bridgman effect**
 - b) Corona effect
 - c) Dember effect
 - d) Destriau effect
24. The B-H curve of _____ is not a straight line.
- a) air
 - b) wood
 - c) silicon steel
 - d) soft iron**
25. If a magnetic flux cuts across 200 turns at a rate of 2 Wb/s, the induced voltage according to Faraday's law is about
- a) **400 V**
 - b) 100 V
 - c) 200 V
 - d) 600 V
26. What is the SI unit of reluctance?
- a) At
 - b) At/m
 - c) N/Wb
 - d) At/Wb**
27. A magnetizing force of 1000 AT/m will produce a flux density of _____ in air.
- a) **1.257 mWb/m²**
 - b) 0.63 Wb/m²
 - c) 1.257 Wb/m²
 - d) 0.63 mWb/m²
28. Hysteresis loss can be reduced by one of the following.
- a) Increasing mmf of the circuit



- b) **Using material narrow hysteresis loop**
c) Using ferromagnetic core
d) Laminating the magnetic circuit
29. The core of a transformer heats up when its primary is fed from an ac source because
a) permeability
b) ferromagnetism
c) reluctance of core
d) **hysteresis loss**
30. Which of the following statement is correct?
a) Inner electrons are always present in the semiconductor.
b) Bound electrons are always present in the semiconductor.
c) Free electrons are always present in the semiconductor.
d) **Inner and bound electrons are always present in the semiconductor.**
31. The emf induced in a coil due to relative motion of a magnet is independent of
a) **Coil resistance**
b) Magnet not visible
c) Number of coil turns.
d) Pole strength of the magnet.
32. When a single turn coil rotates in a uniform magnetic field, at uniform speed the induced emf will be
a) **Alternating**
b) Steady
c) Pulsating
d) None of these
33. Principle of dynamically induced emf is used in a
a) Choke
b) **Transforme**
c) Generator
d) Thermo-couple
34. The direction of dynamically induced emf in a conductor can be determined by
a) Fleming's left-hand rule.
b) **Fleming's right-hand rule.**
c) Helix rule.
d) Corkscrew rule.
35. Principle of statically induced emf is used in
a) **Transformer**
b) Motor
c) Generator
d) Battery
36. Magnitude of statically induced emf depends on the
a) Coil resistance
b) Flux magnitude
c) **Rate of change of flux**
d) None of these
37. The property of a coil by which a counter emf is induced in it, when the current through the coil changes, is called
a) **Self inductance**
b) Mutual inductance
c) Capacitance
d) None of these
38. If in an iron cored coil the iron core is removed so as to make the air-cored coil, the inductance of the coil will be
a) More
b) **Less**



- c) The same
d) None of these
39. Lower the self-inductance of a coil
- a) More will be the weber-turns.
b) More will be the emf induced.
c) Lesser the flux produced by it.
d) **Smaller the delay in establishing steady current through it.**
40. When an electric current is passed through a bucket full of water, lot of bubbling is there. The electric current is
- a) Ac. c) Pulsating
b) Dc. d) **None of these**
41. Property of a material which opposes the production of magnetic flux in it is called
- a) mmf c) **permeance**
b) reluctance d) Permittivity
42. Unit of mmf is
- a) **AT** c) Henry
b) Weber/ampere d) AT/m
43. Conductance is analogous to
- a) Reluctance c) **Permeance**
b) M.m.f d) Inductance
44. An air gap is usually inserted in magnetic circuits to
- a) **Prevent saturation.** c) Increase in flux.
b) Increase in mmf. d) Increase in inductance.
45. Permeability is reciprocal of
- a) **Reluctivity** c) Permittivity
b) Susceptibility d) Conductivity
46. The magnetic reluctance of a magnetic circuit decreases with
- a) Decrease in cross-sectional area.
b) **Increase in cross-sectional area.**
c) Increase in length of the magnetic path.
d) Decrease in relative permeability of the magnetic material of the circuit.
47. A ring-shaped coil with fixed number of turns of it carries a current of certain magnitude. If an iron core is threaded into the coil without any change in coil dimensions, the magnetic induction density will
- a) **Increase** c) remain unaffected
b) Reduce d) unpredictable



48. The ratio of total flux (flux in the iron path) to useful flux (flux in the air gap) is called
- utilization factor
 - fringing factor
 - leakage factor**
 - depreciation factor
49. According to Faraday's law of electromagnetic induction, an emf is induced in a conductor whenever it
- lies in a magnetic field.
 - Lies perpendicular to the magnetic field.
 - Cuts the magnetic flux.**
 - Moves parallel to the direction of magnetic field.
50. "In all cases of electromagnetic induction, an induced voltage will cause a current to flow in a closed circuit in such a direction that the magnetic field which is caused by that current will oppose the change that produces the current", is the original statement
- Lenz's law.**
 - Faraday's law of magnetic induction.
 - Fleming's law of induction
 - Ampere's law
51. In Fleming's left-hand rule thumb always represents direction of
- Current flow
 - Induced emf
 - Magnetic field
 - Mechanical force**
52. If a current carrying conductor is placed in a magnetic field, the mechanical force experienced on the conductor is determined by
- Simple product
 - Dot product
 - Cross product**
 - Any of these
53. The force experienced by a current carrying conductor lying parallel to a magnetic field is
- Zero**
 - $B I l$
 - $B I l \sin \theta$
 - $B I l \cos \theta$
54. What is the coupling coefficient when there is ideal coupling?
- 0
 - 100
 - 1**
 - None of the above

55. The field at any point on the axis of a current carrying coil will be
- Perpendicular to the axis.
 - Parallel to the axis.**
 - At an angle of 45° with the axis.
 - Zero.
56. The magnetic flux inside the exciting coil
- Is the same as on its outer surface.**
 - Is zero.
 - Is greater than that on its outside surface
 - Is lower than that on its outside surface.
57. If the two conductors carry current in opposite directions there will be
- A force of attraction between the two conductors.
 - A force of repulsion between the two conductors.**
 - No force between them.
 - None of these
58. **The Fleming left-hand rule is applicable to**
- Generator
 - Motor**
 - Transformer
 - (a) and (b) both
59. The Inductor doesn't allow sudden changes in _
- Voltage
 - Current**
 - Resistance
 - Inductance
60. If a straight conductor of circular cross-section carries a current, then
- No force acts on the conductor at any point
 - An axial force acts on the conductor tending to increase its length.
 - A radial force acts towards the axis tending to reduce its cross-section.**
 - A radial force acts away from the axis tending to increase its cross-section.