

Electrical Machines

1) If a sinusoidal voltage source is connected to a power transformer, its no load current would be

- a) sinusoidal and lagging the voltage by 90°
 - b) sinusoidal and lagging the voltage by less than 90°
 - c) rich in third harmonic and its fundamental would lag the voltage by 90°
 - d) rich in third harmonic and its fundamental would lag the voltage by less than 90°
- = Answer (b) sinusoidal and lagging the voltage by less than 90°

2) In a single-phase transformer, the magnitude of leakage reactance is twice that of resistance of both primary and secondary. With secondary short-circuited, the input power factor is

- a) $\frac{1}{\sqrt{2}}$
 - b) $\frac{1}{\sqrt{5}}$
 - c) $\frac{2}{\sqrt{5}}$
 - d) $\frac{1}{3}$
- = Answer (b) $\frac{1}{\sqrt{5}}$

$$\begin{aligned}\text{Power factor} &= \frac{R}{Z} \\ &= \frac{R_{eq}}{\sqrt{R_{eq}^2 + X_{eq}^2}} \\ &= \frac{R_{eq}}{\sqrt{R_{eq}^2 + (2R_{eq})^2}} \\ &= \frac{R_{eq}}{\sqrt{R_{eq}^2 + 4R_{eq}^2}} \\ &= \frac{R_{eq}}{\sqrt{5R_{eq}^2}} \\ &= \frac{R_{eq}}{R_{eq}\sqrt{5}} \\ &= \frac{1}{\sqrt{5}}\end{aligned}$$

3) The leakage flux in a transformer depends on

- a) applied voltage
 - b) the frequency
 - c) the load current
 - d) mutual flux
- = Answer (c) the load current

4) Voltage regulation of a large transformer is mainly influenced by

- a) no load current and power factor
 - b) winding resistances and load power factor
 - c) leakage fluxes and load power factor
 - d) winding resistances and core loss
- = Answer (c) leakage fluxes and load power factor

5) A 100 KVA, 6600/400 V, 50 Hz single-phase transformer has 80 turns on low voltage side. At 25 Hz its flux increases by 10%. The high voltage and kVA rating at 25 Hz will be respectively

a) 3630 V,55 kVA b) 6600 V,100 kVA c) 7260 V,110 kVA d) 3300 V,50 kVA
 = Answer (a) 3630 V,55 kVA

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$

$$\Rightarrow N_1 = \frac{V_1}{V_2} \times N_2$$

$$\Rightarrow N_1 = \frac{6600}{400} \times 80$$

$$\therefore N_1 = 1320$$

$$E_1 = 4.44 \phi f N_1$$

$$\therefore \phi_m = \frac{E_1}{4.44 f N_1}$$

$$= \frac{6600}{4.44 \times 50 \times 1320}$$

$$= 0.0225 \text{ Wb}$$

At 25 Hz, $\phi_m = 0.0225 \times 1.1$
 $= 0.0247 \text{ Wb}$

$$E_1 = 4.44 \times 0.0247 \times 50 \times 1320$$

$$= 3630 \text{ V}$$

$$\text{kVA rating} = \frac{3630 \times 100}{6600}$$

$$= 55 \text{ kVA}$$

6) Two transformer operating in parallel will share the load according to their

a) leakage reactance b) pu impedance c) efficiency d) rating
 = Answer (d) rating

7) Short-circuit test is performed on a transformer with a certain impressed voltage at rated frequency. If the short-circuit test is now performed with the same magnitude of impressed voltage but at a frequency higher than the rated frequency, then

a) the magnitude of current and power factor both will increase
 b) the magnitude of current will decrease but the power factor will increase
 c) the magnitude of current will increase but the power factor will decrease
 d) the magnitude of current as well as the power factor will decrease
 = Answer (d) the magnitude of current as well as the power factor will decrease

8) Which of the following is correct regarding autotransformer ?

a) The volt-ampere of autotransformer is greater than volt-ampere of two winding transformer
 b) The volt-ampere of autotransformer is same as volt-ampere of two winding transformer
 c) In autotransformer there is induction only
 d) All of the above
 = Answer (a) The volt-ampere of autotransformer is greater than volt-ampere of two winding transformer

9) As the load on transformer is increased, the core losses

a) decrease slightly b) increase slightly c) remain constant d) may decrease or increase slightly depending upon the nature of load
 = Answer (d) may decrease or increase slightly depending upon the nature of load

10) Consider the following statements:

At starting, the field excitation of a DC shunt motor is kept at its maximum value to reduce

1. sparking of brushes
2. acceleration time
3. starting current
4. voltage dip in supply

Of these statements, the correct statements are

a) 1 and 2 b) 2,3 and 4 c) 1,3 and 4 d) 1,2,3 and 4

= Answer (b) 2,3 and 4

11) In a transformer, if the iron and copper losses are 40.5 kW and 50 kW respectively, then at what fraction of load the efficiency will be maximum ?

a) 0.8 b) 0.57 c) 0.70 d) 0.90

= Answer (d) 0.90

At maximum efficiency,

$$x^2 p_c = p_i \text{ [where, } x = \text{loading of transformer}$$

$$p_c = \text{copper loss}$$

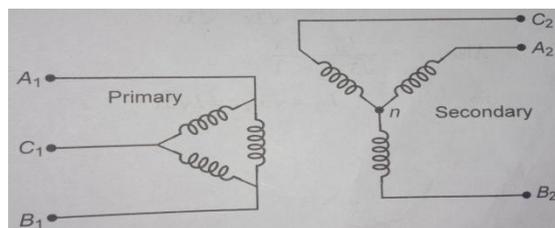
$$p_i = \text{iron loss]}$$

$$\Rightarrow x^2 \times 50 = 40.5$$

$$\Rightarrow x^2 = \frac{40.5}{50}$$

$$\therefore x = 0.90$$

12) In a three-phase Δ/Y transformer shown in the figure, the phase displacement of secondary line voltage with corresponding primary line voltages will be



a) 15° b) 30° lag c) 30° lead d) 180°

= Answer (c) 30° lead

13) As compared to the use of a single series DC motor for electric traction for a given starting time t , the series-parallel control using two similar motors with time $t/2$ for each series and parallel operation would give a saving in starting energy of

a) 100% b) 50% c) 25% d) 10%

= Answer (c) 25%

14) Consider the following statements:

Permanent magnet DC motors used in cassette tape recorders have

- 1.magnets on stator and armature on the rotor.
- 2.magnets on the rotor and armature on the stator.
- 3.electronic commutation and no brushes.
- 4.mechanical commutation.
- 5.automatic speed governors.

