INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

Course Name	:	**ELECRICAL MACHINES - II**
Course Code	:	A40212
Class	:	II B.TECH-II SEM
Branch	:	EEE
Year	:	2016-2017
Course Faculty	:	Mr. K Devender Reddy, Assistant Professor

OBJECTIVE:

As an extension of electrical machines –I course this subject facilitates to study of the performance of transformers and induction motors which are the major part of industrial drives and agriculture pump sets.

GROUP-I (SHORT ANSWER TYPE QUESTIONS)

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I **SINGLEPHASE TRANSFORMERS** **SHORT ANSWER TYPE QUESTIONS**		
1	Mention the differences between core and shell type transformers.	Evaluate	1
2	Give the EMF equation of a transformer and define each term	Apply	1
3	What are the applications of step-up & step-down transformer?	Apply	1
4	What types of cores are used for transformers?	Evaluate	1
5	Discuss the purpose of Oil used in the transformer.	Understand	1
6	On what size the construction of bushings in a transformer depend?	Evaluate	1
7	Discuss about copper losses in a transformer.	Analyze	1
8	Discuss about Eddy current loss in transformer.	Analyze	1
9	Discuss about Hysteresis loss in a transformer.	Analyze	1
10	Discuss all day efficiency	Analyze	1
	LONG ANSWER QUESTIONS		
1	Give the concept of single phase ideal transformer. Describe its performance with the help of neat phasor diagram	Analyze	1

2	Explicate in detail with a neat diagram about the constructional details of single phase transformers.	Analyze	1
3	Derive the EMF equation of transformer? Hence derive the voltage ratio.	Evaluate	1
4	What is the efficiency of transformer? How the efficiency of transformer can be calculated?	Evaluate	1
5	Discuss the effect of variable frequency and supply voltage on iron loss and performance of the transformer?	Analyze	1
6	Define voltage regulation of a transformer & enumerate the factors which influence the magnitude of this change?	Evaluate	1
7	Draw the exact equivalent circuit of a transformer and describe briefly the various parameters involved in it?	Evaluate	1
8	Define 'efficiency' and 'all-day efficiency' of a transformer. Mention how these are affected by the power factor?	Analyze	1
9	Draw the complete phasor diagram for a transformer, when the load power factor is i) Lagging ii) Leading.	Apply	1
10	Discuss the different losses taking place in the transformer and their variation with the load current.	Evaluate	1
ANALYTICAL QUESTIONS			
1	A 15kVA 2400-240-V, 60 Hz transformer has a magnetic core of 50-cm2 cross section and a mean length of 66.7 cm. The application of 2400 V causes magnetic field intensity of 450 AT/m (RMS) and a maximum flux density of 1.5 T. Determine i) The turn's ratio ii)The numbers of turns in each winding iii)The magnetizing current	Understand	1
2	The exciting current for a 50 kVA, 480/240V 50 Hz transformer is 2.5% of rated current at a phase angle of 79.80. Find the components of magnetizing current & loss component. Also find the magnetizing reactance & core loss resistance.	Understand	1
3	The voltage ratio of single phase 50 Hz transformer is 5000/500 V at no-load. Calculate the number of turns in each winding, if the value of the flux in the core is 7.82 mWb	Understand	1
4	The EMF per turn of a 1- φ, 2200/220 V, 50 Hz transformer is approximately 12V. Calculate i) The number of primary and secondary turns, and ii) The net cross-sectional area of core for a maximum flux density of 1.5 T.	Understand	1
5	A 30 KVA, 2400/120V, 50Hz transformer has a high voltage winding resistance of 22Ω. The low voltage winding resistance is 0.035Ω and leakage reactance is 0.012Ω. Find the equivalent circuit parameters when referred to the low voltage side.	Remember	1
6	A single phase, 50 Hz core type transformer has square cores of 20 cm side. The permissible flux density in the core is 1.0 Wb/m2. Calculate the number of turns per limb of the high and low voltage sides for a 3000/220V ratio. To allow for insulation of stampings, assume the net length to be 0.9xGross iron length.	Evaluate	1
7	125 KVA transformers has a primary voltage of 2000V at 60Hz, primary turns are 182 and secondary turns are 40. Neglecting losses calculate i) No load secondary EMF. ii) Flux in the core	Apply	1

