Bachelor of Electrical EngineeringExamination, 2018

(2ndYear, 1stSemester)

ELECTRICAL MACHINES - I

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. Question no. 5 carries 18 marks.

1.	a) Explain how the primary current increases as the current on the secondary side of the transformer is increased.	2
	b) Draw and explain the phasor diagram of a single phase transformer under lagging power factor load.	6
	c) Derive an expression for computing the per unit voltage regulation of a transformer both for leading and lagging power factor load.	8
2.	a) Draw the equivalent circuit of a transformer and define its various parameters. Clearly state the assumptions involved in the applicability of this equivalent circuit.	8
	b) How the transformer equivalent circuit parameters are determined in the laboratory.	8
3.	a) A What is an auto-transformer? Derive an expression for saving in conductor material in an auto-transformer over a two winding transformer of equal rating. State the advantages and disadvantages of auto-transformer over two winding transformer.	8
	b) A 25kVA, 2000/200 Volt, 2-winding transformer is to be used as an auto-transformer with constant source voltage of 2000 Volt. At full-load of unity power factor, calculate the power output, power transformed and power conducted. If the efficiency of the two winding transformer at 0.8 power factor is 95%, the efficiency of the transformer.	8
4.	a) Two single phase transformers are operating in parallel. Derive an expression for the current driven by each, sharing a common load, when no-load voltages of these are not equal.	8

	b) Distinguish between Power and Distribution transformers.	2
	c) The daily variation of load on a 100 kVA transformer is as follows: 8:00 AM to 1:00 PM ---- 66kW, 45 kVAr 1: 00 PM to 6:00 PM ----- 80 kW, 50 kVAr 6:00 PM to 1:00 AM ---- 30 kW, 30 kVAr 1: 00 AM to 8:00 AM ---- No-load This transformer has no-load core loss of 270 watts and a full load ohmic loss of 1200 watts. Determine the all-day efficiency of the transformer.	6
5.	Write short notes on any four of the following : a) Conservator and breather b) Transformer oil c) Buchholz relay d) Explosion vent e) CRGOS	4 × 4½

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Use a separate Answer-Script for each part.

Question No.	PART - II	Marks
	Answer question no. 6 and any two from the rest.	
6.	Justify the following (any six) :	**6x3**
i)	A separately excited DC generator has better voltage regulation than a shunt one.	
ii)	Due to the armature reaction, magnetic neutral is shifted in the direction of rotation in a DC generator.	
iii)	O.C.C or no-load characteristics alone can determine the stable voltage at no-load operation.	
iv)	In a DC machine, the armature reaction is mainly cross magnetizing.	
v)	Interpole is employed in a DC machine only for reducing the effect of armature reaction.	
vi)	Without formation of CuO in the interface between brush and commutator, commutation process goes on smoothly.	
vii)	Swinburne's method of testing of DC machine can be performed on DC series motor	
viii)	Pole shoes are generally laminated in a DC machine.	
7. i)	Discuss the effects of armature reaction.	**6+3+7**
ii)	What is compensating winding? How does it help to reduce the adverse effects of armature reaction?	

Question No.		Marks
iii)	A shunt generator delivers 75 kW at 240 V and 500 r.p.m. the armature and field resistances are 0.03Ω and 60Ω respectively. Calculate the speed of the machine running as a shunt motor and taking 75 kW input at 240 volts. Allow 1 V per brush for contact drop.	
8. i)	Discuss different methods of speed control of a DC shunt motor	8+8
ii)	A 220 V shunt motor has an armature resistance of 0.5Ω and takes a current of 40 A on full load. By how much must the main flux be reduced to raise the speed by 50% if the developed torque is constant?	
9. i)	Define back pitch, front pitch and commutator pitch of a DC machine winding.	6 +2 + 8
ii)	Why Hopkinson's method of testing DC generator is also called regenerative method?	
iii)	The Hopkinson test on two shunt machines gave the following results for full load: Line voltage, 250 V. Line current excluding field currents, 50A; motor armature current 380 A; Field currents 5A and 4.2 A. Calculate the efficiency of each machine. Armature of each machine 0.02 Ω,	
10.	Write short notes on the following :	8x2
i)	Characteristics of different types of DC motors.	
ii)	Ward-Leonard Method of speed control of DC motor.	