Of these statements,the correct statements are

a) 1,3 and 5 b) 1,4 and 5 c) 2,3 and 5 d) 1 and 4

=Answer (b) 1,4 and 5

15) If a 230 V DC series motor is connected to a 230 V AC supply,then the motor will

- a) vibrate violently b) run with less efficiency and more sparking
- c) not run d) None of the above

=Answer (b) run with less efficiency and more sparking

16) The interpoles in DC machines have a tapering shape in order to

- a) reduce the overall weight
- b) reduce the saturation in the interpole
- c) economics on the material required for interpoles and their windings
- d) increase the acceleration of commutation

= Answer (d) increase the acceleration of commutation

17) If two 8-pole DC machines of identical armatures are wound,one with lap winding and the other with wavw winding,then

- a) wave wound machine will have more rated current and more voltage
- b) lap wound machine will have more rated voltage and more current
- c) lap wound machine will have more rated voltage and less current
- d) wave wound machine will have more rated voltage and less current

=Answer (a) wave wound machine will have more rated current and more voltage

18) If the speed of a DC motor increases with load torque,then it is a

- a) series motor b) permanent magnet motor
- c) differentially compounded motor d) cumulatively compounded motor

=Answer (c) differentially compounded motor

19) A DC shunt motor having unsaturated magnetic circuit runs at 1000 rpm with rated voltage.If the applied voltage is half of the rated voltage,the motor will run at

a) 2000 rpm b) 1000 rpm c) 750 rpm d) 500 rpm

Answer = (b) 100 rpm

20) A 4-pole DC generator is running at 1500 rpm. The frequency of current in the armature winding will be

a) 25 Hz b) 50 Hz c) 100 Hz d) 200 Hz

= Answer (b) 50 Hz

Frequency of current in the armature winding

$$\begin{aligned} &= \frac{PN_s}{120} \\ &= \frac{4 \times 1500}{120} \\ &= 50 \text{ Hz} \end{aligned}$$

21) Consider the following statements :

1. Interpole windings are connected in series with armature winding.
 2. Polarity of interpole must be the same as that of the main pole in advance.
 3. Distortion of the main field under the pole shoes is not affected by the use of interpoles.
- Of these statements regarding interpole used in DC motors, the correct statement(s) is/are

a) 1 and 2 b) 2 and 3 c) 1 and 3 d) Only 1

= Answer (b) 2 and 3

22) Consider the following statements :

For a level compounded DC generator to run at constant speed, the series field mmf must effectively compensate –

1. Armature reaction mmf
2. Armature resistance voltage drop
3. Brush contact voltage drop

Of these statements, correct statement(s) is/are

a) Only 2 b) 1 and 2 c) 1 and 3 d) 1, 2 and 3

= Answer (b) 1 and 2

23) A DC shunt motor has external resistances of R_a and R_f in the armature and field circuits respectively. Armature current at starting can be reduced by keeping

a) R_f maximum and R_a minimum b) R_a maximum and R_f maximum
c) R_a minimum and R_f minimum d) R_a maximum and R_f minimum

= Answer (d) R_a maximum and R_f minimum

24) A pair of similar DC shunt generators operate in parallel and supply a common load. It is required to switch-off machine 1 and allow machine 2 to supply the entire load. The following operations are to be used to achieve this :

1. Switch-off the main switch of machine 1.
2. Reduce the field current of machine 1.
3. Increase the field current of machine 2.
4. Ensure that machine 1 just floats.

The correct sequence of these operations is

a) 4, 3, 2 and 1 b) 2, 3, 4 and 1 c) 2, 4, 3 and 1 d) 3, 2, 4 and 1

= Answer (b) 2,3,4 and 1

25) Consider the following statements about Commutating poles which are fitted on most large DC shunt motors :

1. The commutating poles are placed in the geometric neutral planes and their number is usually equal to the number of main poles.
2. The winding on the commutating poles is connected in series with the shunt field winding on the main poles.
3. The polarity of the commutating pole must be that of the next main pole further ahead.
4. The commutating poles neutralize the reactance voltage produced in the coil undergoing commutation.

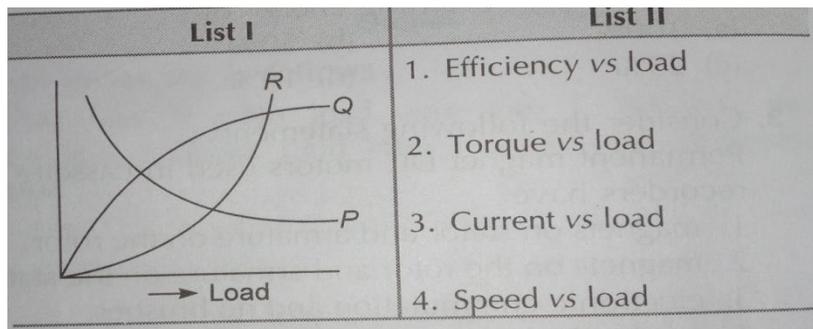
Of these statements, the correct statements are

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

= Answer (b) 1 and 4

26) Typical characteristics of a DC series motor, operating under loaded condition, are shown in the following figure. List I gives the identification of these characteristics while List II gives the description of important load characteristics of DC motors working on load.

Match List I with List II and select the correct answer using the codes given below the lists.



Codes

- | | | |
|------|---|---|
| P | Q | R |
| a) 4 | 2 | 3 |
| b) 2 | 3 | 1 |
| c) 3 | 2 | 1 |
| d) 4 | 1 | 2 |

= Answer (d) 4 1 2

27) 'Crawling' in an induction motor is due to

- a) time harmonics in supply b) slip-ring rotor
 c) space harmonics produced by winding currents d) insufficient starting torque

= Answer (c) space harmonics produced by winding currents

28) Match List I with List II and select the correct answer using the codes given below the lists.

	List I	List II
P.	Single-phase induction motor	1. Rotor resistance starting
Q.	3-phase slip-ring induction motor	2. Not self starting
R.	3-phase squirrel cage induction motor	3. Autotransformer starting

Codes

- P Q R
a) 2 1 3
b) 1 2 3
c) 2 3 1
d) 3 1 2
=Answer (a) 2 1 3

29) As compared to DOL starting, a cage induction motor with star-delta starting shall have

- a) more starting torque b) more starting time
c) reduced starting current d) smoother acceleration
= Answer (c) reduced starting current

30) Slip test is performed to determine

- a) slip
b) direct axis reactance and quadrature axis
c) positive sequence reactance and negative sequence reactance
d) sub-transient reactance
= Answer (b) direct axis reactance and quadrature axis

31) The speed of a 3-phase induction motor is controlled from 1 pu to 2 pu using a variable frequency inverter. The equivalent circuit parameter which is most likely to vary is

- a) stator leakage inductance b) rotor leakage inductance
c) magnetising inductance d) core loss resistance
= Answer (c) magnetising inductance

32) In a 3-phase induction motor, torque and the supply voltage are related as

- a) $T \propto V^{1/2}$ b) $T \propto V$ c) $T \propto V^2$ d) $T \propto \frac{1}{V}$
= Answer (c) $T \propto V^2$

33) Maximum starting torque of a 3-phase induction motor is obtained when the rotor resistance is

- a) equal to the rotor reactance b) very small and rotor reactance is large
c) double that of the rotor reactance d) 1.5 times rotor reactance
= Answer (a) equal to the rotor reactance

34) If R_2 is the standstill rotor resistance of an induction motor running at a slip s , the mechanical load equivalent to an electrical resistance R_L in a stationary equivalent circuit is equal to

a) $\frac{R_2}{s}$ b) $\frac{R_2}{s^2}$ c) $\frac{R_2(1-s)}{s}$ d) $\frac{R_2(1-s^2)}{s}$
 = Answer (c) $\frac{R_2(1-s)}{s}$