8	A transformer takes 0.8A when its primary is connected to 200V, 50 Hz supply. The secondary is open circuited. The power absorbed from the supply is 60 watts. Determine the iron loss current and magnetizing current.	Analyze	1
9	being equally divided between iron and copper. During a day the transformer operates on full load for 3 hours, one half loads for 4 hours and the output being negligible for remaining of the day. Calculate all day efficiency	Apply	1
10	Find the all day efficiency of 500KVA distribution transformer whose cu loss and iron loss at full load are 4.5 KW and 3.5 KW respectively. During a day of 24 hours, it is loaded under No ofhrs loadinginKW pf 6 400 0.8 12 350 0.75 4 150 0.8 2 0 -----	Apply	1
	UNIT- II **TESTING OF TRANSFORMERS** **SHORT ANSWER TYPE QUESTIONS**		
1	Define voltage regulation of a transformer. What causes a change in secondary terminal voltage of transformer as it is loaded?	Remember	2
2	Does the transformer draw any current when secondary is open	Apply	2
3	Differentiate a classical transformer with an auto transformer.	Apply	2
4	Discuss whether the transformers can be used in parallel	Analyse	2
5	What is impedance in transformers?	Evaluate	2
6	Why is the short circuit test performed at reduced voltage on the HV side?	Understand	2
7	Is the sumpner's test data used for pre-determination of regulation of transformer? Justify the answer.	Remember	2
8	Discuss why Sumpner's test is beneficial for finding efficiency?	Remember	2
9	State any two important conditions to be satisfied for satisfactory and successful operation of transformers connected in parallel.	Evaluate	2
10	Is the efficiency of a transformer same at the same load at 0.8 pf lag and 0.8 pf lead?	Remember	2
	LONG ANSWER QUESTIONS		
1	With neat diagram, discuss the various tests to be conducted on transformer to obtain its equivalent circuit. Derive all related equations.	Evaluate	2
2	Describe the tests to be done on a single phase transformer to determine the equivalent circuit parameters.	Evaluate	2
3	Discuss about parallel operation of transformers for unequal voltages ratios.	Analyze	2
4	OC test is preferred to conduct on LV side & SC test is preferred to conduct on HV side. Describe the reasons.	Apply	2

5	Discuss why parallel operation of transformers is necessary. Under what conditions, the no-load circulating current is zero in two single-phase transformers operating in parallel?	Evaluate	2
6	Suggest a suitable test to predetermine the efficiency of a transformer and discuss it	Apply	2
7	Describe the method by which the separation of the core losses of a Transformer is achieved.	Analyze	2
8	With the help of neat experimental circuit, explain how Sumpner's test is Carried out on a pair of single phase transformer.	Evaluate	2
9	Derive an expression for load sharing between two transformer operating in Parallel with equal voltage ratios.	Evaluate	2
10	Derive an expression for load sharing between two transformer	Evaluate	2
ANALYTICAL QUESTIONS			
1	A 300 KVA, single - phase transformer is designed to have a resistance of 1.5% and maximum efficiency occurs at a load of 173.2 KVA. Find its efficiency when supplying full-load at 0.8 p.f lagging at normal voltage and frequency.	Remember	2
2	Calculate the regulation of a transformer in which the Ohmic loss is 1% of the output and the reactance drop is 4% of the voltage, when the power factor is 0.8 lagging, leading and unity.	Understand	2
3	A 100 KVA, 50 Hz, 440/11000 V, 1-phase transformer has an efficiency of 98.5% when supplying full- load current at 0.8 p.f and an efficiency of 99% when supplying half full-load current at unity p.f. Find the iron losses and copper losses corresponding to full load current	Remember	2
4	Calculate the voltage regulation for a 200/400 V, 4 KVA transformer at full load & pf. 0.8 lagging with following test data: OC test: 200 V, 0.8 A, 70 W (LV side) SC test: 20 V, 10 A, 60 W (HV side)	Understand	2
5	Hz, the wattmeter reading on HV side is 6 kW on rated voltage and on LV side is 15 kW when circulated full load current. Find the efficiency of each transformer on 3/4th load & 0.8 pf lagging. What will be the maximum efficiency of each transformer?	Apply	2
6	The iron loss in a transformer core at normal flux density was measured at frequency of 30 Hz and 50 Hz, the results being 30 W and 54 W respectively. Calculate (i)The hysteresis loss and (ii) The eddy current loss at 50 Hz.	Apply	2
7	The following results were obtained from tests on 30 KVA, 3000/110 V, and transformer O.C. test: 3000 V, 0.5 A, 350 W S.C. test: 150 V, 10 V, 500W Calculate the efficiency of the transformer at full load with 0.8 lagging power factor.	Apply	2
8	In a test for determination of the losses of a 440V, 50 Hz transformer, the total iron losses were found to be 2500W at normal voltage and frequency. When the applied voltage and frequency were 220V and 25Hz, the iron losses were found to be 850W. Calculate the eddy current loss at normal voltage and frequency.	Remember	2
9	Calculate the regulation of a transformer in which the Ohmic loss is 1% of the output and the reactance drop is 4% of the voltage, when the power factor is 0.8 lag, lead and unity.	Apply	2

