Ref No. : Ex//EE/T/222/2018

Bachelor of Electrical Engineering, 2nd Year 2nd Semester Examination, 2018

SUBJECT: ELECTRICAL MACHINES-II

Time: Three Hours | Full Marks: 100 (50 each part)

Use a separate Answer-Script for each part

PART - I

Answer Question no. and any two from the rest.

1. (i) 'If two identical transformers have tapings at 50% and 86.7% then they can be connected in Scott connection and their role can be interchanged'- Justify **5+6+9=20**

   (ii) How Dy1 and Yd11 transformers can be connected in parallel with minor changes.

   (iii) In Scott-connected transformers, teaser transformer supplies 0.8 leading power factor load of 40 kW at 220 V and main transformer supplies 0.85 lagging power factor load of 30 kW at 220 V, from a three phase input line voltage of 3.3 kV. Determine the input line currents. Neglect magnetizing currents and the leakage impedance drops. Draw voltage and current phasors computed.

2. (i) Why a core type three phase transformer is better than other (shell type or 3-Ph bank) for harmonics related problems. **4+6+5=15**

   (ii) What is the harmonics related problem with Yy connected transformer without neutral.

   (iii) How Delta winding is used to overcome the problems of harmonics in a three phase transformer ?

[Turn over

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PART - I

3. **(i)** Explain the term 'relative phase displacement' for three phase transformers? **4+6+5=15**

(ii) Draw the connection diagram and phasor diagram of the following connections.

a) Yz1 , b) Dz6

(iii) Why zigzag connection has inherent properties of elimination of third harmonics?

4. i) Taps should be provided at the middle of the high voltage winding, explain. **5+5+5=15**

ii) Write the advantages of tertiary winding.

iii) Describe the operation of a reactor type tap changer .

Write Short notes on any two

5. **(i)** Full wave and chopped wave impulse voltage tests on a transformer for detection of faults. **7.5 x 2 =15**

(ii) Development of voltage stress along the windings of a three phase transformer for impulse and RMS voltages and the measure should be taken to withstand it.

B.E. ELECTRICAL ENGINEERING SECOND YEAR SECOND SEMESTER EXAMINATION – 2018

ELECTRICAL MACHINES- II

Time : Three hours **Full Marks: 100**

PART – II

Different parts of the same question should be answered together.

1.	Answer **any one from (a) and (b)**	**[10]**
	(a) Show that a rotating magnetic field of constant amplitude can be produced by supplying a balanced three phase voltage source to a balanced three phase winding. What happens if the phase sequence is changed?	
	(b) Explain the principle of operation of a three phase induction motor. What is slip? Derive the expression for the frequency of rotor current in terms of supply frequency and slip. How can the direction of rotation of an induction motor be reversed? Explain the terms Cage rotor and wound rotor.	
2.	Answer **any one from (a) and (b)**	**[10]**
	(a) Describe the construction of a double cage induction motor and explain how high starting torque is developed in double cage induction motor. Draw the equivalent circuit of double cage rotor induction motor.	
	(b) Describe the phenomenon of cogging and crawling. What measure can eliminate these effects?Why these effects are not exhibited in slip ring induction motor?	
3.	**Answer any one from (a) and (b)**	**[10]**
	(a) Develop equivalent circuit of a three phase induction motor and explain how the mechanical power developed is taken care in the equivalent circuit. What are the assumptions taken for developing equivalent circuit?	
	(b) Derive expression for starting torque in terms of full load torque in case of (i) DOL starting, (ii) Auto transformer starting and (iii) Star – Delta starting for a three phase induction motor.	
4.	Answer **any one from (a) and (b)**	**[10]**
	(a) Develop the expression for torque of a three phase induction motor. Find the condition for maximum torque developed in a three phase induction motor.	
	(b) Draw torque vs. slip characteristic and also show how torque vs. slip characteristic changes with the variation of rotor resistance and rotor inductance. How the high starting torque can be developed in a slip ring induction motor? What is the effect of change in supply voltage on the operating performance of an induction motor?	

5.	Answer **any two from (a), (b) and (c)**	**[5 x 2 = 10]**

(a) The output of 3-phase, 50 Hz 6-pole Induction Motor is 5 hp at 935 rpm. (i) Calculate the input if the stator losses are 400 Watt, (ii) What starting torque will the machine develop when switched directly onto the supply if maximum torque developed at 800 rpm? Allow 1% loss for windage and friction.

(b) A three phase, 400 Volt, 4-pole, 50 Hz induction motor has a star connected stator and rotor winding. The rotor resistance and standstill reactance per phase are 0.22 ohm and 1.22 ohm respectively, stator to rotor turns ratio being 1.3. The full load slip is 4%. Calculate the full load torque and power developed. Find also the maximum torque and corresponding speed.

(c) A squirrel cage type induction motor when started by means of a star-delta starter takes 180% of full load line current and develops 35% of full load torque at starting. Calculate the starting torque and current in terms of full load values, if an auto-transformer with 75% tapping were employed.