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

Course: Electrical Actuators And Drives –EPEC7009 **Semester: II**
Program: MTECH. AUTOMATION & ROBOTICS
Time: 03 hrs. **Max. Marks: 100**

Instructions: Consider necessary assumptions if required for any question and mention the same clearly

SECTION A (5x4=20M)

S. No.		Marks	COS
Q 1	Describe the speed control valve and flow control valve used in the robotic applications.	**4**	**CO5**
Q2	Write the DC motor performance equations which are used in the mathematical modelling.	**4**	**CO2**
Q3	Discuss the main factors influencing the selection of electric drives for robotic applications?	**4**	**CO4**
Q4	Explain how the quality of the supply can be improved, when an inadequate reactive power compensation and the motor terminal voltage varies during a drive control.	**4**	**CO4**
Q5	Draw the speed - torque curves of separately excited and DC series motor in the case of Dynamic breaking.	**4**	**CO1**
	SECTION B (10x4=40M)		
Q 6	A separately excited dc motor has the following parameters. R=0.5 Ω , K_f=1 , B=0.1 kg m^2/sec , J=2.0 Kg m^2 The motor drives a constant load torque. With field current I_f=2 A and armature terminals connected to a 100 V dc source, the motor rotates at 450 rpm. (a) Determine the motor current la . (b) Determine the friction torque ($B.\omega_m$) and the load torque (T_L). (c) The motor is now disconnected from the dc supply. Obtain an expression for speed as a function of time. The load torque remains on the motor shaft after the motor is disconnected from the supply. What is the new steady-state speed?	**10**	**CO1**
Q7	Explain the basic approach of closed-loop speed control of a separately excited DC-Drive speed control considering the current limit as well.	**10**	**CO3**
Q8	When pneumatic systems are used, and to control many robotic applications in the industry Depending on their application to the robotic actuation, explain the any two types of pneumatic pumps used in the actuation with the help of neat diagram.	**10**	**CO5**
Q9	Practically for all the motors, the speed will drop as the load torque changes, this leads to the change in the motor torque and load torque characteristics does not guarantee a stable operating point, so in order to have stable equilibrium operating point derive the condition for system to be stable.	**10**	**CO1**
	SECTION-C (2x20=40M) (Internal choice to attempt any one from Q11 and Q12)		
Q 10	A 3Ph , 20hp , 415 V , 4 pole , 1440 rpm , star connected squirrel cage induction motor	**20**	**CO4**

	having R_s=0.15Ω , R_r'= 0.4 Ω , Xs=0.4 Ω , Xs'=0.4 Ω is operated form a stator voltage control. It is required to operate the motor in the speed range of 1200<Nr<1440 rpm when driving a centrifugal pump the absorbs 20hp at 1440 rpm. Determine the range of output voltage from the voltage controller. Neglect rotational losses , 1 hp=746 W.		
Q11	A 2hp, 110V , 1200 rpm separately excited DC Motor. fed from a Single phase full converter connected to a single phase 120V ,50 Hz, supply. Having machine Parameters : Ra=0.4 Ohms, La=5m H , Motor constant :Kϕ=0.09 V/rpm a)During the motor operation Motor runs at 1000rpm , draws a line current of 30A, assuming the motor current is ripple free determine the supply power factor. b)During the inverter operation (regeneration action), the polarity of the motor backemf Ea is reversed , say by reversing the field excitation determine the firing angle to keep the motor at 30A with the speed 1000rpm	**20**	**CO2**
Q12	In metro rail systems, If a DC drive(dc separately excited motor) system is using, explain how forward , reverse motoring and regenerative breaking can be achieved with the help of quadrant of operation , respective chopper circuit and necessary waveforms	**20**	**CO2**

Name: **Enrolment No:**	UPES