Question Bank- EE 401
Type 1- Multiple Choice Questions

Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	DC Machines

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE II: DC Machines

1. A 6-pole DC machine has 300 conductors and flux per pole is 15 mWb. If the machine is driven at 1800 rpm, then the average emf induced per conductor will be
   a. 3.6V
   b. 7.2V
   c. 9V
   d. 162V

2. A commutator with a diameter of 50cm rotates at 1000 rpm. For a brush width of 1.5cm, the time of commutation is
   a. 573µsec
   b. 256msec
   c. 625 µsec
   d. 448msec

3. Match List-I (Tests on DC machines) with List-II (Results) and select the correct answer:

List-I (Tests on DC machines)	**List-II (Results)**
A] Field test	1] Stray losses in case of DC series machines
B] Swinburne's test	2] Constant losses
C] Hopkinson test	3] Performance of machines regarding commutation and temperature rise
D] Retardation test	4] Stray losses in case of DC shunt machines

   a. A1 B3 C2 D4
   b. A4 B1 C2 D3
   c. A1 B2 C3 D4
   d. A4 B3 C2 D1

4. At a certain speed and flux, the voltage generated by a DC generator is 230V. If the speed is increased by 20% and the flux is simultaneously reduced by 10%, the voltage generated will be
   a. Decreased by 8%
   b. Increased by 10%
   c. Decreased by 20%

d. Increased by 8%

5. Lap winding is employed in a DC machine of
   a. High current and low voltage rating
   b. Low current and high voltage rating
   c. High current and high voltage rating
   d. Low current and low voltage rating

6. Pole shoe of a DC machine is laminated for the purpose of
   a. Decreasing hysteresis loss
   b. Decreasing eddy current loss
   c. Manufacturing ease
   d. Decreasing both eddy current and hysteresis loss

7. In a DC motor, the windage loss is proportional to
   a. Square of flux density
   b. Supply voltage
   c. Square of supply voltage
   d. Square of armature speed

8. The principle of dynamically induced emf is utilized in
   a. Transformer
   b. Generator
   c. Thermocouple
   d. Choke

9. The direction of induced emf in case of a DC machine can be determined using
   a. Fleming's left hand rule
   b. Faraday's law of magnetic induction
   c. Fleming's right hand rule
   d. Biot-Savart's law

10. In a DC machine
    a. The current and emf in armature conductors are unidirectional while those at the terminals are alternating.
    b. The current and emf in armature conductors and at the terminals are unidirectional.
    c. The emf in armature conductors and at the terminals is alternating while current is unidirectional.
    d. The current and emf in armature conductors are alternating while those at the terminals are unidirectional.

11. In a DC machine, the brushes are physically placed in the
    a. Interpolar axis and electrically connected to the coils lying in polar axis
    b. Polar axis and electrically connected to the coils lying in the polar axis
    c. Interpolar axis and electrically connected to the coils lying in the interpolar axis
    d. Polar axis and electrically connected to the coils lying in the interpolar axis

12. A lap wound DC machine has 400 conductors and 8 poles. The voltage induced per conductor is 2V. The machine generates a voltage of
    a. 800V
    b. 400V
    c. 200V
    d. 100V

13. In DC machines, the air gap flux distribution in space at no load is
    a. Rectangular
    b. Triangular
    c. Flat topped
    d. Pulsating

14. In a DC machine without any brush shift, the shift of the magnetic neutral axis owing to armature reaction is
    a. Against the direction of rotation for both the generator and the motor
    b. In the direction of rotation for the generator and against the direction of rotation for the motor
    c. In the direction of rotation for both the generator and the motor
    d. Against the direction of rotation for the generator and in the direction of rotation for the motor

15. In a DC machine, the number of mechanical and electrical degrees will be same when the number of poles of the machine is
    a. 8
    b. 4
    c. 2
    d. 1

16. In Swinburne's method of testing DC machine, the shunt machine is run as a

a. Generator at full load at rated speed and rated voltage
b. Generator at no load at near rated speed and rated voltage
c. Motor at no load at rated speed and rated voltage
d. Generator at no load at rated speed and rated terminal voltage

17. A DC shunt generator has full load voltage regulation of 10% at rated speed of 1000 rpm. If it is now driven at 1250 rpm, then its voltage regulation at full load would
    a. Remain unchanged
    b. Be less than 10%
    c. Be 12.5%
    d. Be more than 10%

18. A DC series motor drives a load. The motor is unsaturated and the load torque is proportional to speed squared. For a speed of 400 rpm, motor line current is 20A. For a speed of 800 rpm, the line current will be-
    a. 40A
    b. 25.25A
    c. 60A
    d. 20A
19. In a shunt DC machine, the armature and field winding resistance are respectively
    a. High and low
    b. Low and high
    c. Of lower values
    d. Of higher values

20. Equalizer rings are required in a lap wound DC machines
    a. to improve commutation
    b. to filter out harmonics
    c. to prevent the flow of circulating currents through brushes
    d. to reduce armature reaction

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Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	3 phase induction machines

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE III: 3 Phase Induction Machines

