Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Electrical Machine Design (ELEG 472) **Semester: VII**
Programme: B Tech Electrical & PSE **Time: 03 hrs.**
No. of Pages: 02 **Max. Marks: 100**

SECTION A

S. No.	Attempt all questions	Marks	CO
Q 1	Explain the advantages of CRGOs strip of transformer core.	**04**	**CO1**
Q 2	A 3phase, 4 pole induction motor has 36 slots. Calculate the order of slot harmonics produced. It is desired to completely eliminate the higher order slot harmonics. Find the angle through which the bars must be skewed. Find the effect of skewing on the lower order harmonics.	**04**	**CO2**
Q 3	Describe utilization factor and stacking factor for the design of a transformer core	**04**	**CO1**
Q 4	Describe the conducting materials and magnetic materials for the design of an Electrical machine.	**04**	**CO2**
Q 5	Distinguish between core type transformer and shell type transformer depending on design and windings placement.	**04**	**CO2**
	SECTION B		
Q 6	Derive the output equation and output coefficient of an AC machine	**10**	**CO4**
Q 7	Explain the design features of Power and Distribution Transformer.	**10**	**CO3**
Q 8	Derive the condition for width of window for optimum output of transformer.	**10**	**CO3**
Q 9	Find the main dimensions of a 50 kW, 3 Phase, 440V, 50 Hz, 2850 r.p.m., slip ring induction motor having an efficiency of 0.82 and a full load power factor of 0.9. Assume: Specific magnetic loading = 0.65 Wb/m^2; Specific electric loading = 28000 A/m; Take the rotor peripheral speed as approximately 50m/s at synchronous speed.	**10**	**CO4**
	(OR)		
Q 9	Determine the main dimensions of a 25000 kVA 13.8 kV 50 Hz, 275 r.pm., 3 phase star connected alternator. Also find the number of stator slots, conductors per slot, conductor area and work out the winding details. The peripheral speed should be about 30 m/s. Assume: Average gap density = 0.45 Wb/m2, Ampere conductors per metre= 23000 and Current density = 2 A/mm2	**10**	**CO4**

SECTION-C			
Q 10	A 1250 kVA, 3300 V, 50 Hz, 400 r.p.m., 3 phase alternator has 180 slots with 5 conductors per slot. Single layer winding with full pitch coils is used. The winding is star connected with one circuit per phase. Determine the specific electric and specific magnetic loadings of the stator bore is 1.8 m and the core length is 0.4 m. using the same loadings, determine the corresponding data for a 2750 kVA. 3300 V, 50 Hz, 750 rpm, 3 phase star connected alternator having 2 circuits per phase. The machines have 60^0 phase spread.	**20**	**CO5**
Q 11	Design a 25 kVA , 11000/433 V, 50 Hz, 3 phase delta/star, core type distribution transformer. The transformer is provided with tappings ±2.5% , ±5% on the H.V winding. Maximum temperature rise not to exceed 45^0C with mean temperature rise of oil 35^0C.	**20**	**CO5**
	(OR)		
Q 11	Calculate the main dimensions and winding details of a 100 kVA , 2000/400 V, 50 Hz, single phase shell type oil immersed, self-cooled transformer. Assume: voltage per turn 10V, flux density in core 1.1 wb/m^2, current density 1 A/mm^2, window space factor 0.33. The ratio of window height to window width and ratio of core depth to width of central limb=2.5 Stacking factor= 0.9.	**20**	**CO5**

Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Electrical Machine Design (ELEG 472) **Semester: VII**
Programme: B Tech Electrical & PSE **Time: 03 hrs.**
No. of Pages: 02 **Max. Marks: 100**

SECTION A

S. No.		Marks	CO
Q 1	Describe why plain walled tanks are not used for large output transformers?	**04**	**CO1**
Q 2	Explain the optimum design conditions of transformers.	**04**	**CO1**
Q 3	Describe the reason behind the transformer oil used as cooling medium? And mention the important characteristics desirable in transformer oil?	**04**	**CO2**
Q 4	Explain the purpose of providing damper windings in synchronous machines?	**04**	**CO2**
Q 5	Explain the location of H.V and L.V windings on a core type transformer and advantages of it.	**04**	**CO2**
	SECTION B		
Q 6	Explain the design considerations of squirrel cage and slip ring induction motor (both stator and rotor)	**10**	**CO3**
Q 7	A 3 phase induction motor has 54 stator slots with 8 conductors per slot and 72 rotor slots with 4 conductors per slot. Find the number of stator and rotor turns. Find the voltage across the rotor slip rings when the rotor is open circuited and at rest. Both stator and rotor are star connected and a voltage of 400 V is applied across the stator terminals.	**10**	**CO4**
Q 8	Core length = 28cm, number of ventilating ducts = 4, width of duct = 1.0cm, pole arc of ventilating ducts = 4, width of duct = 1.0cm, pole arc = 19cm. Slot pitch = 5.32 cm, semi-closed slots with slot opening = 0.5cm, air gap length = 0.5cm, flux/pole = 0.15Wb. Calculate the ampere turns for the air gap of a machine using the following data.	**10**	**CO4**
Q 9	Describe the effect of higher values of specific magnetic loading in design of Electrical Machines and performance of machine?	**10**	**CO3**
	(OR)		
Q 9	Describe the effect of higher values of specific Electric loading in design of Electrical Machines and performance of machine?	**10**	**CO3**

SECTION-C			
Q 10	The following is the design data available for a 150 kVA 3 phase, 50 Hz, 400 V, Delta connected 375 r.p.m alternator of salient pole type: Stator bore D=2.0 m Stator core length L= 0.15 mm Pole arc/pole pitch = 0.66 Turns per phase= 150 Single layer concentric winding with 5 conductors per slot Short circuit ratio = 1.2 Assume that the distribution of gap flux is rectangular under the pole arc with zero values in the inter polar region. Calculate: (i) Specific magnetic loading (ii) Armature mmf per pole (iii) Gap density over pole arc (iv) Air gap length MMF required for air gap is 0.88 of no load field mmf and the gap contraction factor is 115.	**20**	**CO5**
Q 11	Determine the main dimensions of the core and window for a 500 kVA, 6600/400 V, 50 HZ single phase core type oil immersed self-cooled transformer Assume: flux density= 1.2 T; Current density= 2.75 A/mm^2; Window space factor= 0.32; Volt/turn= 16.8; Type of core= cruciform core; Height of window= 3 times window width Calculate the number of turns and cross sectional area of the conductors used for the primary and secondary windings.	**20**	**CO5**
	(OR)		
Q 11	A 2000 kVA, 3 phase 50 Hz, 6600 V, 500 rpm synchronous generator with a concentric winding has the following design data: Specific magnetic loading = 0.45 Wb/m^2 Specific electric loading =22000 A/m Gap length = 3.5 mm Field turns per pole = 60 Short circuit ratio = 1.2 The effective gap area is 0.6 times the actual area Peripheral speed is 20 m/s. Find the stator core length, stator bore, turns per phase, mmf for air gap, armature mmf per pole, and the field current for no load and rated voltage.	**20**	**CO5**