DEPARTMENT OF ECE

University Institute of Engineering & Technology

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Question Bank

B-TECH 2nd YEAR E.C.E **SEM: 4th**

SUBJECT: Electrical Machine PAPER CODE: ECE S-204

(Q) 1:-Draw the equivalent ckt of transformer& identify the test by which the value of each ckt element can be found.

(Q) 2:- Explain the construction & working Principal of DC Generator.

(Q) 3:-How can we refer the transformer winding resistance and leakage reactance from one side to the other?

(Q) 4:-Classify the various types of Electrical machine. What is basis of the classification?

(Q) 5:- A 6 pole dc machine armature has 36 slots , 2coil-sides/slots, 8 turns/ coil and is wave wound. The pole shoe is 18 cm long and the mean air-gap diameter is 25 cm. the avg. flux density over one /pole pitch is 0.8 T. find the Induced EMF and mechanical power output when the armature current is 10A.

(Q) 6:- A transformer has 150 primary turns & 75 secondary turns. Its primary is excited at 200V & the secondary is loaded with an impedance of $5 < 30^0$ Ω. Calculate the primary current and its pf.

(Q) 7:-.Define relative permeability.

(Q) 8:- A 200KW 400V separately excited dc motor runs at 600rpm. It has 864 lap- connected conductors. The full load armature copper loss is 8KW.Calculate the useful flux/pole.

(Q) 9:-Explain the working principal & starting of Induction Motors.

(Q) 10:- What is condition of maximum efficiency of Transformer?

(Q) 11:- Explain why synchronous motors are not self starting.

(Q) 12:-Explain the ckt model of Induction Motors.

(Q) 13: Why Transformer ratings expressed in KVA.

(Q) 14:-A dc series motor runs at 1000 rpm drawing 25 A from a 250V supply with its field halves connected in Series. At what speed would it run if the field halves are reconnected in

iparallel? Also calculate the armature current. Assume load torque proportional to square of speed and voltage drop of resistance, field resistance to be negligible.

(Q) 15:- Define the synchronous speed.

(Q) 16:-Define pole pitch and coil pitch.

(Q) 17:-What do you mean by Armature Reaction?

(Q) 18:-What are the applications of DC Motor?

(Q) 19:-Explain all the method of starting of Induction motor.

(Q) 20:-Summarize the properties of magnetic materials.

(Q) 21:-Explain the Hysteresis and eddy current losses and obtain its expression.

(Q) 22:- Obtain EMF equation of DC Generator.

(Q) 23:-Explain the various three phase transformer connection.

(Q) 24:-Explain the construction & working principal of Synchronous Motor.

(Q) 25:-Define Voltage Regulation in context to Transformer.

(Q) 26:- Explain autotransformers in brief.

(Q) 27:- What do you mean by Equivalent circuit for induction motor?

(Q) 28:- Define phasor diagram on no – load in Transformer.

(Q) 29:- Explain torque – slip characteristic for induction motor.

(Q) 30:- What do you mean by speed control and breaking for induction motor?

(Q) 31:- Define Starters for cage and wound rotor type for induction motor

(Q) 32:- Explain speed control for induction motor.

(Q) 33:- Define breaking for induction motor.

(Q) 34:- What do you mean by methods of starting for induction motor?

(Q) 35:- Define Construction of Synchronous machines.

(Q) 36:- Explain EMF equation Synchronous machines.

(Q) 37:- What do you mean by voltage Regulation ?

(Q) 38:- What do you mean by energy conversion in machines?

(Q) 39:- Define Effect of pitch in Synchronous machines.

(Q) 40:- Explain , armature reaction in Synchronous machines.

(Q) 41:- Define, losses in Synchronous machines.

(Q) 42:- What do you mean by V –curves in Synchronous machines.

(Q) 43:- What do you mean by Torque Power Relation in motor?

(Q) 44:- Define open characteristics of dc Generator.

(Q) 45:- Explain Methods of synchronization for Synchronous machines.

(Q) 46:- Define Typical applications of AC motor in industries

(Q) 47:- What do you mean by excitation in Synchronous machines.

(Q) 48:- Define types of DC Generator.

(Q) 49:- Define types of DC Motor.