1. A 3-phase, 50Hz induction motor has a full-load speed of 1440rpm. The number of poles of the motor is
    a. 4
    b. 5
    c. 6
    d. None of these

2. The power factor of a delta connected 3-phase 50kW induction machine is 0.4 when delivering 35% of its rated load. If the stator is reconnected in star, then its
    a. pf is worsened, stator current increases
    b. pf is improved, stator current increases
    c. pf remains unchanged, stator current decreases
    d. pf is improved, stator current decreases

3. The decrease in the number of poles of a 3-phase induction machine results in
    a. Increase in maximum pf
    b. No change in maximum pf
    c. Decrease in maximum pf
    d. Cannot be determined

4. The complete circle diagram for a 3-phase IM can be drawn with the help of
    a. Blocked-rotor test and Stator-resistance test
    b. Stator-resistance test and Running-light test
    c. Running-light test and Blocked-rotor test
    d. Running-light test, Blocked-rotor test and Stator-resistance test

5. A 3-phase IM requires starter
    a. Because the motor does not possess an inherent starting torque
    b. To increase the starting torque
    c. Because the induced secondary voltage and hence the currents in the windings are abnormally high during starting
    d. Because there is no back emf induced in the stator winding during starting

6. The following starting method for a 3-phase squirrel cage induction motor is inferior in view of the poor starting torque per ampere of the line

current drawn

a. Autotransformer method of starting
b. Impedance starting
c. Direct-on-line starting
d. Star-delta starting

7. The stator of a 3-phase, 6-pole slip ring induction motor is connected to 50Hz source but its rotor is energized from 20Hz source. The rotor would run at a speed of
   a. 600rpm or 1400rpm
   b. 1600rpm or 400rpm
   c. 600rpm or 400rpm
   d. 1600rpm or 600rpm

8. A slip ring induction motor drives a constant torque load. If the supply voltage reduces to $(1/\sqrt{2})$ times its previous stator voltage, then slip and current get modified by factors of
   a. 2 and 2 respectively
   b. $\sqrt{2}$ and 2 respectively
   c. $\sqrt{2}$ and $(1/\sqrt{2})$ respectively
   d. 2 and $\sqrt{2}$ respectively

9. A squirrel cage induction motor has a full-load slip of 0.05. The motor starting current at rated voltage is 6 times its full-load current. What is the percentage tapping on the autotransformer starter which will give full-load torque at start?
   a. 74.50
   b. 33.33
   c. 68.90
   d. 86.20

10. In a squirrel cage induction motor high starting torque is achieved by using
    a. High resistance in series with the rotor circuit
    b. Double cage rotor
    c. Short circuited rotor winding across slip rings
    d. None of the above

11. In double cage induction motor the inner cage has
    a. High resistance and high leakage reactance
    b. High resistance and low leakage reactance
    c. Low resistance and low leakage reactance
    d. Low resistance and high leakage reactance

12. The rotor slots in a 3-phase induction motor are kept inclined. This phenomenon is known as
    a. Crawling
    b. Skewing
    c. Cogging
    d. None of these

13. Presence of 5^{th} harmonics in induction motor causes
    a. Cogging
    b. Small reverse breaking torque
    c. Crawling
    d. Hunting

14. The equivalent circuit per phase of a three phase transformer is similar to that of a three phase induction motor but the transformer does not develop any torque. This is due to
    a. Absence of air gap
    b. Low supply voltage
    c. Non-fulfilment of condition of space condition of winding
    d. None of the above

15. The power factor of a lightly loaded induction motor is quite low because
    a. of the current due to air gap
    b. the current drawn is largely a magnetizing component due to laminated core
    c. the current drawn is largely an energy component due to laminated core
    d. the current drawn is largely a magnetizing component due to air gap

16. In a 3-phase induction motor, the maximum torque
    a. varies as rotor circuit resistance
    b. varies inversely as rotor circuit resistance
    c. is independent of rotor circuit resistance
    d. is constant

17. The maximum possible speed of a 3-phase squirrel cage induction motor running at a slip of 4% is
    a. 3000rpm
    b. 960rpm
    c. 1440rpm

d. 2880rpm

18. The torque developed by a 3-phase induction motor depends on
    a. Speed, frequency and number of poles
    b. Voltage, current and stator impedance
    c. Synchronous speed, rotor speed and frequency
    d. Rotor emf, rotor current and rotor pf

19. In a 3-phase slip ring induction motor, 3-phase balanced supply is given to the rotor and stator winding is short circuited. The rotor would
    a. run at half the synchronous speed
    b. run in the direction of rotating field
    c. not run
    d. run against the direction of rotating field

20. In case of a 3-phase induction motor, shaft power is 2700W and mechanical losses are 180W. At a slip of 4%, the rotor ohmic loss will be
    a. 115.2W
    b. 120W
    c. 108W
    d. 105W

Question Bank- EE 401
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Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	3 phase transformer

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE IV: 3 Phase Transformer

1. A three phase delta-star transformer has secondary to primary turns ratio per phase 5. For a primary line current of 10A, the secondary line current will be
   a. 3.464A
   b. 50A
   c. 1.155A
   d. 1.633A