35) The speed of a 3-phase induction motor operating in its stable region

- a) decreases with increase in load torque
 - b) increases with increase in load torque
 - c) decreases with decrease in load torque
 - d) remains constant
- = Answer (a) decreases with increase in load torque

36) The starting torque of a 3- phase induction motor can be increased by increasing the

- a) rotor resistance b) rotor reactance c) stator resistance d) stator reactance
- = Answer (a) rotor resistance

37) In a 3-phase squirrel cage induction motor,skewing of rotor slots rduces

- a) parasitic torque and noise but increases pullout torque
 - b) parasitic torque and noise but increases starting torque
 - c) noise but increases pullout torque and parasitic torque
 - d) parasitic torque,noise,pullout torque and starting totorque
- = Answer (d) parasitic torque,noise,pullout torque and starting totorque

38) The chording angle for eliminating 5th harmonics should be

- a) 30° b) 34° c) 36° d) 35°

= Answer (c) 36°

For eliminating 5th harmonic

$\cos\frac{n\alpha}{2}$ should be zero

$$\cos\frac{n\alpha}{2} = 0$$

$$\Rightarrow \cos\frac{n\alpha}{2} = \cos\frac{\pi}{2}$$

$$\Rightarrow \frac{5\alpha}{2} = \frac{\pi}{2}$$

$$\Rightarrow 5\alpha = \pi$$

$$\Rightarrow \alpha = \frac{180}{5}$$

$$\therefore \alpha = 36^\circ$$

39) An induction motor and synchronous motor are connected to a common feeder line.To operate the feeder line at unity power factor,the synchronous motor should be

- a) under-excited b) over-excited
 - c) normally-excited d) disconnected from the common terminals
- = Answer (b) over-excited

40) Match List I (power factor) with List II (armature reaction of an alternator) and select the correct answer using the codes given below the lists.

List I		List II		
P. UPF		1. Fully demagnetising		
Q. ZPF		2. Fully magnetising		
R. ZPF leading		3. Cross-magnetising		
S. Intermediate lagging		4. Partly cross-magnetising and partly demagnetising		
Codes				
	P	Q	R	S
(a)	3	1	4	2
(b)	3	1	2	4
(c)	1	3	2	4
(d)	1	3	4	2

= Answer (b) 3 1 2 4

41) A synchronous motor with negligible armature resistance runs at load angle at 20° at the rated frequency. If supply frequency is increased by 10%, keeping other parameter constant, the new load angle will be

a) 12° b) 18° c) 20° d) 22°

= Answer (d) 22°

42) Consider the following statements :

The synchronous generators used in thermal power stations have

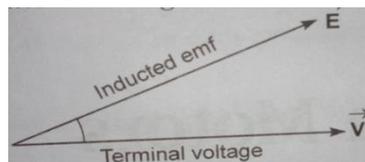
1. cylindrical rotor.
2. slip rings and brushes.
3. laminated rotor.
4. stator slots in multiple of 6.
5. 3-phase star-connected stator winding.

Of these statements, the correct statements are

a) 1,2,3 and 4 b) 1,2,3 and 5 c) 3,4 and 5 d) 1,2,4 and 5

= Answer (b) 1,2,3 and 5

43) The phasor diagram of a synchronous machine connected to an infinite bus is shown in the figure. The machine is acting as a



a) generator and operating at a lagging power factor

b) generator and operating at a leading power factor

c) motor and operating at a leading power factor

d) motor and operating at a lagging power factor

= Answer (a) generator and operating at a lagging power factor

44) For a P pole machine, the relation between electrical and mechanical degrees is given by

- a) $\theta_{elec} = \frac{P}{2} \theta_{mech}$ b) $\theta_{elec} = \frac{4}{P} \theta_{mech}$ c) $\theta_{mech} = \theta_{elec}$ d) None of these
= Answer (a) $\theta_{elec} = \frac{P}{2} \theta_{mech}$

45) The distribution factor is the ratio of

- a) arithmetic sum of coil emfs to phasor sum of coil emfs
b) phasor sum of emf per coil to the arithmetic sum of emf per coil
c) phasor sum of coil emfs to the arithmetic sum of coil emfs
d) phasor sum of coil emfs to the per phase voltage
= Answer (c) phasor sum of coil emfs to the arithmetic sum of coil emfs

46) Main advantage of using fractional-pitch winding is to reduce

- a) amount of copper in the winding
b) size of the machine
c) harmonics in the generated emf
d) cost of the machine
= Answer (c) harmonics in the generated emf

47) The zero power factor characteristic for the Potier's diagram can be obtained by loading the alternator using

- a) lamp load b) synchronous motor c) water load d) DC motor
= Answer (b) synchronous motor

48) In a synchronous machine, damper windings are used to

- a) help in starting as a motor
b) run it as an induction motor
c) help in starting as a motor and to reduce hunting
d) increase efficiency
= Answer (c) help in starting as a motor and to reduce hunting

49) Match List I with List II and select the correct answer using the codes given below the lists.

List I		List II	
P.	Currents in damper windings	1.	Direct axis synchronous reactance
Q.	Currents in field windings	2.	Quadrature axis synchronous reactance
R.	Armature currents with unity internal power factor	3.	Transient reactance
S.	Armature currents with zero power factor	4.	Sub-transient reactance

Codes				
	P	Q	R	S
(a)	4	3	1	2
(b)	3	4	2	1
(c)	3	4	1	2
(d)	4	3	2	1

= Answer (d) 4 3 2 1

50) In a 3-phase star-connected generator, if the fundamental and third harmonic rms voltages in each phase are respectively V_1 and V_3 , the line voltage of the generator will be

a) $\sqrt{3(V_1^2 + V_3^2)}$ b) $\sqrt{3}V_1$ c) $\sqrt{3}(V_1 + \frac{V_3}{3})$ d) None of these

= Answer (b) $\sqrt{3}V_1$

51) Which of the following capacitors start split-phase induction motors will have the largest value of capacitance ?

a) ½ HP, 3450 rpm b) ½ HP, 1725 rpm c) ½ HP, 1140 rpm d) ¾ HP, 1140 rpm

= Answer (d) ¾ HP, 1140 rpm

52) While a 2-pole AC servomotor is in operation, if the voltage across the control field winding becomes zero, then the motor has a tendency to run as a single-phase induction motor. To prevent this

a) rotor having high mass moment of inertia is used for such a motor

b) drag-cup type of light rotor with high rotor resistance is preferred

c) a low rotor resistance is used

d) the number of turns in the control field winding used is less than the main reference winding

= Answer (b) drag-cup type of light rotor with high rotor resistance is preferred

53) Match List I (type of single-phase motor) with List II (type of appliance) and select the correct answer using the codes given below the lists.

List I		List II	
P.	Permanent magnet type	1.	Rocket
Q.	Shaded pole	2.	Refrigerator compressor
R.	Universal	3.	Sewing machine
S.	Capacitor-shunt, capacitor-run induction motor	4.	Photocopying machine

Codes				
	P	Q	R	S
(a)	1	2	3	4
(b)	1	2	4	3
(c)	4	1	3	2
(d)	1	4	3	2

= Answer (d) 1 4 3 2

54) Which of the following single-phase motor has highest starting torque ?