10	240V/120V, 12KVA transformer has full load unity p.f. efficiency of 96.2%. It is connected as an autotransformer to feed a load at 360V. What is its rating and full load efficiency at 0.85 p.f. lagging?	Apply	2
UNIT - III AUTO AND POLY PHASE TRANSFOMRMERS SHORT ANSWER TYPE QUESTIONS			
1	What is an auto transformer?	Understand	3
2	A 3-phase transformer over a bank of 3-single phase transformers of equal rating, has the advantage of what?	Understand	3
3	The percentage capacity of V-V bank compared to delta – delta is?	Evaluate	3
4	Draw the circuit connection of Delta-Delta.	Analyze	3
5	Draw the circuit connection of Scott Connection.	Apply	3
6	Write about star-star connection in a three a phase transformer.	Remember	3
7	Write about delta-star connection in a three a phase transformer.	Remember	3
8	What are the advantages of Three-phase Transformers?	Remember	3
9	List out at least two essential factors for production of noise in a transformer.	Analyze	3
10	If the polarity of one of the transformer is reversed on a delta bank of single phase transformers that are connected for three phase operation, what would be the result?	Analyze	3
LONG ANSWER QUESTIONS			
1	Show that an auto-transformer will result in saving copper in place of two winding transformer.	Evaluate	3
2	With neat diagram, discuss the Construction of a three-phase transformer.	Evaluate	3
3	What are the disadvantages of current & voltage harmonics in transformers? Discuss how these harmonics can be eliminated.	Understand	3
4	Describe the two possible ways of connections of 3-phase transformers with relevant relations amongst voltage and currents	Analyze	3
5	Discuss T-T connection of transformer with the help of neat phasor diagrams.	Evaluate	3
6	With neat diagram describe the Scott connection of a 3 phase transformer.	Evaluate	3
7	Describe the tertiary winding connection of transformer with the help of neat diagrams.	Evaluate	3
8	With a neat sketch discuss the constructional details of a three phase transformer.	Remember &Evaluate	3
9	Justify that power handling capacity is reduced by 42.3% in Open-delta connection.	Apply	3
10	Describe the advantage of using tertiary in a bank of star-star transformers and List out the merits and demerits of a delta/star connected three phase transformer	Understand	3
ANALYTICAL QUESTIONS			