2. Which of the following 3-phase connections of a transformer causes interference to the nearby communication system
   a. Star-delta
   b. Star-star
   c. Delta-star
   d. Delta-delta

3. Scott connected transformers can convert:
   i. 3 to 2 phases ii. 2 to 3 phases
   iii. 2 to 4 phases iv. 3 to 4 phases

   From the above correct answer is-
   a. (ii) only
   b. (i) and (ii)
   c. (iii) and (iv)
   d. (i) and (iv)

4. A bank of three identical single-phase 250kVA, 11kV/230V transformer is used to provide 400V low tension supply from a 11kV, 3-phase sub-station. The effective kVA rating of the bank will be
   a. 250
   b. $250\sqrt{3}$
   c. 500
   d. 750

5. Supply to one terminal of a Δ-Y connected 3-phase core type transformer, which is on no-load fails. 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

6. Keeping in view the requirement of parallel operation, which of the 3-phase connections given below are possible?
   a. Δ-Δ to Y-Y
   b. Δ-Δ to Y- Δ
   c. Δ-Y to Δ-Y
   d. Δ-Y to Y- Δ

Question Bank- EE 401
Type 2- Short Question

Question Paper Details					
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B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	DC Machines

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MODULE II: DC Machines

1. A 4-pole dynamo with wave wound armature has 51 slots containing 20 conductors in each slot. The induced emf is 357V and the speed is 8500rpm. The flux per pole will be _____

2. A 240V DC shunt motor with an armature resistance of 0.5Ω has a full load current of 40A. Find the ratio of the stalling torque to the full load torque when a resistance of 1Ω is connected in series with the armature.

3. A DC shunt motor is running at 1200rpm, when excited with 220V DC. Neglecting losses and saturation, the speed of the motor when connected to a 175V DC supply is _____

4. A 240V DC series motor takes 40A when giving its rated output at 1500 rpm. Its armature resistance is 0.3Ω. What should be the external resistance required to be added to obtain rated torque at 1000 rpm?

5. A DC shunt generator has a speed of 800 rpm when delivering 20A to the load at the terminal voltage of 220V. If the same machine is run as a motor it takes a line current of 20A from 220V supply. Will the machine have a higher speed while running as motor or as a generator?

6. A DC motor has a no load speed of 6000rpm when connected to a 120V DC supply. The armature resistance is 2.5Ω and other losses may be neglected. The speed of the motor with supply voltage of 60V developing a torque of 0.5Nm is _____

7. A 200V, 2000rpm, 10A, separately excited DC motor has an armature resistance of 2Ω. Rated DC voltage is applied to both the armature and field winding of the motor. If the armature draws 5A from the source, the torque developed by the motor is _____

8. A DC series motor driving an electric train faces a constant power load. It is running at rated speed and rated voltage. If the speed has to be brought down to 0.25pu, the supply voltage has to be approximately brought down to _____

9. The armature resistance of a permanent magnet DC motor is 0.8Ω. At no load, the motor draws 1.5A from a supply voltage of 25V and runs at 1500rpm. The efficiency of the motor while it is operating on load at

1500rpm drawing a current of 3.5A from the same source will be _____

10. A 8-pole DC generator has a wave wound armature containing 32 coils of 6 turns each. Its flux per pole is 0.06Wb. The machine is running at 250rpm. The induced armature voltage is _____

11. A 220V DC machine supplies 20A at 200V as a generator. The armature resistance is 0.2Ω. If the machine is now operated as a motor at same terminal voltage and current but with the flux increased by 10%, the ratio of motor speed to generator speed is _____

12. A 240V DC shunt motor draws 15A while supplying the rated load at a speed of 80 rad/s. The armature resistance is 0.5Ω and the field winding resistance is 80Ω. What will be the value of external resistance to be added in the armature circuit to limit the armature current to 125% of its rated value?

13. A 220V DC shunt motor is operating at a speed of 1440 rpm. The armature resistance is 1.0Ω and armature current is 10A. If the excitation of the machine is reduced by 10%, what is the extra resistance to be put in the armature circuit to maintain the same speed and torque?

14. A 220V 15kW 1000 rpm shunt motor with armature resistance of 0.25Ω has a rated line current of 68A and a rated field current of 2.2A. What will be the change in field flux in order to obtain a speed of 1600 rpm while drawing a line current of 52.8A and field current of 1.8A?

