Answer the following questions

Question 1 (25 marks)

(a) Develop a mathematical model that represents the dynamic state of the separately excited dc motor. Setup the differential equations in the matrix form. Neglect the saturation of the magnetic core. (12 Marks)

(b) The phases of a 3-phase circuit consist of equal resistances and equal inductances connected in series. The phases are not coupled. Drive the voltage equations in the arbitrary reference frame and draw the equivalent circuit. (13 Marks)

Question 2 (25 marks)

A separately excited dc motor is rated at 1150 rpm, 240 V, and 3 hp. The armature resistance and the inductance are 1.43Ω and 10.4 mH, respectively. The moment of inertia of the motor is 0.068 kg-m^2 while K_V is 1.8, and the frictional losses are negligible. Determine the speed and the armature current at no-load as a function of time after the motor is energized by applying the rates voltage at t=0. Assume that the motor is at rest at $t \le 0$.

Question 3 (25 marks)

A 400 V, 3-phase, 50 Hz, 4-ploe, 15 A, 0.88 PF squirrel-cage induction motor has a full-load speed of 1455 rpm. The stator losses total 150 watts. Total inertia of motor plus load is 0.0563 kg-m2.

i. Calculate the number of starts and stops (by plugging) per minute that this motor can make without exceeding the permissible temperature rise.

ii. How many starts and stops can be made if the motor has 8 poles, all other conditions remaining unchanged?

iii. Also calculate the number of reversals per minute that the motor can make by plugging, without exceeding the designed temperature. (15 Marks)

Question 4 (25 marks)

(a) Drive the mathematical model by which the dynamic response of a balanced three phase induction motor can be predicted. (13 Marks)

(b) Drive a mathematical model to describe the dynamic behavior of three phase salient-pole synchronous generator in the arbitrary reference frame, having one damper coil on the quadrature axis and one damper coil on the direct axis. (12 Marks)

With my best wishes

This exam measures the following ILOs					
Skills	Knowledge &Understanding Skills		Intellectual Skills		Professional Skills	
	A1	A3	B1		C17	
Question Number	Q1	Q4	Q2	Q3	Q1	Q4