1	A 3 phase step down transformer connected in delta/star delivers power to a balanced 3phase load of 120 KVA at 0.8 pf. The input line voltage is 11kV and the turn's ratio of transformer (phase to phase) is 10. Determine the line voltage line currents, phase voltages, phase currents on both primary &secondary sides.	Understand	3
2	Two single phase furnaces are supplied at 250 V from a 6.6 kV, 3- f system through a pair of Scott connected transformer, if the load on the main transformer is 85 kW at 0.9 pf lagging and that on the teaser transformer is 69kW at o.8 pf lagging. Find the values of line currents on the three phase side. Neglect the losses.	Evaluate	3
3	A 3 phase, 100 KVA, 5000/400 V Star/Star, 50 Hz transformer has an iron loss of 1400 W. The maximum efficiency of transformer occurs at 80% of load. Calculate (i) The efficiency of transformer at full load and 0.85 pf lagging (ii) The maximum efficiency at UPF.	Evaluate	3
4	A 500 KVA, 3-phase, 50Hz transformer has a voltage ratio (line voltages) of 33/11 KV and is delta/star connected. The resistances per phase are: high voltage 35Ω, low voltage 0.876 Ω and the iron loss is 3050W. Calculate the value of efficiency at full load and one-half of full load with 0.8 lagging power factor	Evaluate	3
5	Two single phase furnaces are supplied at 500 V from a 3.3 kV, 3- f system through a pair of Scott connected transformer, if the load on the main transformer is 65 kW at 0.8 pf lagging and that on the teaser transformer is 49kW at o.7 pf lagging. Find the values of line currents on the three phase side. Neglect the losses.	Analyze	3
6	A 200 KVA, 3-phase, 50 Hz, 4000/400V transformer is connected on the HV side and Y connected on the LV side. The resistance of the HV winding in 1.5 Ω per phase and that of the LV winding 0.03 Ω per phase. Calculate the iron losses of the transformer at normal voltage and frequency if its full- load efficiency be 97.8% at 0.9 p.f (lag).	Apply	3
7	A 3 phase, 100 KVA, 5000/400 V Star/Star, 50 Hz transformer has an iron loss of 1400 W. The maximum efficiency of transformer occurs at 80% of load. Calculate (i) The efficiency of transformer at full load and 0.85 pf lagging (ii) The maximum efficiency at UPF	Apply	3
8	In a Scott connection, calculate the values of line currents on the Three-phase side, if the loads on the 2-phase side are 300 KW and 450KW, both at 100V and 0.707 p.f. (lag) and the 3- phase line voltage is 3,300V. The 300KW load is on the leading phase on the 2-phase side. Neglect transformer losses	Understand	3
9	A 3 phase step down transformer is connected to 6.6KV mains and takes 10A. The ratio of turns per phase is 12. Neglect losses. Calculate the secondary line voltage, line current and output for the following connections(i) Y/Δ(ii)Δ/Y.	Apply	3
10	Two transformers are connected in open-delta and supply a balanced 3 phase load of 240 KW at 400V and a p.f of 0.866. Determine: (i)Secondary line current (ii) the kva load on each transformer	Apply	3
UNIT - 1V POLY-PHASE INDUCTION MOTORS SHORT ANSWER TYPE QUESTIONS			
1	In a 3 – phase induction motor running at slip 's' the mechanical power Developed in terms of input power P2 is.	Evaluate	4
2	What do you mean by AC three-phase induction motor?	Understand	4