15. A 15kW, 230V DC shunt motor has armature circuit resistance of 0.4Ω and field circuit resistance of 230Ω. At no load and rated voltage, the motor runs at 1400 rpm and the line current drawn by the motor is 5A. At full load, the motor draws a line current of 70A. Neglect armature reaction. The full load speed of the motor in rpm is _____

16. A DC shunt generator delivers 45A at a terminal voltage of 220V. The armature and the shunt field resistances are 0.01Ω and 44Ω respectively. The stray losses are 375W. The percentage efficiency of the DC generator is _____

17. A DC motor has following specifications:
    10HP, 37.5A, 230V;
    Flux/pole= 0.01 Wb
    Number of poles= 4

Number of conductors= 666
Number of parallel paths= 2
Armature resistance= 0.267Ω
The armature reaction is negligible and rotational losses are 600W. The motor operates from a 230V DC supply. If the motor runs at 1000 rpm, the output torque produced (in Nm) is _____

18. The no load speed of a 230V separately excited DC motor is 1400rpm. The armature resistance drop and the brush drop are neglected. The field current is kept constant at rated value. The torque of the motor (in Nm) for an armature current of 8A is _____

19. A separately excited 300V DC shunt motor under no load runs at 900rpm drawing an armature current of 2A. The armature resistance is 0.5Ω and leakage inductance is 0.01H. When loaded, the armature current is 15A. Then, the speed in rpm is _____

20. At a certain speed and flux, the voltage generated by a DC generator is 230V. If the speed is increased by 20% and the flux is simultaneously reduced by 10%, by what percentage will the voltage generated change?

Question Bank- EE 401
Type 2- Short Question

Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	3 phase induction machine

Paper Setter Details			
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MODULE III: 3 Phase Induction Machine

1. A 4-pole, 3-phase induction motor operates from a supply whose frequency is 50Hz.

    a. The speed at which the magnetic field of the stator is rotating is _____

    b. When the slip is 0.04, the speed of the rotor is _____

    c. When the slip is 0.03, the frequency of the rotor current will be _____

    d. The frequency of the rotor current at standstill will be _____

2. A small 3-phase induction motor has short circuit current equal to 3.5 times the full load current. Determine the starting torque as a fraction of full-load torque if the slip at full load is 0.03pu

3. When started by means of an autotransformer with 50% tapping, supply current at start of an induction motor is reduced to _____ of that when started by means of a star-delta starter.

4. An induction motor having full load torque of 60Nm when delta connected, develops a starting torque of 120Nm. For the same supply voltage if the motor is changed to star connection the starting torque developed will be _____

5. An induction motor is to be started directly from the mains. If the starting torque is equal to the full load torque, find the starting current in terms of full load current if the slip of the motor at full load is 4%.

6. The power input to a 415V, 50Hz, 6-pole, 3-phase induction motor running at 975rpm is 40kW. The stator losses are 1kW and friction and windage losses total 2kW. The efficiency of the motor is _____

7. The synchronous speed for the 7^{th} space harmonic mmf wave of a 3-phase, 8-pole, 50Hz induction machine is _____ in the _____ (forward/reverse) direction.

8. A 400V, 15kW, 4 pole, 50Hz, Y-connected induction motor has full load slip of 4%. The output torque of the machine at full load is _____

9. A 4-pole 50Hz 3-phase induction motor has rotor resistance and standstill rotor reactance of 0.04Ω and 0.16Ω per phase respectively. Calculate the value of the external rotor resistance per phase to be inserted to obtain 70% of maximum torque at starting.

10. A 3-phase cage rotor induction motor is started with direct-on-line (DOL) switching at the rated voltage. If the starting current drawn is 6 times the full load current, and the full load slip is 4%, then the ratio of the starting torque to the full load torque is approximately _____

11. A 3-phase squirrel cage induction motor has a starting torque of 150% and a maximum torque of 300% with respect to rated torque at rated voltage and rated frequency. Neglect the stator resistance and rotational losses. The value for slip for maximum torque is _____

12. A 400V, 50Hz, 30HP, 3-phase induction motor is drawing 50A current at 0.8 power factor lagging. The stator and rotor copper losses are 1.5kW and 900W respectively. The friction and windage losses are 1050W and the core losses are 1200W. The air gap power of the motor will be _____

13. A 3-phase, 10kW, 400V 4-pole, 50Hz star connected induction motor draws 20A on full load. Its no load and blocked rotor test data are given below
    No load test: 400V, 6A, 1002W
    Blocked rotor test: 90V, 15A, 762W
    Neglecting copper loss in no load test and core loss in blocked rotor test, estimate the full load efficiency of the motor.

14. A 3-phase 400V, 6-pole, 50Hz squirrel cage induction motor is running at a slip of 5%. The speed of stator magnetic field with respect to rotor magnetic field and speed of rotor with respect to stator magnetic field are _____ and _____

15. The locked rotor current in a 3-phase star-connected 15kW, 4-pole, 230V, 50Hz induction motor at rated conditions is 50A. Neglecting losses and magnetizing current, the approximate locked rotor line current drawn when the motor is connected to a 236V, 57Hz supply is _____

16. A 4-pole induction motor, supplied by a slightly unbalanced 3-phase 50Hz source, is rotating at 1440rpm. The electrical frequency in Hz of the induced negative sequence current in the rotor is _____

17. A 4-pole 50Hz, 3-phase induction motor has rotor resistance and standstill rotor reactance of 0.025Ω and 0.1Ω per phase respectively.

    a. The speed at which maximum torque occurs is _____

    b. The value of external rotor resistance per phase to be inserted to obtain 80% of maximum torque at starting is _____

