BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) EXAMINATION, 2019

(3^{rd}Year, 1^{st} Semester)

ELECTRICAL MACHINES – II

Time : Three Hours | Full Marks : 100

(50 marks for each part)
Use a separate Answer Script for each part

PART – I

Answer any three questions.
Two marks are for well organized answers.

1.(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. How can you change the direction of the rotating magnetic field? Find out the speed of the rotating magnetic field produced. 12

(b) Explain the principle of operation of a three phase induction motor. Why this type of motor is known as asynchronous motor? 4

2.(a) Starting from basic principle develop the expression for torque produced in a three phase induction motor. Establish the condition for maximum torque developed. Draw torque vs. slip characteristic and also show how torque vs. slip characteristic changes with the variation of rotor resistance and rotor inductance. 10

(b) Derive the relation between output power of the rotor, input power to the rotor and slip of a three phase induction motor. 6

3.(a) Develop equivalent circuit of a polyphase induction motor stating the assumption(s) taken and also develop its approximate equivalent circuit for the ease of calculation. 8

(b) Describe no-load and blocked rotor tests of an induction motor and calculate the equivalent circuit parameters from these test results. 8

4.(a) Why starters are necessary for starting an induction motor? What are the various types of starters used for starting of squirrel cage induction motor? Describe with circuit diagram the working of any one type of starter for starting squirrel cage induction motor and hence derive an expression for starting torque in terms of full-load torque. 10

(b) Describe briefly the phenomenon of cagging and crawling? What measures can eliminate these effects? 6

5.(a) Explain how improved starting performance of a three phase squirrel cage motor may be obtained by means of a double cage rotor winding. Draw equivalent circuit of a double cage rotor induction motor. Derive the relationship between the torques developed by outer and inner cages of a double cage induction motor. 10

(b) The resistance and reactance (equivalent) values of a double cage induction motor for the stator, outer and inner cage are 0.25, 1.0 and 0.15 ohm of resistance while 3.5, zero and 3.0 ohm of reactance respectively. Find the starting torque if the phase voltage is 250 Volt and the synchronous speed is 1000 rpm. 6

Ref No. : **Ex/EE/5/T/313/2019**

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING), THIRD YEAR
FIRST SEMESTER EXAM, 2019

SUBJECT: ELECTRICAL MACHINES-II

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

Use a separate Answer-Script for each part

Question No.	PART - II	Marks
	Answer question no. 1 and any two from the rest	
1.	Answer any five from the following	**4x5 = 20**
(i)	Draw a shell type three phase transformer and show the coils with polarities and fluxes in the core. 'The flux densities in the central limbs can be more compared to yokes in case of a certain polarity connection- explain	
(ii)	Star – Delta connection can be used in a transformer to introduce a phase difference of 30° between its output and corresponding input line voltages but star-star cannot be used for the same. – Justify.	
(iii)	The resistance and reactance of a 100 KVA 11000/400V Δ-Y distribution transformer are 0.02 and 0.07 p.u respectively. The phase impedance of the transformer referred to the primary is (a) $(0.02 + j0.07)\Omega$ (b) $(0.55 + j1.925)\Omega$ (c) $(15.125 + j52.94)\Omega$ (d) $(72.6 + j254.1)\Omega$	
(iv)	'In a 3-ph 60Hz balanced system 9^{th} harmonics of current will have 120^{o} angle between each phase'- justify	
(v)	'Taps are generally provided at the middle of the winding' – justify.	
(vi)	Draw the Scott Connection for 3-phase to 2 phase conversion.	
2.(i)	Why tertiary windings are frequently connected in delta.	**3+3+9**
(ii)	Draw the Regulator transformer tap-changer scheme.	

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

Use a separate Answer-Script for each part

Question No.	PART - II	Marks
(iii)	In Scott-connected transformers, teaser transformer supplies 0.5 leading power factor load of 50 kW at 110 V and main transformer supplies 0.75 power factor lagging load of 75 kW at 110 V, from a three phase input line voltage of 11000V. Determine the input line currents. Neglect magnetizing currents and the leakage impedance drops. Draw voltage and current phasors computed.	
3.(i)	What is relative phase displacement between two transformers ? Why it is important for parallel operation of transformers?	6 + 9
(ii)	Draw the vector diagrams and connection diagrams for the following vector group connections. a) Dd6 b) Dy1 c) Yz11	
4.(i)	Why do harmonics come in the induced voltage of the transformer?	5+5+5
(ii)	In Y-y transformer 3rd currents cannot flow in the line- explain.	
(iii)	Why in Dd transformer has a core flux more sinusoidal than that in Yd transformer?	
5.(i)	What are the common sources of high voltage impulses on transformers?	4+8+3
(ii)	Why Shielding and Graded insulation is required in a transformer to protect from the high voltage impulses?	
(iii)	What are the routine tests and type tests recommended by IS for a distribution transformer?	