- a) split-phase motor b) Shaded pole motor
c) Capacitor-start motor d) Repulsion motor

= Answer (c) Capacitor-start motor

55) A capacitor-start single-phase induction motor is switched-on to supply with its capacitor replaced by an induction of equivalent reactance value. It will

- a) not start b) start and run c) start and then stall d) None of these

= Answer (a) not start

56) In a two-value capacitor motor, the capacitor used for running purpose is

- a) dry type AC electrolytic capacitor
b) paper spaced oil filled type
c) an air capacitor
d) ceramic type

= Answer (b) paper spaced oil filled type

57) The capacitor in a capacitor-start induction motor is connected in series with

- a) starting winding b) running winding
c) squirrel cage winding d) compensating winding

= Answer (a) starting winding

58) The starting capacitor of a single-phase motor is

- a) electrolytic capacitor b) ceramic capacitor
c) paper capacitor d) None of these

= Answer (a) electrolytic capacitor

59) Which of the following single-phase motor will operate at high power factor ?

- a) shaded-pole motor b) capacitor run motor
c) split-phase motor d) capacitor start motor

= Answer (b) capacitor run motor

60) In a shaded pole motor, shading coils are used to

- a) reduce winding losses
 - b) reduce friction losses
 - c) produce rotating magnetic field
 - d) to protect against sparking
- = Answer (c) produce rotating magnetic field

61) If an AC servomotor has one of its winding excited by AC, then voltage measured at the other winding with rotor running will be

- a) zero
 - b) proportional to rotor speed
 - c) proportional to the square of the rotor speed
 - d) constant independent of speed
- = Answer (b) proportional to rotor speed

62) In an AC servomotor, the control winding is supplied with input voltage of

- a) same frequency as the reference winding voltage but with 90° phase difference
 - b) same frequency as the reference winding voltage and also having same phase
 - c) any frequency compared to the reference winding but with 90° phase difference
 - d) any frequency compared to the reference winding but of the same phase
- = Answer (a) same frequency as the reference winding voltage but with 90° phase difference

63) A two-phase servomotor develops maximum torque at

- a) forward speed of one-half of the synchronous speed
 - b) backward speed of one-half of the synchronous speed
 - c) synchronous speed
 - d) a speed of twice the synchronous speed
- = Answer (a) forward speed of one-half of the synchronous speed

64) An AC servomotor exhibits

- a) two time constants which depend upon rotor inertia and mechanical friction
 - b) two time constants which depend upon rotor inertia, the slope of its torque-speed characteristic and mechanical friction
 - c) a dominant time constant which depend upon rotor inertia and mechanical friction
 - d) a dominant time constant which depend upon rotor inertia, the slope of its torque-speed characteristic and mechanical friction
- = Answer (d) a dominant time constant which depend upon rotor inertia, the slope of its torque-speed characteristic and mechanical friction

65) Two transformer of different kVA ratings working in parallel, share the load in proportion to their ratings when their,

- a) per unit leakage impedances on the same kVA base are the same
 - b) per unit leakage impedances on their respective ratings are equal
 - c) ohmic value of the leakage impedances are inversely proportional to their ratings
 - d) ohmic values of the magnetising reactances are the same
- = Answer (b) per unit leakage impedances on their respective ratings are equal

66) A 220/440 V,50 Hz,5 kVA single-phase transformer operates on 220 V,40 Hz supply with secondary winding.Then

- a) the eddy current loss and hysteresis loss of the transformer decrease
 - b) the eddy current loss and hysteresis loss of the transformer increase
 - c) the hysteresis loss of the transformer increases while eddy current loss remains the same
 - d) the hysteresis loss remains the same whereas eddy current loss decreases
- = Answer (a) the eddy current loss and hysteresis loss of the transformer decrease

67) Two transformer of the same type,using the same grade of iron and conductor materials,are designed to work at the same flux and current densities but the linear dimensions of one are two times those of the other in all respects.The ratio of kVA ratings of the two transformer closely equals

- a) 16 b) 8 c) 4 d) 2
- = Answer (a) 16

68) The hysteresis and eddy current losses of a single phase transformer working on 200 V,50 Hz supply are P_h and P_e respectively.The percentage decrease in these,when operated on a 160 V,40 Hz supply are

- a) 32,36 b) 20,36 c) 25,20 d) 40,80
- = Answer (b) 20,36

69) Two transformer of identical voltages but of different capacities are operating in parallel.For satisfactory load sharing

- a) impedances must be equal
 - b) per unit impedances on their own rating must be equal
 - c) per unit impedances and X/R ratios must be equal
 - d) impedances and X/R ratios must be equal
- = Answer (b) per unit impedances on their own rating must be equal

70) Supply to one terminal of a delta-star connected three-phase core type transformer which is on no load.Assuming magnetic circuit symmetry.voltages on the secondary side will be

- a) 230,230,115 b) 230,115,115 c) 345,115,115 d) 345,0,345
- = Answer (b) 230,115,115

71) Autotransformer is used in transmission and distribution

- a) when operator is not available
 - b) when iron losses are to be reduced
 - c) when efficiency considerations can be ignored
 - d) when the transformation ratio is small
- = Answer (d) when the transformation ratio is small

72) When a transformer winding suffers a short-circuit,the adjoining turns of the same winding experience

a) an attractive force b) a repulsive force c) no force d) None of these
= Answer (a) an attractive force

73) The winding of a Q kVA, V_1/V_2 three-phase, delta connected, core type transformer are reconnected to work as a single-phase transformer. The maximum voltage and power ratings of the new configuration are

a) $\frac{3V_1}{3V_2}, 3Q$ b) $\frac{V_1}{V_2}, \frac{Q}{3}$ c) $\frac{\sqrt{3}V_1}{\sqrt{3}V_2}, 2Q$ d) $\frac{2V_1}{2V_2}, \frac{2Q}{3}$
= Answer (b) $\frac{V_1}{V_2}, \frac{Q}{3}$

74) In a constant voltage transformer (CVT), the output voltage remains constant due to

a) capacitor b) input inductor c) saturation d) tapped windings
= Answer (a) capacitor

75) A single-phase transformer is to be switched to the supply to have minimum inrush current. The switch should be closed at

a) maximum supply voltage
b) zero supply voltage
c) $\frac{1}{\sqrt{2}}$ maximum supply voltage
d) $\frac{1}{2}$ maximum supply voltage
= Answer (a) maximum supply voltage

76) The core flux of a practical transformer with a resistive load

a) is strictly constant with load changes
b) increases linearly with load
c) increases as the square root of the load
d) decreases with increased load
= Answer (a) is strictly constant with load changes

77) A 1 kVA, 230 V/100 V, single-phase, 50 Hz transformer having negligible winding resistance and leakage inductance is operating under saturation, while 250 V, 50 Hz sinusoidal supply is connected to the high voltage winding. A resistive load is connected to the low voltage winding which draws rated current. Which one of the following quantities will not be sinusoidal ?