18. A 3-phase, 50Hz, 6-pole induction motor has a rotor resistance of 0.1Ω and reactance of 0.92Ω. Neglect the voltage drop in stator and assume that the rotor resistance is constant. Given that the full load slip is 3%. The ratio of maximum torque to full load torque is _____

19. The starting line current of a 415V, 3-phase, delta connected induction motor is 120A, when the rated voltage is applied to its stator winding. The starting line current at a reduced voltage of 110V is _____

20. A 3-phase squirrel cage induction motor has a starting current of 7 times the full load current and full load slip of 5%

    a. If an autotransformer is used for reduced voltage starting to provide 1.5 per unit starting torque, the autotransformer ratio (%) will be _____

    b. If a star-delta starter is used to start this induction motor, the per unit starting torque will be _____

    c. If a starting torque of 0.5 per unit is required then the per unit starting current should be _____

Question Bank- EE 401
Type 2- Short Question

Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	3 phase transformer

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE IV: 3 Phase Transformer

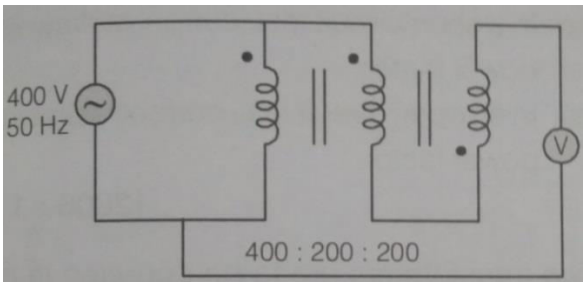
1. A 3-phase transformer bank consists of three identical 2300/230V, 15kVA single phase transformers connected in Δ-Δ. The bank supplies a 20kVA, unity power factor 3-phase load. If one of the single phase transformer develops a fault and is removed, the load carried by each of the transformers now operating in open delta will be _____ kVA.

2. A 3-phase Δ/Y transformer is supplied 6000V on delta connected side. The terminal voltage on the secondary side when supplying full load at 0.8 lagging power factor is 415V. The equivalent resistance and reactance drops for the transformer are 1% and 5% respectively. What is the turns ratio of the transformer?

3. In a single phase 3 winding transformer the turns ratio for primary: secondary: tertiary windings is 20:4:1 with the lagging currents of 50A at a power factor of 0.6 in the tertiary winding. Find the primary current and power factor.

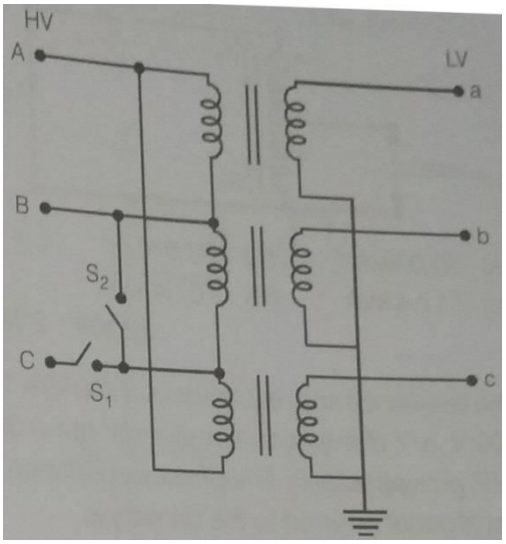
4.

A 400V/200V/200V, 50Hz three winding transformer is connected as shown in figure. The reading of the voltmeter will be_____



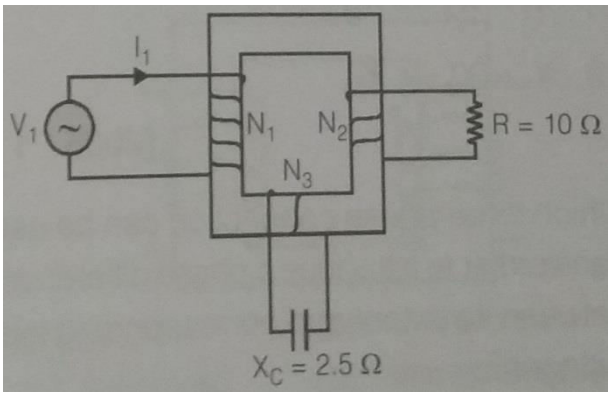
5.

The following figure shows a Δ-Y connected 3-phase distribution transformer used to step down the voltage from 11000V to 415V line-to-line. It has two switches S_1 and S_2. Under normal conditions S_1 is closed and S_2 is open. Under certain conditions, when S_1 is open and S_2 is closed, the magnitude of voltage across LV terminals a and c will be _____



6.

The following figure shows an ideal three winding transformer. Windings are wound on the same core as shown. The turns ratio $N_1:N_2:N_3$ is 4:2:1. A resistor of 10Ω is connected across winding-2. A capacitor of reactance 2.5Ω is connected across winding-3. Winding-1 is connected across a 400V supply. If the supply voltage phasor V1= $400\angle 0^0$, the supply current phasor I_1 is given by



_____

7. The resistance and reactance of a 100kVA 11000/400V, Δ-Y distribution transformer are 0.02 and 0.07 pu respectively. The phase impedance of the transformer referred to the primary is _____

8. Three single phase transformers are connected to form a Δ-Y three phase transformer 110kV/11kV. The transformer supplies at 11kV a load of 8MW at 0.8 pf lagging to a nearby plant. Neglect the transformer losses. What will be the ratio of phase currents in delta side to star side?

