Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: Electrical Machine Design **Semester: VII**
Program: B Tech Electrical & PSE **Time 03 hrs.**
Course Code: ELEG 472 **Max. Marks: 100**
Instructions: Answer All Questions

SECTION A

S. No.	Answer All Questions	Marks	CO
Q 1	A 3-phase induction motor has a starting speed which is 95% of its synchronous speed and has a rotor resistance per phase of 0.1 ohms. Calculate the additional resistance to be added in rotor per phase in order to attain maximum torque at starting.	**5**	**CO2**
Q 2	Distinguish between core type transformer and shell type transformer depending on design and windings placement.	**5**	**CO1**
Q 3	A 125 W, 230V, 1250 rpm universal motor has a full load efficiency of 63.3 percent, calculate the power developed by armature of the motor if the sum of iron, friction and windage losses is approximately $1/3^{rd}$ of total losses.	**5**	**CO2**
Q 4	Explain the purpose of providing damper windings in synchronous machines?	**5**	**CO1**
	SECTION B		
Q 5	Determine the main dimensions of a 1.25 MVA 11 kV 50 Hz, 750 rpm., 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 25 m/s. Assume: Average gap density = 0.40 Wb/m^2, ac= 28000 A/m and Current density = 2 $A/mm^{2.}$.	**10**	**CO3**
Q 6	Describe the effect of higher values of specific Electric loading in design of Electrical Machines and performance of machine?	**10**	**CO2**
Q 7	A 3-phase, 4-pole, 50 Hz squirrel cage induction motor has a rotor diameter 0.27m and core length 0.12m. The peak density in the air gap is 0.4 wb/m^2. The rotor has 33 bars, each of resistance 100 µ ohms. And a leakage inductance 2 µH. The Slip is 6%. Calculate (a) Peak value of current in each bar (b) Rotor I^2R losses (c) Rotor output (d) Torque exerted. Note: neglect the resistance of end rings.	**10**	**CO3**
Q 8	Explain the design features of Power and Distribution Transformer.	**10**	**CO2**
	(OR)		

Q 8	Derive the condition for width of window for optimum output of transformer.	**10**	**CO2**
SECTION-C			
Q 9	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 of a 2 MVA, 3 phase 50 Hz, 3.3KV, 1500 rpm synchronous generator with a concentric winding has the following design data: B_{AV} = 0.425 Wb/m^2 ., ac =18000 A/m, Gap length = 3.25 mm, Field turns per pole = 60, Short circuit ratio = 1.12, The effective gap area is 0.6 times the actual area, Peripheral speed is 35 m/s.	**20**	**CO4**
Q 10	Design a 50 kVA , 11/4.4 KV, 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**	**CO4**
	(OR)		
Q 10	Calculate the number of turns and cross sectional area of the conductors used for the primary and secondary windings and Determine the main dimensions of the core and window for a 1MVA, 6600/400 V, 50 HZ single phase core type oil immersed self-cooled transformer. Assume: flux density= 1.2 T; Current density= 2.20 A/mm^2; Window space factor= 0.32; Volt/turn= 13.2; Type of core= cruciform core; Height of window= 2.5 times window width.	**20**	**CO4**