

Ref No. : Ex/EE/5/T/313/2019 (Old)

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

SUBJECT: ELECTRICAL MACHINES-II

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Time: Three Hours

Full Marks: 100 (50 each part)

Use a separate Answer-Script for each part

Question No.	PART - I	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° 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.	

[Turn over

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 3 rd 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?	

PART – II

Answer any Three questions.

Two marks are for neatness and well organized answer.

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| 6. | (a) Sketch the cross-sectional view of a dc machine and label its main parts. Name different materials used to construct different parts of a dc machine. | 8 |
| | (b) Prove that the volume or weight of copper used for identical rated DC machines are same for both lap and wave armatures, when they are on the same magnetic field. | 4 |
| | (c) Develop the conditions for avoiding dummy coils in a wave wound armature. Why equalizer is not required in simplex wave winding? | 4 |
| 7. | (a) Illustrate different methods of excitation of dc machine. | 4 |
| | (b) Derive an equation for induced emf of a dc generator. | 4 |
| | (c) With the help of OCC explain how voltage is built-up in a dc shunt generator. What is critical field resistance and critical speed? Explain. | 8 |
| 8. | (a) Derive the general torque equation of a dc motor. | 6 |
| | (b) What are the different losses takes place in a dc machine? Mention the factors on which these losses depend upon. How these losses are reduced? | 5 |
| | (c) A shunt machine connected to 250 volt mains has an armature resistance of 0.14 ohm and resistance of field is 125 ohms. Find the ratio of the speed as generator to the speed as a motor, the line current in each case being 90 A. | 5 |
| 9. | (a) What is armature reaction and what are the effects of armature reaction in DC machines and what are the methods for reducing the effects of armature reaction? | 8 |
| | (b) Explain the commutation process in DC machine and what are the role(s) of interpole in commutation process in DC machine? | 8 |
| 10. | Write notes on any two of the following: | 2x8 |
| | (a) Parallel operation of DC shunt generators | |
| | (b) Speed Control of DC motors | |
| | (c) Hopkinsons method of testing of Dc machines | |