Question Bank- EE 401
Type 3- Subjective Question

Question Paper Details					
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B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	DC Machines

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MODULE II: DC Machines

1. Why does a DC shunt motor run at a constant speed?

2. Show that the effect of armature mmf on the main field/field flux is entirely cross-magnetizing in an unsaturated DC machine.

3. What will result if the field circuit of a DC motor is opened?

4. Why are the pole shoes in a DC machine laminated though the field winding carries a direct current and not an alternating current?

5. Describe the different types of excitation of DC machines.

6. Explain the voltage build up process of a DC shunt generator.

7. Mention the different reasons behind failure to build up voltage in a DC shunt generator.

8. Why are DC series motors used in trains?

9. Write down the function of carbon brushes used in DC machines.

10. Briefly explain the factors that prevent sparkless commutation in a DC machine.

11. Draw the flux distribution, mmf distribution due to armature conductors carrying current along with the flux distribution due to the main poles of a DC machine.

12. Explain clearly the functions of interpoles in DC machines.

13. Explain clearly the functions of compensating windings in DC machines.

14. What are commutating poles? Why are they used?

15. Describe Swinburne's test with the help of a neat diagram to find out the efficiency of a DC machine. What are the main advantages and disadvantages of this test?

16. Explain the principle of torque production in a DC motor.

17. What are the critical field resistance and critical speed of a DC shunt generator? Explain their significance?

18. Define the term "SPEED REGULATION" of a DC motor. What is meant by good speed regulation?

19. Draw and explain the speed-armature current characteristics of a DC shunt motor.

20. Draw and explain the speed- armature current characteristics of a DC series motor.

Question Bank- EE 401
Type 3- Subjective Question

Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	Three phase induction machines

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE III: Three Phase Induction Machines

1. Explain the working principle of a 3-phase induction motor.

2. Define slip in an induction motor. Can it be negative? Can its value be more than 1?

3. Why is it not possible to run an induction motor at synchronous speed?

4. What factors determine the direction of rotation of induction machine?

5. What will happen if single phasing occurs while working of a 3-phase induction motor?

6. What is the condition for maximum starting torque of an induction motor?

7. Draw the equivalent circuit of a 3-phase induction motor.

8. Draw and explain how the torque-speed curve of an induction motor will vary with varying supply voltage.

9. Discuss about the effect of rotor resistance on the torque speed characteristics of a 3-phase induction motor.

10. Show that the mechanical power developed in a 3-phase induction motor can be represented by a pure resistance in the rotor circuit.

11. Explain the phenomenon "*COGGING*" in an induction motor.

12. Derive the expression for developed torque in a 3-phase induction motor.

13. Draw the torque-slip curve of a 3-phase induction motor. Indicate clearly in the diagram full-load torque, starting torque, maximum torque, stable and unstable zone.

14. Explain why the no load current of an induction motor is much higher than that of an equivalent transformer.

15. Explain the phenomenon "*CRAWLING*" in an induction motor.

16. Draw the phasor diagram of a 3-phase induction motor when it is operating on load.

17. Why the rotor bar is skewed in case of squirrel cage induction motor?

18. Classify 3-phase induction motor on the basis of rotor construction. Describe the constructional features of each type with necessary diagram.

19. Why is the rotor of a 3-phase induction motor forced to rotate in the same direction as the rotating magnetic field?

20. State under what conditions in a 3-phase induction motor
    i. The rotor and stator frequencies are the same.
    ii. The rotor frequency is smaller than the stator frequency.
    iii. The rotor frequency is greater than the stator frequency.

Question Bank- EE 401
Type 3- Subjective Question

Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	3 phase transformer

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE IV: 3 Phase Transformer

1. Explain the use of tertiary winding in a Y-Y transformer.

2. What are the differences between an autotransformer and an induction regulator?

3. What are the reasons for higher efficiency of autotransformers as compared to conventional transformers?

4. Explain with reasons why a Δ-Δ transformer cannot be paralleled with a Δ-Y transformer.

5. Show that open delta connection of a 3-phase transformer delivers only 57.7% of the VA rating of its normal Δ-Δ connection.

6. What are the different phasor groups? Why are phasor groups mentioned in the name plate of a transformer?

7. State the condition of parallel operation of 3-phase transformers.

8. What are the advantages of V-V connections of transformer?

9. On the parallel operation of two transformers-
   i. Unequal per unit impedance
   ii. Unequal X/R ratio

10. What are the utilities of different phasor groups of 3-phase transformers?

11. What schemes of connections are commonly used for 3-phase to 6-phase transformation?

12. Draw the Scott connection of transformers and mark the terminals and turns ratio. What are the applications of Scott connection?

13. Describe the function of the closed delta tertiary winding employed in some three phase transformers.

14. Give the equivalent circuit and applications of a 3-winding transformer. Explain how the parameters can be determined experimentally.

