

CBCS SCHEME

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17ME72

Seventh Semester B.E. Degree Examination, July/August 2022 Fluid Power Systems

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With a neat block diagram, explain the structure of hydraulic power system. (10 Marks)
b. What are various advantages, disadvantages and applications of fluid power system? (10 Marks)

OR

- 2 a. What are the desirable properties of hydraulic fluids? Explain. (10 Marks)
b. Explain the working of return line and suction line filtering with the aid of sketches. (10 Marks)

Module-2

- 3 a. List the types of gear pump. Explain the construction and working of external gear pump with a neat sketch. (10 Marks)
b. Explain with the neat sketch the construction and working bladder type accumulator. (05 Marks)
c. An external gear pump has 125 mm outside diameter, 85 mm inside diameter and 40 mm width. For a pump speed of 1500 rpm determine the theoretical volumetric displacement and theoretical flow rate. If the volumetric efficiency is 90%, what is the actual flow rate in ℓpm (litres per minute)? (05 Marks)

OR

- 4 a. Explain the construction and operation of single acting cylinder. (05 Marks)
b. Explain with a neat sketch rack and pinion rotary actuator. (05 Marks)
c. A hydraulic motor operating at 75 bar pressure, has a volumetric displacement of $175 \text{ cm}^3/\text{rev}$. The motor runs at 2000 rpm to deliver a torque of 175 N-m, while using a flow rate of 375 ℓpm . Determine the volumetric mechanical and overall efficiencies. Also determine the actual power delivered by the motor. (10 Marks)

Module-3

- 5 a. Explain the hydraulic regenerative circuit with a neat sketch. (10 Marks)
b. List various types of DCV. With a neat sketch, explain the working of 4-way valve. (10 Marks)

OR

- 6 a. With a neat sketch, explain the working of pressure compensated flow control valve. (10 Marks)
b. Explain the hydraulic cylinder sequencing circuits with a neat sketch. (10 Marks)

Module-4

- 7 a. Describe the various components used in pneumatic power system and its symbol. (10 Marks)
b. Explain the working of a double acting type pneumatic cylinder with a neat sketch. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Explain the working of simple and pilot operated poppet valve used in pneumatic system with a neat sketch. (10 Marks)
- b. Explain the working of check valve and shuttle valve used in pneumatic system with a neat sketch. (10 Marks)

Module-5

- 9 a. Explain direct and indirect actuation of pneumatic cylinders. (10 Marks)
- b. Explain with neat sketches different methods commonly employed for controlling the speed of pneumatic cylinder. (10 Marks)

OR

- 10 a. Explain the principle of cascade control system. (10 Marks)
- b. Draw and explain the electrical control circuitry for controlling a single acting cylinder. (10 Marks)

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17ME73

Seventh Semester B.E. Degree Examination, July/August 2022 Control Engineering

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Write neat sketches, wherever required.

Module-1

- 1 a. Explain loop control system, with an example and block diagram. (07 Marks)
- b. Explain briefly the requirements of an ideal control system. (06 Marks)
- c. With an example and block diagram, explain the closed loop control system. (07 Marks)

OR

- 2 a. Define controllers. Enumerate the classification of the controllers. (04 Marks)
- b. Explain the PI controller. Enumerate its characteristics. (08 Marks)
- c. Explain the PID controller. Enumerate the characteristics of PID controllers. (08 Marks)

Module-2

- 3 a. Obtain the transfer function of the mechanical system shown in Fig. Q3 (a). (10 Marks)

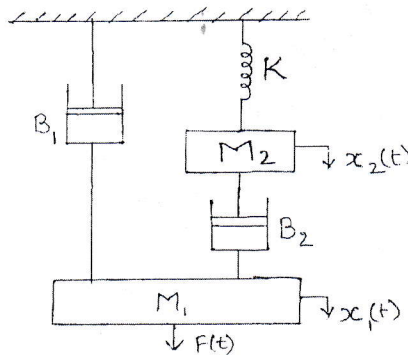


Fig. Q3 (a)

- b. Obtain the transfer function of an armature controlled DC motor. (10 Marks)

OR

- 4 a. Obtain the closed loop transfer function of the system shown in Fig. Q4 (a) by block diagram reduction technique. (10 Marks)