a) Voltage induced across the low voltage winding
b) Core flux
c) Load current
d) Current drawn from the source
= Answer (d) Current drawn from the source

78) A single-phase transformer has a maximum efficiency of 90% at full load and unity power factor. Efficiency at half load at the same power factor is

a) 86.7% b) 88.26% c) 88.9% d) 87.8%
 = Answer (d) 87.8%

79) The equivalent circuit of a transformer has leakage reactances X_1, X'_2 and magnetizing reactance X_M . Their magnitude satisfy

a) $X_1 \gg X'_2 \gg X_M$ b) $X_1 \ll X'_2 \ll X_M$
 c) $X_1 \approx X'_2 \gg X_M$ d) $X_1 \approx X'_2 \ll X_M$
 = Answer (d) $X_1 \approx X'_2 \ll X_M$

80) Which three-phase connection can be used in a transformer to introduce a phase difference of 30° between its output and corresponding input line voltages ?

a) Star-star b) Star-delta c) Delta-delta d) Delta-zigzag
 = Answer (b) Star-delta

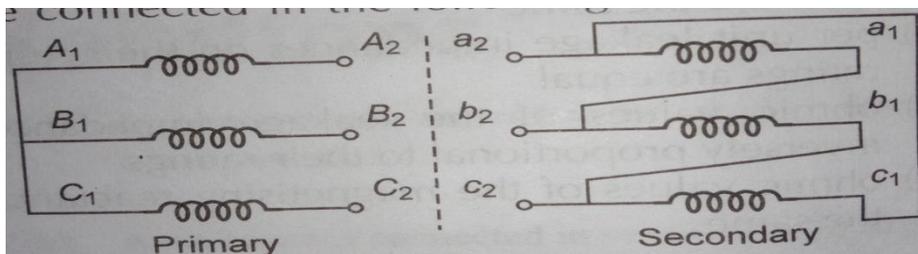
81) In transformers, which of the following statements is valid ?

a) In an open-circuit test, copper losses are obtained while in short-circuit test, core losses are obtained
 b) In an open-circuit test, current is drawn at high power factor
 c) In a short-circuit test, current is drawn at zero power factor
 d) In an open-circuit test, current is drawn at low power factor
 = Answer (d) In an open-circuit test, current is drawn at low power factor

82) In a transformer zero voltage regulation at full-load is

a) not possible
 b) possible at unity power factor load
 c) possible at leading power factor load
 d) possible at lagging power factor
 = Answer (c) possible at leading power factor load

83) Three single-phase transformers are connected to form a 3-phase transformer bank. The transformers are connected in the following manner :



a) Yd0 b) Yd1 c) Yd6 d) Yd11
 = Answer (b) Yd1

84) Match List I (the windings of large DC series motor) with List II (their functions) and find the correct answer using the codes given below the lists.

List I		List II	
P. Series field winding		1. To avoid field distortion under the pole	
Q. Shunt field winding		2. To avoid sparking	
R. Commutating pole winding		3. To generate working flux	
S. Compensating windings		4. To avoid runaway speeds on no load	
Codes			
P	Q	R	S
(a) 3	4	2	1
(b) 4	3	2	1
(c) 2	3	1	4
(d) 1	2	4	3

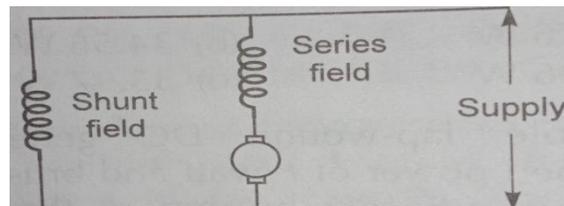
= Answer (a) 3 4 2 1

85) Neglecting all losses, the developed torque (T) of a DC separately excited motor, operating under constant terminal voltage, is related to its output power (P) as under

a) $T \propto \sqrt{P}$ b) $T \propto P$ c) $T^2 \propto P^2$ d) T is independent of P

= Answer (b) $T \propto P$

86) A cumulative compounded long shunt motor is driving a load at rated torque and rated speed. If the series field is shunted by a resistance equal to the resistance of the series field, keeping the torque constant,



- a) the armature current increases
- b) the motor speed increases
- c) the armature current decreases
- d) the motor speed decreases

= Answer (a,b)

87) A differentially compounded DC motor with interpoles and with brushes on the neutral axis is to be driven as a generator in the same direction with the same polarity of the terminal voltage. Then, it will be a

- a) cumulatively compounded generator but the interpole coil connections are to be reversed
- b) cumulatively compounded generator without reversing the interpole coil connections
- c) differentially compounded generator without reversing the interpole coil connections
- d) differentially compounded generator but the interpole coil connections are to be reversed

= Answer (b) cumulatively compounded generator without reversing the interpole coil connections

88) The torque speed characteristic of a repulsion motor resembles which of the following DC motor characteristic ?

- a) Separately excited b) Shunt c) Series d) Compound

= Answer (c) Series

89) A 4-pole generator with 16 coil has a two layer winding. The pole pitch is

a) 32⁰ b) 16⁰ c) 8⁰ d) 4⁰

= Answer (d) 4⁰

Number of conductor,

$$Z = 16 \times 2 \\ = 32$$

Is in double layer so number of slot = 16

$$\text{Pole pitch} = \frac{\text{Slots}}{\text{pole}} \\ = \frac{16}{4} \\ = 4$$

90) A 4-pole lap wound DC generator has a developed power of P watt and brush voltage of E volt. Two adjacent brushes of the machine are removed as they are burn out. If the machine operates with the remaining brushes, the developed voltage and power that can be obtained from the machine are

a) E,P b) E/2,P/2 c) E,P/4 d) E,P/2

= Answer (c) E,P/4

91) The compensating winding in a DC machine is located

a) in armature slot for compensation of the armature reaction

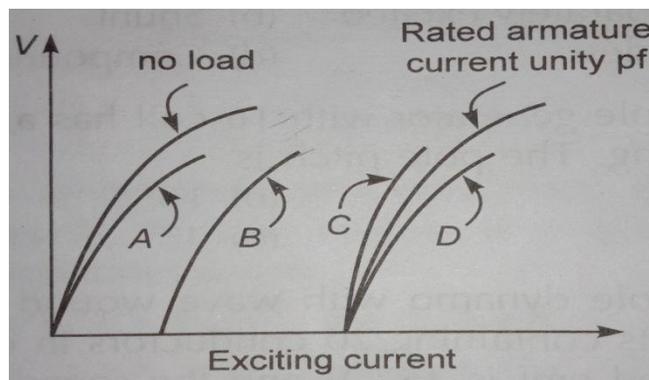
b) on compensating poles for improving the comutaion.

