UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Engineering System Components
Program: M. Tech (Automation and Robotics Engineering)
Course Code: ECEG 7023

Semester : 1
Time : 03 hrs.
Max. Marks: 100
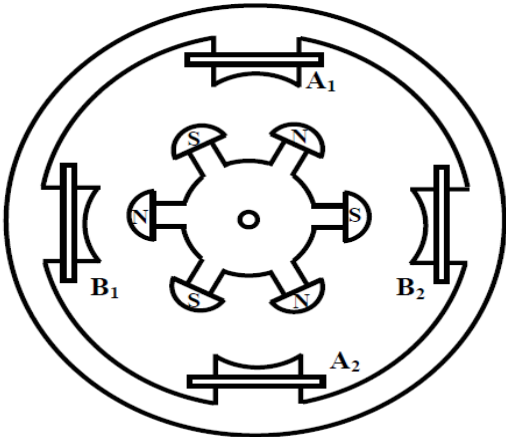
Instructions: All section questions are compulsory.

SECTION A
(5Qx4M=20Mark)

S. No.		Marks	CO
Q 1	Define the following terms link, higher pair, lower pair, and kinematic chain.	4	CO1
Q 2	Define the term sensor and actuator with appropriate example.	4	CO1
Q 3	Describe the different factors influencing choice of transducer.	4	CO2
Q 4	Explain specific energy, energy density, and power density of battery technology.	4	CO3
Q 5	Define end of life of the battery. List out different factors affect the life of the battery.	4	CO2

SECTION B
(4Qx10M= 40 Marks)

Q 6	What is piezoelectric Effect? List out at least two different material that exhibits piezoelectric effect.
	
	    a) Naturally occurring crystals
	    b) Synthetic crystals
	    c) Synthetic ceramics
	
	With neat, diagram how piezoelectric effect is used to for the development and implementation of electronic fuel injector that used in all category of vehicles.
		10	CO5

Q 7	Describe the terms State-of-Charge, Depth-of-Discharge, and State of Health as applied to lithium ion batteries used in the electric vehicles.	10	CO3
Q 8	Define resistance temperature detectors and list out different materials used. A platinum resistance thermometer has a resistance of 150 at 20°C. Calculate its resistance at 50°C (Assume $\alpha_{20} = 0.00392$).	10	CO4

	OR Explain different motor in tabular form used in the robotics application with following characteristics power density, efficiency, controllability, reliability, technological maturity and cost.		
Q 9	a) Write an ALP to find addition of two 8 bit numbers. b) Write an ALP to find multiplication of two 8 bit numbers.	**10**	**CO3**

SECTION-C
(2Qx20M=40 Marks)

Q 10	With neat sketch explain construction and working principle of permanent magnet type stepper motor. Explain different drive techniques to control stepper motor. Calculate full step angle and half step angle of the stepper motor shown in below figure. **Two-phase six-pole permanent magnet stop motor.**	**20**	**CO5**
Q 11	Embedded System Developers needs to be aware of the four main pillars for development. With neat diagram, explain the system. Also explain the tools/Hardware/software used in the embedded system development. **OR** Explain battery management system for lithium ion battery model, also elucidate nine co estate of BMS that covers SOC, SOP, SOE, SOF, SOS, SOT, SOH, RUL and SOB. How these parameters are helpful with respect to energy management system in the electric vehicle.	**20**	**CO4**