(Q) 50:- Explain Starting of Synchronous machines.

(Q) 51:- A 20hp, 250V shunt motor with Ra=0.22 Ω, Rf=170 Ω. At no-load and rated voltage, the speed is 1200 rpm and the armature current is 3 A. At full-load and rated voltage, the line current is 55A. What is the full-load speed?

(Q) 52:- A 230V shunt motor delivers 30hp at the shaft at 1120rpm. If the motor has an efficiency of 87% at this load, determine: a) The total input power. b) The line current.

(Q) 53:- A separately excited motor runs at 1045rpm, with a constant field current, while taking an armature current of 50A at 120V. The armature resistance is 0.1 Ω if the load on the motor changes such that it now takes 95A at 120V, determine the motor speed at this load.

(Q) 54:- A separately excited DC motor has the following specifications: Terminal voltage = 250 V, field voltage = 250 V, armature resistance = 0.03 Ω, field resistance = 250 Ω. Initially the motor was running at speed = 1103 rpm while supplied by the rated terminal voltage and the armature current = 120 A. While supplying constant torque, what is the speed of the motor if the terminal voltage is reduced to 200 V?

(Q) 55:- A 20 hp, 250 V DC shunt motor drives a load that requires a constant torque regardless the speed of operation. The armature resistance is 0.1 Ω. When this motor is running at full load,

the armature current is 65 A at a speed of 1100 rpm. If the flux is reduced to 75% of its original value, find the armature current and the speed of the motor at this new condition?

(Q) 56:- The speed of 500 v shunt motor is to be raised from 700 rpm to 1000 rpm by field weakening the total torque remaining unchanged, the armature and the shunt field resistance are 0.8Ω ,750 Ω respectively and the supply current at lower speed is 12 A, calculate the additional shunt field resistance required.

(Q) 57:- A 500v, 10 HP, shunt motor has full load efficiency of 85% .for the same torque it is desired to reduce its speed by 30% by insertion of resistance in the armature circuit assuming that all the losses except copper losses vary directly with speed, calculate the value of the inserted resistance and the efficiency of the motor when running at the reduced speed, the resistance of the field and armature are 400 Ω and 0.25 Ω.

(Q) 58:- A 15-kVA, 2400:240-V, 60 Hz transformer has the following equivalent circuit parameters:

R1= 2.5 Ω R2=0.025Ω X1=7Ω X2=0.07Ω Rc= 32Ω Xm=11.5kΩ

If the transformer is supplying a 10-kW, 0.8 PF lagging load at rated voltage, assuming the output voltage is the reference, draw the transformer's exact equivalent circuit referred to the primary (H.V) side and use it to calculate:

1. The input current 2. The input voltage 3. The input power factor

(Q) 59:- The equivalent parameters of a transformer, having a turns ratio of 5, are R1=0.5Ω, R2=0.021Ω, X1=3.2Ω, X2=0.12Ω, Rc=350Ω, and Xm=98Ω. Draw the approximate equivalent circuit of the transformer, referred to a) The primary b) The secondary.

(Q) 60:- The equivalent parameters of a 150kVA, 2400V/240V transformer, are R1=0.2Ω, R2=2mΩ, X1=0.45Ω, X2=4.5mΩ, Rc=10kΩ, and Xm=1.55kΩ. The transformer is operating at rated load and rated voltage with 0.8 lagging power factor. Using the approximate equivalent circuit referred to the primary side, determine: 1. Voltage regulation. 2. The transformer power loss.

(Q) 61:- The equivalent parameters of a 110kVA, 2200V/110V transformer, are R1=0.22Ω, R2=0.5mΩ, X1=2Ω, X2=5mΩ, Rc=5494.5Ω, and Xm=1099Ω. Using the approximate equivalent circuit referred to the primary side, when the transformer is operating at 80% full load with unity power factor determines: 1. Voltage regulation. 2. The transformer power loss. 3. Efficiency.