c) on pole shoes for avoiding the flashover at the comutation surface

d) on pole shoes to avoid the sparking at the brushes

= Answer (c) on pole shoes for avoiding the flashover at the comutation surface

92) Figure shows the magnetization curves of an alternator at rated armature current, unity power factor and also at no load. The magnetization curve for rated armature current, 0.8 power factor leading is given by



a) curve A

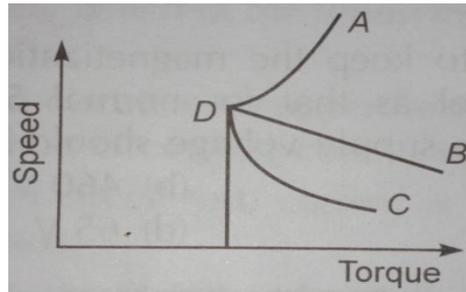
b) curve B

c) curve C

d) curve D

= Answer (c) curve C

93) A DC series motor fed from rated supply voltage is over loaded and its magnetic circuit is saturated. The torque-speed characteristic of this motor will be approximately represented by



- a) curve A
 - b) curve B
 - c) curve C
 - d) curve D
- = Answer (b) curve B

94) The DC motor, which can provide zero speed regulation at full load without any controller, is

- a) series
 - b) shunt
 - c) cumulative compound
 - d) differential compound
- = Answer (b) shunt

95) Distributed winding and short chording employed in AC machines will result in

- a) increase in emf and reduction in harmonic
 - b) reduction in emf and increase in harmonics
 - c) increase in both emf and harmonics
 - d) reduction in both emf and harmonics
- = Answer (a) increase in emf and reduction in harmonics

96) A three phase slip ring induction motor is fed from the rotor side with stator winding short circuited. The frequency of the currents flowing in the short circuited stator is

- a) slip frequency
 - b) supply frequency
 - c) frequency corresponding to rotor speed
 - d) zero
- = Answer (a) slip frequency

97) Skew is used in induction motors in order to reduce torque due to

- a) time harmonics
 - b) space harmonics
 - c) slots harmonics
 - d) reverse rotating fields
- = Answer (c) slots harmonics

98) A 6-pole 50 Hz induction motor rotating at 1400 rpm is inmode

a) generating b) breaking c) motoring d) None of these
= Answer (a) generating

$$N_s = \frac{120f}{P}$$
$$= \frac{120 \times 50}{6}$$
$$= 1000 \text{ rpm}$$
$$S = \frac{N_s - N_r}{N_s}$$
$$= \frac{1000 - 1400}{1000}$$
$$= -0.4$$

Slip s less than 1, so motor will run as a generator.

99) An induction motor is fed from a balanced three phase supply at rated voltage and frequency through a bank of three single phase transformers connected in delta-delta. One unit of the bank develops fault and is removed. The,

- a) single phasing will occur and the machine fails to start
 - b) single phasing will not occur but the motor terminal voltages will become unbalanced and the machine can be loaded to the extent of 57.7% of its rating
 - c) the machine can be loaded to the extent of 57.7% of its rating with balanced supply at its terminals
 - d) the machine can be loaded to the extent of $66\frac{2}{3}\%$ with balanced supply at its terminals
- = Answer (c) the machine can be loaded to the extent of 57.7% of its rating with balanced supply at its terminals

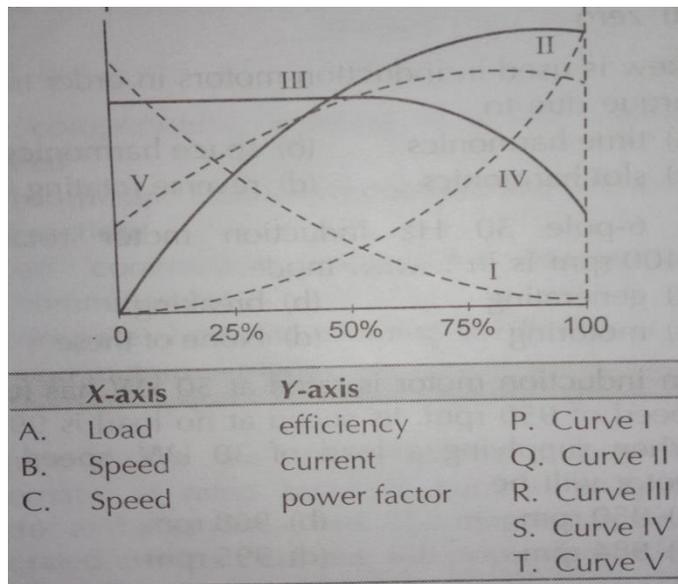
100) Unbalanced supply voltage given to a 3-phase, delta connected induction motor will cause

- a) zero sequence currents
 - b) less heating of the rotor
 - c) negative sequence component current
 - d) All of the above
- = Answer (c) negative sequence component current

101) In an induction motor, if the air gap is increased

- a) speed will reduce
 - b) efficiency will improve
 - c) power factor will be lowered
 - d) breakdown torque will reduce
- = Answer (c) power factor will be lowered

102) Out of the following characteristic shown in figure identify the appropriate one to match the following for a 3-phase induction motor



- a) A-Q,B-R,C-T
 - b) A-P,B-R,C-T
 - d) A-R,, B-Q,C-T
 - d) A-S,B-T,C-P
- = Answer (a) A-Q,B-R,C-T

103) When the supply voltage to an induction motor is reduced by 10%,the maximum torque will reduced by approximately

- a) 5% b) 10% c) 20% d) 40%
- = Answer (c) 20%

104) If an induction machine is run at above synchronous speed,it act as

- a) a synchronous motor b) an induction generator
 - c) an induction motor d) None of these
- = Answer (b) an induction generator

105) Starting torque can be obtained in the case of a single-phase induction motor with identical main and auxiliary winding by connecting

- a) a capacitor across the mains
 - b) a capacitor in series with the machine
 - c) a capacitor in series with the auxiliary winding
 - d) the main and the auxiliary windings in series
- = Answer (c) a capacitor in series with the auxiliary winding

106) The following starting method for an induction motor is inferior in view of the poor starting torque per ampere of the line current drawn

- a) direct on line starting
 - b) auto transformer method of starting
 - c) series induction method of starting
 - d) star delta method of starting
- = Answer (a) direct on line starting

107) The phase sequence of a three-phase alternator will reverse if

- a) the field current is reversed keeping direction of rotation same
 - b) the field current remains the same but the direction of rotation is reversed
 - c) the field current is reversed and the number of poles is doubled
 - d) the number of poles is doubled without reversing the field current
- = Answer (b) the field current remains the same but the direction of rotation is reversed

108) If a 400 V, 50 Hz, star connected, 3 phase squirrel cage induction motor is operated from a 400 V, 75 Hz supply, the torque that the motor can now provide while drawing rated current from the supply ?