15. Draw and explain the circuit diagram of a transformer arrangement for converting a 3-phase to 2-phase supply

16. Draw the connection and phasor diagram of a three phase Dz6 transformer.

17. Draw the connection and phasor diagram of a three phase Yz11 transformer.

18. What are the different phasor groups and what is their utility?

19. In a Scott connected transformer, why does the teaser winding have 86.6% of number of turns compared to the main winding?

20. In a Scott connected transformer, why is the teaser winding connected at the center of the main winding?

Question Bank- EE 401
Type 4- Broad Questions

Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	DC Machines

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE II: DC Machines

1. What is armature reaction in a DC machine? How does it affect commutation? What steps are taken to have effective commutation?

2. Derive the torque equation of a DC series motor. Sketch the speed-torque characteristics of a DC series motor after deriving the necessary relation.

3. Explain the nature of no-load and external characteristics of a DC shunt generator.

4. A 240V DC short shunt compound generator is supplying a load of 100A at 240V. The resistance of its armature, series field and shunt field windings are 0.1Ω, 0.5Ω and 50Ω respectively. Find the induced emf and the armature current.

5. What are the essential conditions for 'building up' of voltage of a DC shunt generator? What are critical resistance and critical speed? Explain these with the help of the external characteristics of the generator and building up process.

6. Sketch the speed-torque characteristics of a DC shunt motor after deriving the necessary relation.

7. A DC generator has an armature emf of 100V when the useful flux per pole is 20mWb and the speed is 800rpm. Calculate the generated emf
   a. With same flux and speed of 1000rpm.
   b. With a flux per pole of 24mWb and speed 900rpm.

8. A 10kW 250V DC shunt generator having an armature resistance of 0.1Ω and field resistance of 250Ω delivers full load at rated speed of 800rpm and at rated voltage of 250V. Machine now runs as motor while taking 10kW at 250V. Find the speed of the machine as motor. Neglect brush contact drop.

9. A DC shunt generator delivers 40kW to 240V when running at 450rpm. The armature and field resistances are 0.03Ω and 60Ω respectively. Calculate the speed of the machine running as a shunt motor and taking 40kW input at 240V. Allow 1V drop per brush.

10. Write a short note on Hopkinson's test of DC machines.

11. Write a short note on Swinburne test of DC machines.

12. Write a short note on commutation in DC machines.

13. With neat diagram, explain the function of compensating windings in large DC machines. Show the physical location of this winding in a DC machine.

14. "A self-excited DC generator fails to build up its voltage"
    -Explain. How can this issue be rectified?

15. "When a DC shunt generator is loaded its terminal voltage falls"
    -Explain with the help of external characteristics of the generator.

16. Two identical DC shunt machines when tested by Hopkinson's method, gave the following data:
    Line voltage= 230V
    Line current excluding both field current= 30A
    Motor armature current= 230A
    Field currents= 5A and 4A
    If the armature resistance of each machine (including brushes) is 0.025Ω, calculate the efficiencies of both the machines.

17. A belt-driven 60kW DC shunt generator running at 500rpm is supplying full load to a bus bar at 200V. At what speed will it run if the belt breaks and the machine continues to run taking 5kW from the bus bar? The armature and field resistances are 0.1Ω and 100Ω respectively. Brush contact drop may be taken as 2V. Neglect armature reaction.

18. Explain briefly the bad effects of armature reaction and mention steps which should be taken at design and construction stage of a DC machine for minimizing armature reaction.

19. Explain the following:
    a. Period of commutation
    b. Reactance voltage during commutation
    c. EMF commutation
    d. Resistance commutation

20. In a DC machine, what do you understand by-
    a. Linear commutation
    b. Under commutation
    c. Over commutation

Question Bank- EE 401
Type 4- Broad Questions

Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	3 phase induction machines

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE III: Three Phase Induction Machines

1. Show that the ratio of torque T at any slip s of a 3-phase induction motor to its maximum torque T_m can be derived as

$$\frac{T}{T_m} = \frac{2}{\frac{S_m}{S} + \frac{S}{S_m}}$$

Where Sm is the slip at maximum torque. Make necessary assumptions.

2. No load and blocked rotor test of a 415V, 3-phase, 50Hz star connected induction motor gave the following results
   i. No-load test (line values): 415V, 3.5A, 250W
   ii. Blocked rotor test (line values): 115V, 13A, 1660W

   Stator resistance per phase is 1.5Ω
   Calculate equivalent circuit parameters.

3. Explain the phenomena "*COGGING*" and "*CRAWLING*" in a three phase squirrel cage induction motor.

4. Write a short note on different methods of starting of a 3-phase induction motor.

5. Show that slip at which maximum torque of a polyphase induction motor occurs is directly proportional to the rotor resistance r_2 but the maximum torque T_{EM} is independent of r_2.

6. Explain the principle of rotor resistance starting of slip-ring type induction motors.

7. Explain how a balanced 3-phase supply applied to a 3-phase stator winding (balanced) can produce a rotating magnetic field of constant magnitude in an induction motor.