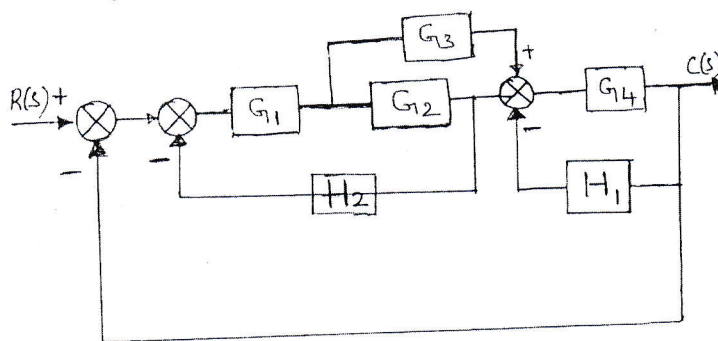


Fig. Q4 (a)

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. Using Mason's gain formula, find $\frac{X_2(s)}{X_1(s)}$ for the system shown in Fig. Q4 (b). (10 Marks)

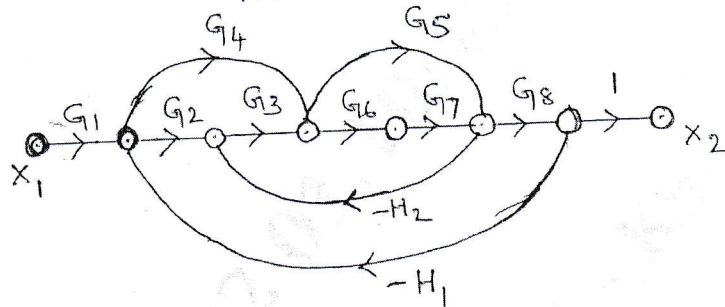


Fig. Q4 (b)

Module-3

- 5 a. Obtain an expression for a second order system subjected to unit step response for an under damped system. (08 Marks)
- b. An unity feed back system with $G(S) = \frac{9}{S^3 + RS^2 + 3KS}$ is conditionally stable. Find K_{mar} and R , if the system oscillates with a frequency of 6 radians/sec. (06 Marks)
- c. A system is represented by $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 8x$, where y is the output and x is the input. Find (i) Delay time (ii) % M_p (iii) Settling time. (06 Marks)

OR

- 6 Plot the root locus for the given transfer function $G(s)H(s) = \frac{K}{s(s+2)(s+4)(s+6)}$. Find the range of K and comment on the stability of the system. (20 Marks)

Module-4

- 7 a. Sketch the polar plot for the system with $G(s)H(s) = \frac{1}{(1+T_1s)(1+T_2s)(1+T_3s)}$. (06 Marks)
- b. Sketch the Nyquist plot for the system with $G(s)H(s) = \frac{40}{(s+4)(s^2+2s+2)}$. Comment on the stability of the system. (14 Marks)

OR

- 8 Sketch the Bode plot for the system with $G(s)H(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$. From the plot determine (i) Phase cross over frequency (ii) Gain cross over frequency (iii) Gain margin (iv) Phase margin. Comment on the stability of the system. (20 Marks)

Module-5

- 9 a. What is system compensation? Explain the two types of system compensation. (06 Marks)
- b. Explain Lead compensation. Enumerate the effects and limitations of lead compensator. (07 Marks)
- c. Explain Lag compensation. Enumerate the effects and limitations of Lag compensator. (07 Marks)

OR

10 a. Explain the following terms:

- (i) State variables.
- (ii) State vector.
- (iii) State
- (iv) State space.
- (v) State trajectory.

(05 Marks)

b. Determine the state controllability and observability of the system by Kalman's test.

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u;$$

$$y = [1 \ 0 \ 0 \ 0]X$$

(15 Marks)

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17ME742

Seventh Semester B.E. Degree Examination, July/August 2022 Tribology

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Tribology Data handbook is permitted.
3. Assume missing data suitably.

Module-1

- 1 a. Explain different types of lubricants with examples. Standard grades of lubricants. (10 Marks)
b. Explain Practical importance of tribology and subsequent use in different fields. (10 Marks)

OR

- 2 a. Explain different properties of Lubricants. (10 Marks)
b. With graph, explain effect of temperature and pressure on viscosity. (10 Marks)

Module-2

- 3 a. Explain any two Friction Measuring methods. (10 Marks)
b. Briefly explain any two theories of Friction. (10 Marks)

OR

- 4 a. With sketches, explain different mechanisms of Wear. (10 Marks)
b. Explain any two testing methods for erosive wear. (10 Marks)

Module-3

- 5 Derive Reynolds equation in 2D. (20 Marks)

OR

- 6 a. Derive Petroff's equation for Lightly loaded bearings. (10 Marks)
b. A full Journal bearing has following datas : Diameter of Journal = 50mm ;
Length = 65mm ; Speed = 1200 rpm ; Radial clearance = 0.025mm ;
Viscosity = 1.125×10^{-3} pa.sec ; Attitude = 0.8. Calculate i) Load carrying capacity
ii) Coefficient of friction iii) Power loss of bearing. (10 Marks)