- a) Reduces b) Increases
 - c) Remains the same d) Increase or reduces, depending upon the rotor resistance
- = Answer (a) Reduces

109) No load test on a 3-phase induction motor was conducted at different supply voltages and a plot of input power versus voltage was drawn. This curve was extra-plotted to intersect the Y-axis. This intersection points yields

- a) core loss b) stator copper loss
 - c) stray load loss d) friction and windage loss
- = Answer (d) friction and windage loss

110) Match List I (different applications) and List II (the motor for these applications) and find the correct answer using the codes given below the lists

List I		List II	
P. Food mixer		1. Permanent magnet DC motor	
Q. Cassette tape recorder		2. Single-phase induction motor	
R. Domestic water pump		3. Universal motor	
S. Escalator		4. Three-phase induction motor	
		5. DC series motor	
		6. Stepper motor	

Codes				
	P	Q	R	S
(a)	3	6	4	5
(b)	1	3	2	4
(c)	3	1	2	4
(d)	3	2	1	4

= Answer (c) 3 1 2 4

111) The direction of rotation of a 3-phase induction motor is clockwise when it is supplied 3-phase sinusoidal voltage having phase sequence A-B-C. For counter clockwise rotation of the motor, the phase sequence of the power supply should be

- a) B-C-A b) C-A-B c) A-C-B d) B-C-A or C-A-B

= Answer (c) A-C-B

112) The type of a single-phase induction motor having the highest power factor at full load is

- a) shaded pole type
- b) split phase type
- c) capacitor start type
- d) capacitor run type

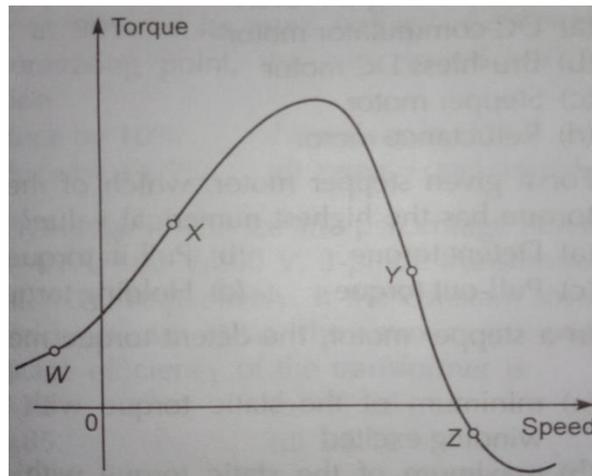
= Answer (d) capacitor run type

113) For an induction motor, operating at a slip s , the ratio of gross power output to air gap power is equal to

- a) $(1 - s)^2$
- b) $(1-s)$
- c) $\sqrt{(1 - s)}$
- d) $(1-\sqrt{s})$

= Answer (b) $(1-s)$

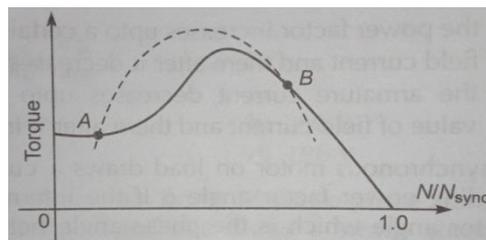
114) On the torque-speed curve of induction motor shown in figure, four points of operation are marked as W, X, Y and Z. Which one of them represents the operation at a slip greater than 1 ?



- a) W
- b) X
- c) Y
- d) Z

= Answer (a) W

115) A 3-phase squirrel cage induction motor supplied from a balanced 3-phase source drives a mechanical load. The torque-speed characteristic of the motor (solid curve) and of the load (dotted curve) are shown. Of the two equilibrium points A and B, which of the following options correctly describes the stability of A and B ?



- a) A is stable B is unstable
- b) A is unstable B is stable

- c) Both are stable
- d) Both are unstable

= Answer (a) A is stable B is unstable

116) Damper winding is provided in a polyphase synchronous motor in order to

- a) depend out the noise of the machine
 - b) prevent hunting
 - c) provide starting torque
 - d) provide a cylindrical structure o reduce wind friction
- = Answer (c) provide starting torque

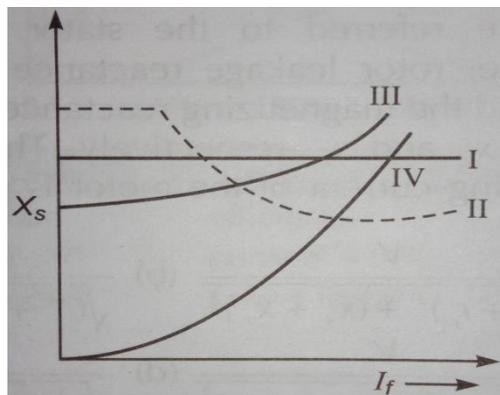
117) The torque angle of a synchronous machine operating from a constant voltage bus is usually defined as the space angle between

- a) rotor mmf wave and stator mmf wave
 - b) rotor mmf wave and resultant flux density wave
 - c) stator mmf wave and resultant flux density wave
 - d) stator mmf wave and resultant mmf wave
- = Answer (a) rotor mmf wave and stator mmf wave

118) A synchronous motor operates at 0.8 power factor lagging. If the field current of the motor is continuously increased

- a) the power factor decreases upto a certain value of field current and there after it increases
 - b) the armature current increases upto a certain value of field current and there after it decreases
 - c) the power factor increases upto a certain value of field current and there after it decreases
 - d) the armature current decreases upto a certain value of field current and there after it increases
- = Answer (d) the armature current decreases upto a certain value of field current and there after it increases

119) In figure the characteristic that corresponds to the variation of synchronous reactance of a synchronous motor with field current is



- a) curve I
 - b) curve II
 - c) curve III
 - d) curve IV
- =Answer (b) curve II

120) During hunting of synchronous motor

- a) negative phase sequyence currents re generated
- b) harmonics are developed in the armature circuit

- c) damper bar develops torque
 - d) field excitation increases
- = Answer (c) damper bar develops torque

121) A cylindrical rotor synchronous motor is switched on the supply with its field windings shorted on themselves, it will

- a) not start
 - b) start but no run at synchronous speed
 - c) start as an induction motor and then run as synchronous motor
 - d) start and run as a synchronous speed
- = Answer (b) start but no run at synchronous speed

122) It is desirable to eliminate 5th harmonic voltage from the phase voltage of an alternator. The coil should be short-pitched by an electrical angle of

- a) 30° b) 36° c) 72° d) 18°
- = Answer (b) 36°

$$\cos \frac{5\alpha}{2} = 0$$

$$\Rightarrow \cos \frac{5\alpha}{2} = \cos 90$$

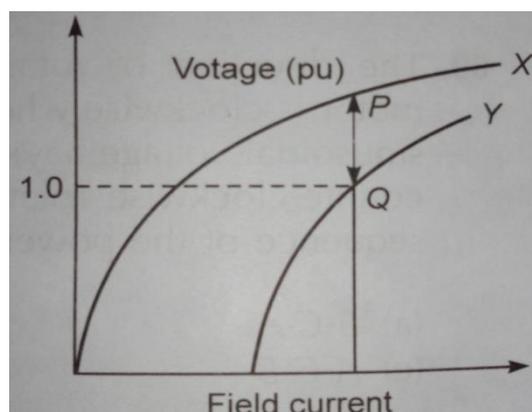
$$\Rightarrow \frac{5\alpha}{2} = 90$$

$$\therefore \alpha = 36$$

123) A stand alone engine driven synchronous generator is feeding a partly inductive load. A capacitor is now connected across the load to completely nullify the inductive current. For this operating condition

- a) the field current and fuel input have to be reduced
 - b) the field current and fuel input have to be increased
 - c) the field current has to be increased and fuel input left unaltered
 - d) the field current has to be reduced and fuel input left unaltered
- = Answer (d) the field current has to be reduced and fuel input left unaltered