8. Derive an expression for the torque developed by the rotor in an induction motor. Also determine an expression for the mechanical power developed.

9. Draw the torque-speed characteristics of a 3-phase induction motor and discuss about the effect of rotor resistance.

10. Write a short note on star-delta starting of a 3-phase induction motor.

11. Write a short note on autotransformer starting of a 3-phase induction motor.

12. Determine the parameters of equivalent circuit of a 3-phase, 50Hz induction motor from the following test results-
    i. No-load test: 400V, 9.5A, 1400W
    ii. Blocked rotor test: 200V, 50A, 7000W

13. Classify the 3-phase induction motor on the basis of its rotor construction. Describe the constructional features of each type with the necessary diagram.

14. A 400V, 50Hz, 4-pole 3-phase induction motor has a rotor resistance 0.04Ω per phase. The maximum torque occurs at a speed of 1200rpm. Calculate the ratio of the starting torque to the maximum torque.

15. Show that a star-delta started 3-phase induction motor is equivalent to an autotransformer started 3-phase induction motor with 58% tapping.

16. A 400V, 50Hz, 4-pole, 3-phase induction motor has a rotor resistance of 0.04Ω per phase. The maximum torque occurs at a speed of 1200rpm. Calculate the ratio of starting torque to maximum torque.

17. Write a short note on speed control of 3-phase induction motor.

18. The power input to a three phase induction motor is 60kW. Total stator losses are 1kW. Find the total mechanical power developed and the rotor copper loss per phase if the motor is running with a slip of 3%.

19. A 3-phase, 6-pole, 50Hz star connected induction motor delivers useful power 25kW while running at a speed of 950rpm. It is connected to a supply of 400V and takes a current of 60A. Its stator resistance per phase is 0.14Ω. Mechanical losses are 900W. Calculate-
    i. Rotor copper loss
    ii. Stator copper loss
    iii. Overall efficiency

20. The power input to a 6-pole, 50Hz, 3-phase induction motor is 700W at no-load and 10kW at full-load. The no-load copper losses may be assumed negligible, while the full load stator and rotor copper losses are 295W and 310W respectively. Find the full-load speed, shaft torque and efficiency of the motor assuming rotational and core losses to be equal.

Question Bank- EE 401
Type 4- Broad Questions

Question Paper Details					
Course	Stream	Semester	Subject	Paper Code	Chapter
B.Tech	Electrical Engg (EE)	4th	Electric Machines-I	EE 401	3 phase transformer

Paper Setter Details			
Name	Designation	Mobile No.	Email ID
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MODULE IV: 3 Phase Transformer

1. State and explain the conditions of parallel operation of two 3-phase transformers.

2. Show when the magnetizing current of a transformer is sinusoidal, the flux produced is non-sinusoidal and when the magnetizing current is non-sinusoidal, the flux produced is sinusoidal.

3. Why are harmonics generated in a transformer although you impress sinusoidal voltage at the terminals of the primary?

4. Derive an expression for saving in conductor material in an autotransformer on a two winding transformer of equal rating.

5. State the different forms of connections used in 3-phase transformers.

6. Write a short note on three winding transformers.

7. Explain the effect of the unbalanced loading of a three phase transformer.

8. Write a short note on autotransformer.

9. Draw the connection and phasor diagram of the following three phase transformers-
   i. Dy11
   ii. Yy6

10. Write a short note on oscillating neutral in a transformer.

11. Explain the tests to be conducted on three isolated secondary windings of a three phase transformer for connecting them
    i. In star
    ii. In delta

12. Three single phase transformers are connected in delta. If one of the transformers is found faulty and removed, what will be the reduction in kVA supplied and why?

13. Write a short note: On-load tap changer of a transformer.

14. Write a short note: 3-phase to 2-phase conversion

15. A set of Scott connected transformers is supplying two single phase loads at 100V. Load across teaser secondary is 350kW at unity power factor and the load across main secondary is 250kW at 0.8 pf lagging. For three phase line-to-line voltage of 6600V, calculate primary line currents. Neglect magnetizing current and leakage impedance drops.

16. "In three phase shell type transformers, a considerable economy is achieved in the core material if the middle phase winding is wound in the reversed direction as compared with the outer two phase windings"
    - Explain

17. Compare a single three phase transformer with 3 single phase transformers forming a three phase transformer.

18. How will you check the polarity of transformer windings before connecting them in star connections.

19. A 2-winding 10 kVA 440/110V transformer is reconnected as a step-down 550/440V autotransformer. Compare the voltampere rating of the autotransformer with that of original 2-winding transformer. Calculate the power transferred to the load:
    i. Inductively and
    ii. Conductively

20. Two single phase furnaces A and B are supplied at 80V by means of a Scott-connected transformer combination from a 6600V, 3-phase system. The voltage of furnace A is leading. Calculate the line currents on the 3-phase side when the furnaces take 500kW and 800kW respectively
    i. at unity power factor;
    ii. Furnace A at unity power factor, furnace B at 0.7 power factor lagging. Draw the corresponding phasor diagrams