(Q) 62:- A 120 KVA, 2400/240 volt transformer has the following parameters: R1=0.75 ohm, X1=0.8 ohm, R2=0.0045 ohm, X2=0.008 ohm the total transformer losses at full load is 4 kW and the load that achieve the transformer maximum efficiency is 57.73% of the rated load.

calculate: 1. The equivalent impedance referred to the primary. 2. The iron and full load copper losses. 3. The transformer maximum efficiency at 0.8 p.f lag. 4. The transformer voltage regulation at the loading conditions mentioned in 3.

(Q) 63:- A 120 KVA, 2400/240 volt transformer has the following parameters: R1=0.75 ohm, X1=0.8 ohm, R2=0.0045 ohm, X2=0.02 ohm The transformer is loaded by 80% of its rated load at 0.8 p.f lag. The transformer has iron losses of 1kW and full load copper losses of 3 kW Calculate: 1. The equivalent impedance referred to the primary. 2. The transformer efficiency at the mentioned loading conditions. 3. The transformer voltage regulation at the mentioned loading conditions. 4. The transformer maximum efficiency at 0.8 p.f lag. 5. If a capacitor is connected in shunt to the load and improve the p.f to 0.85 lag, calculate the transformer efficiency and voltage regulation at the new conditions.

(Q) 64:- Open circuit and short circuit tests are performed on a 10kVA, 220V/110V, 60 Hz transformer, and both tests are performed with the instrument on the high-voltage side, and the following data are obtained: Open-circuit test : input voltage= 220V, input current= 3.16A, input power =500W. Short-circuit test : input voltage=65V, input current =10A, input power 400W. Obtain the approximate equivalent circuit, referred to the a) High voltage side, b) Low voltage side.

(Q) 65:- A three phase, 12 pole, salient pole alternator is coupled to a diesel engine running at 500 rpm. It supplies an induction motor which has a full load speed of 1440 rpm. Find the percentage slip and number of poles of the induction motor.

(Q) 66:- A three phase slip ring induction motor has a star connected rotor. It has an induced emf of 60 volts on open circuit between the slip rings at stand still when the rated voltage is supplied to the stator. The resistance and stand still reactance of rotor per phase are 0.5 Ω and 5 Ω respectively. Determine the rotor current per phase (i) when the rotor is at stand still and connected to a star connected rheostat of resistance 5 Ω and reactance of 0.5 Ω per phase. (ii) when running at 4 % slip with rheostat short circuited.

(Q) 67:- A three phase, 50 Hz, 6 pole squirrel cage induction motor runs at 960 rpm on full load. The stand still rotor resistance and reactance per phase are 0.01 ohm and 0.05 ohm respectively. Express the maximum torque developed in terms of full load toque. Find the slip at which the maximum torque occurs.

(Q) 68:- A three phase, 10 pole, 600rpm, star connected alternator has 12 slots per pole with 8 conductors per slot and the windings are short chorded by 2 slots. The air gap flux per pole contains a fundamental component of 0.09 webers, third harmonic component having an amplitude of 20% and the fifth harmonic component having an amplitude of 10 % of the fundamental. Calculate the RMS values individual components, phase and line voltages.

(Q) 69:- Two synchronous generators are running in parallel on a common bus bar. The bus bar is connected to a lighting load of 3MW and other loads of total 5 MW working at a power factor 0.72 lagging. One of the generators is loaded in such a way that it supplies a load of 5 MW at a power factor of 0.8 lagging. Calculate the load supplied by the other generator and the operating power factor.

(Q) 70:- A 12 MVA, three phase 50 Hz, 4 pole, 6.6 kV, star connected alternator is connected to an infinite bus bar. It has a synchronous reactance of 25%. While operating at full load and unity power factor the natural period of oscillation is limited to 2.5 seconds. Calculate the moment of inertia of the rotor

(Q) 71:- A 2 MW, 11 kV bulk load is operating on an average power factor of 0.8 lagging. A synchronous condenser is installed to supply an additional load of 560 kW to improve the power factor to 0.95. The synchronous condenser has an efficiency of 92%. Determine the kVA rating of the condenser and the power factor at which it operates.

(Q) 72:- . Calculate the maximum power received from the 11 kV bus when the synchronous impedance of the synchronous motor is 3 ohm/phase, and armature resistance is 1.5 ohm/phase. The field current of the motor is so adjusted that the motor develops a back emf of 10.5 kV. Calculate the corresponding value of armature current and the power factor.