124) Curve X and Y in figure denote open circuit and full load zero power factor (ZPF) characteristic of a synchronous generator. Q is a point on the ZPF characteristic at 1.0 pu voltage. The vertical distance PQ in figure gives the voltage drop across



a) synchronous reactance b) magnetising reactance
 c) Potier reactance d) leakage reactance
 = Answer (a) synchronous reactance

125) Which of the following motor definitely has permanent magnet rotor ?

a) DC commutator motor b) Brushless DC motor
 c) Stepper motor d) Reluctance motor
 = Answer (c) Stepper motor

126) For a given stepper motor, which of the following torque has the highest numerical value ?

a) Detent torque b) Pull-in torque c) Pull-out torque d) Holding torque
 = Answer (d) Holding torque

127) In a stepper motor, the detent torque means

a) minimum of the static torque with the phase winding excited
 b) maximum of the static torque with the phase winding excited
 c) minimum of the static torque with the phase winding unexcited
 d) maximum of the static torque with the phase winding unexcited
 = Answer (c) minimum of the static torque with the phase winding unexcited

128) Out of the following factors for a DC machine :

- I. Interpole
- II. Armature resistance
- III. Armature leakage reactance
- IV. Reduction in field current
- V. Armature reaction

The factors that are responsible for decrease in the terminal voltage of a shunt generator are

a) I, II and IV b) II, III and V c) II, IV and V d) II, IV and V
 = Answer (d) II, IV and V

129) In relation to DC machines, match List I (performance variables) with List II (proportional to) and indicate the correct answer using the codes given below the lists.

List I		List II	
P. Armature emf (E)		1. Flux (ϕ), speed (ω) and armature current I_a	
Q. Developed torque (T)		2. ϕ and ω	
R. Developed power (P)		3. ϕ and I_a	
		4. I_a and ω	
		5. I_a only	
Codes			
	P	Q	R
(a)	3	2	1
(b)	2	5	4
(c)	3	5	4
(d)	2	3	1

= Answer (d) 2 3 1

130) A 50 kW DC shunt motor is loaded to draw rated armature current at any given speed. When driven (i) at half the rated speed by armature voltage control and (ii) at 1.5 times the rated speed by field control, the respective output powers delivered by the motor are approximately.....

- (a) 25 kW in (i) and 75 kW in (ii)
- (b) 25 kW in (i) and 50 kW in (ii)
- (c) 50 kW in (i) and 75 kW in (ii)
- (d) 50 kW in (i) and 50 kW in (ii)

= Answer (b) 25 kW in (i) and 50 kW in (ii)

131) In a DC machine, which of the following statements is true ?

- a) Compensating winding is used for neutralizing armature reaction while interpole winding is used for producing residual flux
- b) Compensating winding is used for neutralizing armature reaction while interpole winding is used for improving commutation
- c) Compensating winding is used for improving commutation while interpole winding is used for neutralizing armature reaction
- d) Compensating winding is used for improving commutation while interpole winding is used for producing residual flux

= Answer (c) Compensating winding is used for improving commutation while interpole winding is used for neutralizing armature reaction

132) A single-phase induction motor with only the main winding excited would exhibit the following response at synchronous speed.

- a) Rotor current is zero
- b) Rotor current is non-zero and is at slip frequency
- c) Forward and backward rotating fields are equal
- d) Forward rotating field is more than the backward rotating field

= Answer (d) Forward rotating field is more than the backward rotating field

133) In a single-phase induction motor driving a fan-load, the reason for having a high resistance rotor is to achieve

- a) low starting torque
- b) quick acceleration
- c) high efficiency
- d) reduced size

= Answer (b) quick acceleration

134) Under no load condition, if the applied voltage to an induction motor is reduced from the rated voltage to half the rated value, then

- a) the speed decreases and the stator current increases
- b) both the speed and the stator current decrease
- c) the speed and the stator current remain practically constant
- d) there is negligible change in the speed but the stator current decreases

= Answer (b) both the speed and the stator current decrease

135) Determine the correctness or otherwise of the following assertion A and the reason R.

Assertion A Under V/f control of induction motor, the maximum value of the developed torque remains constant over a wide range of speed in the subsynchronous region.

Reason R The magnetic flux is maintained almost constant at the rated value by keeping the ratio V/f constant over the considered speed range.

- a) Both A and R are true and R is the correct reason for A
- b) Both A and R are true but R is not the correct reason for A
- c) Both A and R are false
- d) A is true but R is false

= Answer (a) Both A and R are true and R is the correct reason for A

136) For a single-phase capacitor start induction motor which of the following statement is valid ?

- a) The capacitor is used for power factor improvement
- b) The direction of rotation can be changed by reversing the main winding terminals
- c) The direction of rotation cannot be changed
- d) The direction of rotation can be changed by interchanging the supply terminals

= Answer (b) The direction of rotation can be changed by reversing the main winding terminals

137) A 3-phase induction motor is driving a constant torque load at rated voltage and frequency. If both voltage and frequency are halved, following statements relate to the new condition if stator resistance, leakage reactance and core-loss are ignored.

1. The difference between synchronous speed and actual speed remains same
2. The air gap flux remains same
3. The stator current remains same
4. The per unit slip remains same

Among the above, correct statements are

- a) 1 and 4
- b) 1, 2 and 3
- c) 1, 2, 3 and 4
- d) All of these

= Answer (b) 1, 2 and 3

138) A rotating electrical machine having its self inductances of both the stator and the rotor windings, independent of the rotor position will be definitely not develop

- a) starting torque
- b) synchronizing torque
- c) hysteresis torque
- d) reluctance torque

= Answer (d) reluctance torque

139) In relation to the synchronous machines, which one of the following statements is false ?

- a) In salient pole machines, the direct-axis synchronous reactance is greater than the quadrature-axis synchronous reactance
- b) The damper bars help the synchronous motor self-start
- c) Short-circuit ratio is the ratio of the field current required to produce the rated voltage on open-circuit to the rated armature current
- d) The V-curve of a synchronous motor represents the variation in the armature current with field excitation, at a given output power

= Answer (c) Short-circuit ratio is the ratio of the field current required to produce the rated voltage on open-circuit to the rated armature current

140) A synchronous generator is feeding a zero power factor (lagging) load at rated current. The armature reaction is

- a) magnetizing b) demagnetizing c) cross-magnetizing d) ineffective
- = Answer (b) demagnetizing

141) The line to line induced emf (in volt), for a three-phase star connection is approximately

- a) 808 b) 888 c) 1400 d) 1538
- = Answer (c) 1400

142) The line to line induced emf (in volt), for a three-phase connection is approximately

- a) 1143 b) 1332 c) 1617 d) 1791
- = Answer (a) 1143

143) A 3-phase synchronous motor connected to AC main is running at full load unity power factor. If its shaft load is reduced by half, with field current held constant, its new power factor will be

- a) unity b) leading c) lagging d) dependent on machine parameter
- = Answer (b) leading

144) An electric motor with 'constant output power' will have a torque-speed characteristic in the form of a

- a) straight line through the origin
 - b) straight line parallel to the speed axis
 - c) circle about the origin
 - d) rectangular hyperbola
- = Answer (d) rectangular hyperbola