UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December, 2017

Program/course: B. Tech- Instrumentation and Control | **Semester – Vth**
Subject: Control System Components | **Max. Marks : 100**
Code : ICEG-322 | **Duration : 3 Hrs**
No. of page/s: 2

Note: Attempt all the sections.

SECTION- A (5x4= 20)

Q-1. What are the different types of control systems? What are the parameters associated with these systems?

Q-2. Enumerate different applications of gear systems in industry and or domestic purposes.

Q-3. How Liquid crystal display (LCD) is gaining more popularty as compare to the Light emitting diode (LED) display system?

Q-4. Sketch and briefly explain the series, shunt and compound wound DC motor.

Q-5. Distinguish the linear motion and angular motion type potentiometers.

SECTION- B (5x8= 40)

Q-6. Sketch and analyze the operation of

(i) Spur gear

(ii) rack and pinion

(iii) bevel gear

(iv) helical gear

Q-7. A 4-pole armature of d.c. machine has 1000 conductors and a flux per pole of 20 mWb. Determine the e.m.f. generated when running at 600 revolution per minute (rpm), when the armature is (i) wave wound (ii) lap wound.

Q-8. Differentiate these compressor system on the basic of their design and working operation aspects, **(i)** Diaphram compressor **(ii)** Vane compressor **(iii)** Helical compressor

Q-9. Elucidate the operation of following relay systems

(i) Series circuit

(ii) Parallel circuit

(iii) AND circuit

(iv) OR circuit

Q-10. Analyze the commercial and industrial applications of stepper motor.

OR

Elucidate the various important tracing methods to plot the recorded parameters in using recorder system. Analyze the importance of ink-pen stylus, motor drive to control chart speed effective operation of recorder system.

SECTION- C **(2x20= 40)**

Q-11. Attempt both the parts.

(a) To control "ON/OFF" position of a stepper motor driven water flow valve, design the excitation sequence of winding of the permanent magnet type stepper motor. In this operation, each constituent step of 45^{o} is required to complete one revolution.

(b) A variable resistive load is connected with the solar power array (SPA) system under constant solar irradiation level. Design an electrical circuit diagram of the entire system and trace the power-voltage (P-V) and current-voltage (I-V) characteristics of SPV with the X-Y reorder system. How this X-Y recorder is efficient than X-t type recorder for this application?

Q-12. A digital tachometer gives the output in binary coded decimal form. The readings for the RPM need to be displayed via a 7- segment display. Design a BCD to 7 segment code converter for this application.

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SECTION- A (5x4= 20)

Q-1. Why all the parameters of a control system are not controlled. Which parameters is normally controlled?

Q-2. Express the relationship among angular velocity, number of teeth, torque and power of gears.

Q-3. What are the applications of gyroscope?

Q-4. Elucidate the electromechanical energy conversion principle with the suitable examples.

Q-5. Analyze the operation of following display systems (i) 7- segment (ii) dot matrix display (iii) Alphanumeric display systems.

SECTION- B (5x8= 40)

Q-6. Enumerate the operation of all the marking mechanism to trace the measured parameters in recorder systems.

Q-7. A 150 V d.c. generator supplies a current of 25 A when running at 1200 rpm. If the torque on the shaft driving the generator is 35.8 Nm. Determine: **(i)** the efficiency of the generator **(ii)** power loss in the generator.

Q-8. Analyze the importance of pneumatic system in commercial applications. How pneumatic systems are gaining more popularity in comparison hydraulic systems?

Q-9. Sketch and analyze the operation **(i)** Spur gear and pinion **(ii)** bevel gear **(iii)** worm gear systems.

Q-10. A 6- pole generator has a lap-wound armature with 40 slots with 20 conductors per slot. The flux per pole is 25 mWb. Calculate the speed at which the machine must be driven to generate an e.m.f. of 300V.

OR

A generator is connected to a 50 Ω load and a current of 10 A flows. If the armature is 0.5Ω, determine (a) the terminal voltage, and (b) the generated e.m.f.

SECTION- C **(2x20= 40)**

Q-11. Attempt both the parts

(a) Design a two mesh gear train using the exact equation

$$r_2 = \sqrt[6]{2k_1k_2 + k_2^2 r_2^2}$$

Consider the overall reduction ratio **(a)** 20:1 **(b)** 40:1. How the number of meshes will be selected.

(b) In closed loop system, the stepper motor is most preferable. The stepper motor controller has important role to control the actuator position. Design a logic sequence for 4- step and 8-step motion for permanent magnet hybrid stepper motor.

Q-12. A pressure transducer measures the pressure of a gasoline transmission pipeline. A local 7 segment readout is used to notify the engineer for low pressure and high pressure warning. Using an Arduino MCU design a system which displays “H” for high pressure and “L” for low pressure. Clearly elucidate the circuit diagram, code/syntax, and truth-table for the system.