3	On what principle does the induction motor work?	analyze	4
4	What are the types of induction motors?	Evaluate	4
5	What are the main parts of AC three-phase induction motor?	Evaluate	4
6	The starting torque of a three-phase induction motor can be increased by increasing what?	Apply	4
7	In a poly phase squirrel-cage induction motor, increased starting torque can be obtained by	Apply	4
8	The ratio among rotor input, rotor output and rotor Cu losses are?	Analyze	4
9	How a rotor rotates in an Induction motor? Explain.	Remember	4
10	Discuss about slip in an Induction motor.	Remember	4
LONG ANSWER QUESTIONS			
1	Describe the principle construction and operation of Induction motor.	Understand	4
2	Discuss the various losses taking place in IM. Explain the effect of slip on the Performance of IM.	Understand	4
3	Derive the torque equation of an induction motor. Mention the condition for maximum torque.	Analyze	4
4	Describe how rotating magnetic field is developed in induction motor.	Understand	4
5	Discuss the following (a) How torque is developed in the rotor of a induction motor. (b) Why in some induction motors double cages areprovided?	Understand	4
6	Why the rotor of a poly phase induction motor can never attain synchronous speed? Discuss.	Understand	4
7	Describe the constructional features of both slip ring and squirrel cage induction motor. Discuss the merits of one over the other.	Understand	4
8	With neat diagram describe the equivalent circuit of 3phase Double Cage IM.	Analyze	4
9	Draw the phasor diagram of an Induction motor and explain.	Analyze	4
10	With a neat sketch discuss the principle of operation of double cage Induction motor Briefly explain the torque slip characteristics of an Induction motor.	Understand	4
ANALYTICAL QUESTIONS			
1	The frequency of stator EMF is 50 Hz for an 8-pole induction motor. If the rotor frequency is 2.5 hz, calculate the slip and the actual speed of rotor.	Understand	4
2	An 8 pole, 3phase alternator is coupled to a prime mover running at 750 rpm. It supplies an induction motor which has a full load speed of 960 rpm. Find the number of poles of IM and slip	Apply	4
3	In case of an 8-pole induction motor the supply frequency was 50 Hz and the shaft speed was 735 rpm. Compute (i) Synchronous speed (ii) Slip speed per unit slip (iii) Percentage slip.	Apply	4
4	A 3- φ induction motor is wound for 4 poles and is supplied from 50Hz system. Calculate i) Synchronous speed ii) Rotor speed, when slip is 4% iii) Rotor frequency when rotor runs at 60 rpm.	Remember	4

5	The EMF in the stator of an 8 pole induction motor has a frequency of 50 Hz and that in the rotor is 1.5Hz. At what speed the motor is running and what isc the slip?	Creating	4
6	An 8-pole, 50 Hz, 3 phase slip ring IM has effective resistance of 0.08 /phase The speed correspond to maximum torque is 650 rpm. What is the value of resistance to be inserted in rotor circuit to obtain maximum torque at starting?	Remember	4
7	A 4 pole, 400 V, 3phase IM has a standstill rotor EMF of 100 V per phase. The rotor has resistance of 50 Ω/ph and standstill reactance of 0.5 Ω/ph. Calculate the maximum torque & slip at which it occurs. Neglect stator impedance	Remember	4
8	The power input to a 500V, 50Hz, 6-pole, 3-phase induction motor running at 975 rpm is 40 KW. The stator losses are 1KW and the friction and wind age losses total to 2KW, Calculate i) The slip ii) Rotor copper loss iii) Shaft power.	Remember	4
9	An 8 pole, 3 phase alternator is coupled to an engine running at 750 rpm. The alternator supplies power to an induction motor which has a full load speed of 1425 rpm. Find the percentage slip and the number of poles of the motor.	Remember	4
10	500HP, 30, 440V, 50Hz induction motor has a speed of 950 rpm on full load. The machine has 6 poles. Calculate a) Slip and Speed of rotor field With respect to stator b) Speed of rotor field With respect to stator c) Complete alternations of rotor voltage per minute. d) Relative speed between stator field with respect to rotors.	Apply	4
UNIT - V CIRCLE DIAGRAM AND SPEED CONTROL OF INDCUTION MOTORS SHORT ANSWER TYPE QUESTIONS			
1	What are the advantages of auto transformer starting?	Analyze	5
2	What are the advantages of slip ring IM over squirrel cage IM?	Analyze	5
3	What is meant by cascade operation?	Apply	5
4	Discuss about direct online starting of an IM?	Apply	5
5	How do changes in supply voltages and frequency affect the performance of an IM?	Remember	5
6	Why no-load current of an Induction motor is much higher than that of an equivalent transformer?	Evaluate	5
7	In what ratio line current and starting torque is reduced with star- delta starting?	Apply	5
8	On what factors does the speed of an Induction motor depends?	Analyze	5
9	Why the induction generator is often called as asynchronous generator?	Evaluate	5
10	What is the application for Induction generators?	Apply	5
LONG ANSWER QUESTIONS			
1	With neat diagram discuss the various tests to be conducted on 3phase IM to plot the circle diagram.	Apply	5
2	Compare DOL starter, Auto transformer starter & Rotor resistance starter with relate to the following: (i) starting current (ii) starting torque	Evaluate	5