Module-4

- 7 a. Derive an expression for load carrying capacity for Pivoted Shoe Slider bearing. (10 Marks)
b. A rectangular slider bearing with fixed shoe has data : Bearing length = 0.0762m ,
Shoe width = 0.065m , Slides velocity = 2.54 m/sec , Load on bearing = 5383.9N ,
Minimum oil film thickness = 1.27×10^{-5} m , Viscosity = 0.06805 N-S/m².
Find Inclination in radians and degree , Coefficient of friction. (10 Marks)

OR

- 8 a. Derive an expression for rate of flow in an hydrostatic step bearings. (10 Marks)
b. Hydrostatic step bearing has datas : Diameter of Shaft = 150mm ,
Diameter of pocket = 100mm , Vertical thrust = 70kN , Speed = 1000 rpm ,
Viscosity = 0.025 Pa.sec , Oil film thickness = 0.125mm. Determine i) Rate of oil flow
ii) Coefficient of friction iii) Power loss. (10 Marks)

Module-5

- 9 a. Explain the common bearing materials with their typical properties and applications. (10 Marks)
b. Define Surface Engineering. List its merits, demerits and industrial applications. (10 Marks)
- OR
- 10 a. Explain Transformation hardening, with neat sketch. (10 Marks)
b. With sketch, explain Physical Vapour Deposition [P.V.D] process. (10 Marks)

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Seventh Semester B.E. Degree Examination, July/August 2022 Mechatronics /

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Briefly explain the multidisciplinary scenario leading to the development of mechatronics with a schematic representative. (10 Marks)
- b. Enumerate the stages through which the mechatronics discipline has evolved. (06 Marks)
- c. List the applications of mechatronics. (04 Marks)

OR

- 2 a. Differentiate between the following:
- (i) Active and passive transducer. (04 Marks)
- (ii) Primary and secondary transducer.
- b. What are proximity sensors? Illustrate with sketches the working principle of,
- (i) Eddy current type proximity sensor. (10 Marks)
- (ii) Proximity switches. (06 Marks)
- c. Define photoelectric effect? Explain photoconductive light sensors. (06 Marks)

Module-2

- 3 a. What is a Flag register? Explain the various types of flags present. Explain with an example. (08 Marks)
- b. What are interrupt signal? Explain with a block diagram how the microprocessor handler the interrupt signal? (07 Marks)
- c. Briefly explain the basic elements of a microprocessor based control system. (05 Marks)

OR

- 4 a. What is the significance of a "BUS" in a microprocessor? With block diagram, explain various types of Bus in a 8085 microprocessor. (08 Marks)
- b. Explain the following (with block diagram, wherever necessary) :
- (i) Fetch cycle.
- (ii) Input / Output Buffer register.
- (iii) Instruction Register.
- (iv) Assembler. (12 Marks)

Module-3

- 5 a. What are programmable logic controllers? Briefly explain the structure of a PLC. (07 Marks)
- b. Explain the concept of a Ladder diagram, represent schematically. (07 Marks)
- c. What is integration? Explain the various features that the mechatronics system should satisfy for integration purpose. (06 Marks)

OR

- 6 a. Write a note on the paradigm shift from a standard actuator to an advanced actuator. (06 Marks)
- b. Briefly explain any three types of Robotic Sensors. (06 Marks)
- c. What are End Effectors? Explain briefly the various forms of End Effectors. (08 Marks)

Module-4

- 7 a. Briefly explain with sketches, the various types of Cams and Cam followers. (10 Marks)
 b. Explain with a sketch the working principle of 'Ratchet and Pawl' mechanism. (05 Marks)
 c. List and explain the various types of Belts. (05 Marks)

OR

- 8 a. With their schematic structure and symbol, explain the following:
 (i) Diodes
 (ii) Traics.
 Also explain their V-I characteristics. (10 Marks)
 b. What are Relays? Explain various types of relays. (05 Marks)
 c. List the specifications of a stepper motor. (05 Marks)

Module-5

- 9 a. Briefly enumerate with sketch, the elements of a typical hydraulic actuation system. (06 Marks)
 b. What are direction control valves? With sketches, explain the sliding spool valve and poppet valve. (10 Marks)
 c. Differentiate clearly between single acting cylinder and double acting cylinder with sketches. (04 Marks)

OR

- 10 a. With a neat sketch, explain how to control a double acting cylinder. (06 Marks)
 b. Explain the basic principle of flow control valves. With sketch explain needle valve. (08 Marks)
 c. Briefly explain with sketch, the working principle of pressure relief valve. (06 Marks)

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