(Q) 73:- A 3000 kVA, three phase, 6 pole, 50 Hz, alternator runs in parallel with other generators on 3.3 kV bus bars. The synchronous reactance is found to be 20%. Calculate the synchronizing power developed per phase per mechanical degree of rotor displacement and the synchronizing torque produced.

(Q) 74:- A salient pole alternator with the pu parameters Ra, Xd, Xq, is supplying the rated current at a lagging power factor of cos θ. Show that (i) The angle between E and I is given by tan φ = (sinθ + Xq) / (cosθ + Ra) (ii) Per unit regulation = [(1+ 2 Racosθ + (Xd+ Xq) sinθ + Ra 2 + XdXq) / sqrt((cosθ + Ra) 2 + (sinθ + Xq) 2) -1]

(Q) 75:- A salient pole alternator has the following per unit parameters Xd = 1.2, Xq = 0.8 and Ra = 0.025. Calculate the excitation voltage on per unit basis when the alternator is delivering rated kVA, at rated voltage at 0.8 pf lagging and leading.

OBJECTIVE QUESTIONS

(76):-The electric current in the motor generator

a) Heat only
b) Magnetic field only
c) (a) and (b)
d) Power only

(77):-If the speed of a d.c. shunt motor is increased, the back emf of the motor will

a) Decrease
b) Increase
c) Remain same
d) Increase then decrease

(78):- The large number of slots in induction motor

a) Provides better overload capacity
b) Reduces overload capacity
c) Provides bigger size of motor
d) Reduces the size of motor

(79):- Which of the following generating machine will offer constant voltage on all loads?

a) Separately excited generator
b) Self-excited generator
c) Level compound generator
d) All the above machines

(80):- The number of bushings in a transformer can be reduced if

a) The tapping are provided at the phase ends
b) The tapping are provided at the high voltage side
c) The tapping are provided in middle of the transformer
d) The tapping are provided on the low voltage side

(81):- The number of parallel paths in wave winding of machine is

a) 4
b) 6
c) 2
d) 8

(82):- Which of the synchronous alternators will complete 1080 electrical degrees in one revolution?

a) 8 pole synchronous alternator
b) 6 pole synchronous alternator
c) 4 pole synchronous alternator
d) 10 pole synchronous alternator

(83):- The primary applied voltage in an ideal transformer on no load is balanced by

a) Primary induced emf
b) Secondary induced emf
c) Secondary voltage
d) Core and copper losses

(84):- The synchronous motor can be made self starting by providing.

a) Damper winding on rotor poles
b) Damper winding on stator
c) (a) or (b)
d) None of the above

(85):- The air cores in transformers are preferred for

a) Low frequency transformers
b) High frequency transformers
c) 5 kVA, 50 Hz transformers
d) None of these

FILL in the blanks

86:-In induction motors, there is large decrease in maximum power factor when the dispersion coefficient is _____

87:- In dc machines the plane passing through the axis of the armature and through center of contact of the brushes is known as _____ plane.

88:-The plane passing through the axis of the armature perpendicular to the magnetic field of the generator at no load is known as _____ plane.

89:- When a transformer is operated on a supply frequency higher than its rated frequency, its kVA rating will become.....

90:- An insulating material should have _____ dielectric loss.

91:- The cause of hum in the transformers is assigned to _____

92:- A good insulating material should be unaffected by _____

93:- In induction motor when the length of the air gap is increased, the magnetizing current of the motor increases while the short circuit current _____

94:- The operating speed of a salient pole machine is _____ as compared to that of cylindrical pole machine.

95- Field systems of the cylindrical rotor alternators are wound in the _____

TRUE FALSE QUESTIONS

96:-To avoid synchronous cusps (S_s = no. of stator slots and S_r = no. of rotor slots) in an induction motor, $S_s - S_r = \pm p$.

97:- The friction and windage loss in a properly designed induction motor should not exceed 5%.

98:- In a synchronous motor when the winding is chorded by 30^0 it minimizes the effect of 5th and 7th harmonic.

99:- Electric machines up to 6.6 kV are called low voltage machines.

100:- In order to transmit torque, the motor shaft should have good shear strength .

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