3	Calculate the minimum torque. Assume stator and rotor copper Losses equal at standstill.	Evaluate	5
4	Describe the speed control of IM by rotor resistance control Method. How this method of speed control is different from stator side speed control methods	Evaluate	5
5	Compare the speed control of 3phase IM by rotor resistance control & variable frequency control	Apply	5
6	What happens if the EMF is injected to the rotor circuit of induction motor?	Analyse	5
7	With the help of experimental circuit, describe how the equivalent circuit parameters are determined by no load and blocked rotor tests on 3 phase Induction motor.	Apply	5
8	With the help of a neat diagram, describe the working of a star - delta starter.	Apply	5
9	Discuss the working principle of Induction generator.	Analyse	5
10	Mention the advantages and disadvantages of Induction generator.	Apply	5
ANALYTICAL QUESTIONS			
1	A cage IM when started by means of a star-Delta starter takes 180 % of full load current & develops 35 % of full load torque at starting. Calculate the starting current & torque in terms of full load torque when started by means of an auto transformer with 75 % tapping.	Creating	5
2	A 3-phase, 400V induction motor has the following test readings:- No-load:- 400V, 1250W, 9 A Short circuit:- 150V, 4KW,38 A Draw the circle diagram. If the normal rating is 14.9 KW, find from the circle diagram, the full load value of current, power factor and slip.	Remember	5
3	A 4 pole, 50 Hz, wound rotor IM has a rotor resistance of 0.56 ph and runs at 1430 rpm at full load. Calculate the additional resistance per phase to be inserted in the rotor circuit to lower the speed to 1200 rpm, if the torque remains constant.	Remember	5
4	Two 50Hz, 3 phase induction motors having six and four poles respectively are cumulatively cascaded, the 6 pole motor being connected to the main supply. Determine the frequencies of the rotor currents and the slips refereed to each stator field if the set has a slip of 2%.	Remember	5
5	A 3 phase, 6 pole 50Hz induction motor when fully loaded, runs with a slip of 3%. Find the value of resistance necessary in series per phase of the rotor to reduce the speed by 10%. Assume that the resistance of the rotor per phase is 0.2 ohm.	apply	5
6	Two slip ring IMs having 10 & 6 poles respectively are mechanically coupled. i. Calculate the possible speed when first motor is supplied from a 50 Hz supply line. ii. Calculate the ratio of power shared by the two motors. iii. If the smallest possible speed is to be attained independently by each machine, calculate the frequency of the voltage to be injected in the rotor circuit	Remember	5
7	A 6 pole, 50 Hz, 3 phase induction motor is running at 3 percent slip when delivering full load torque. It has standstill rotor resistance of 0.2 ohm and reactance of 0.4 ohm per phase. Calculate the speed of the motor if an additional resistance of 0.6 ohm per phase is inserted in the rotor circuit. The full load torque remains constant	Apply	5

8	Two 50 Hz, 3 phase Induction motors having six and four poles respectively are cumulatively cascaded, the 6 pole motor being connected to the main supply. Determine the frequency of the rotor currents and the slips referred to each stator field if the set has a slip of2%.	Evaluate	5
9	A 50 KVA, 400V, 3 phase, 50 Hz squirrel cage Induction motor has full load slip of 5%. Its standstill impedance is 0.866 ohms per phase. It is started using a tapped auto transformer. If the maximum allowable supply current at the time of starting is 100A, calculate the tap position and the ratio of starting torque to full load.	Understand	5
10	A three-phase delta-connected cage type induction, motor when connected directly to a 400 V, 50Hz supply, takes a starting current of 100 A, in each stator phase. Calculate i) The line current for `direct--on-line starting.	Apply	5