

CBCS SCHEME

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15ME72

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020

Fluid Power Systems

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Define Pascal's law and its applications. (06 Marks)
- b. Brief the various components of hydraulic system and its fluid power symbol. (06 Marks)
- c. What are the four primary functions of a hydraulic fluid? Name the various fluid properties that a fluid should possess. (04 Marks)

OR

- 2 a. With a neat sketch, explain the working of a hydraulic filter. (06 Marks)
- b. What is the purpose of seals in fluid power system? List the various types of seals used on fluid power system. (06 Marks)
- c. Brief the various advantages of fluid power system. (04 Marks)

Module-2

- 3 a. With a neat sketch explain the working of external gear pump. (06 Marks)
- b. Classify the various types of accumulators. Explain the construction and working of bladder type of accumulator. (06 Marks)
- c. A vane pump is to have a volumetric displacement of 82 cm^3 . It has a rotor diameter of 5 cm, a cam ring diameter of 7.5 cm, and a vane width of 4 cm. What must be the eccentricity? What is the maximum volumetric displacement possible? (04 Marks)

OR

- 4 a. Explain the working of hydraulic cylinder cushioning with a neat sketch. (06 Marks)
- b. What are the various types of hydraulic cylinder mountings? Brief them with a neat sketch. (06 Marks)
- c. A hydraulic motor has a 100 cm^3 volumetric displacement. If it has a pressure rating of 140 bar and receives oil from a $0.001 \text{ m}^3/\text{sec}$ theoretical flow rate pump, find the motor:
(i) Speed (ii) Theoretical torque (iii) Theoretical KW power (04 Marks)

Module-3

- 5 a. Brief the construction feature and working of pressure relief valve. (06 Marks)
- b. Explain the regenerative circuit and its application. (06 Marks)
- c. With a neat sketch brief the working of check valve. (04 Marks)

OR

- 6 a. Explain the working of 4/2 manually operated direction control valve with a neat sketch. (06 Marks)
- b. With a neat circuit explain the working of sequencing hydraulic circuit and its application. (06 Marks)
- c. Explain the working of metering in hydraulic circuit with a suitable sketch. (04 Marks)

Module-4

- 7 a. Explain the working of pneumatic filter with a neat sketch. (06 Marks)
b. Brief the various components of pneumatic system and its fluid power symbol. (06 Marks)
c. Brief the working of quick exhaust valve. (04 Marks)

OR

- 8 a. With a neat sketch explain the construction and working of pneumatic lubricator. (06 Marks)
b. Explain the working of single vane rotary cinder with a suitable sketch. (06 Marks)
c. With a neat sketch explain the working of shuttle valve. (04 Marks)

Module-5

- 9 a. With a suitable pneumatic circuit, explain the indirect actuation of double acting cylinder using memory valve. (10 Marks)
b. Explain the controlling of double acting pneumatic cylinder using solenoid operated direction valve with a circuit. (06 Marks)

OR

- 10 a. Explain the sequencing of two cylinders A and B using cascading method circuit for the cylinder sequence $A^+B^+A^-$. (10 Marks)
b. Design a suitable electro pneumatic circuit to control of a double acting cylinder using a single limit switch. (06 Marks)

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15ME73

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Control Engineering

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. With a block diagram differentiate open loop and closed loop system. (08 Marks)
b. Discuss the main requirements of an ideal control system. (08 Marks)

OR

- 2 Explain following types of controller with block diagram and state its characteristics.
(i) Proportional
(ii) Proportional plus derivative
(iii) Integral
(iv) Proportional plus integral (16 Marks)

Module-2

- 3 a. Obtain the transfer function for an armature controlled D.C motor, which relates output angular displacement (Q) with input voltage (e). (08 Marks)
b. A thermometer is dipped in a vessel containing liquid at a constant temperature of θ_1 . thermometer has a thermal capacitance for storing heat as C and thermal resistance to limit heat flow as R . If the temperature indicated by thermometer is θ_r , obtain the transfer function of the system. (08 Marks)

OR

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

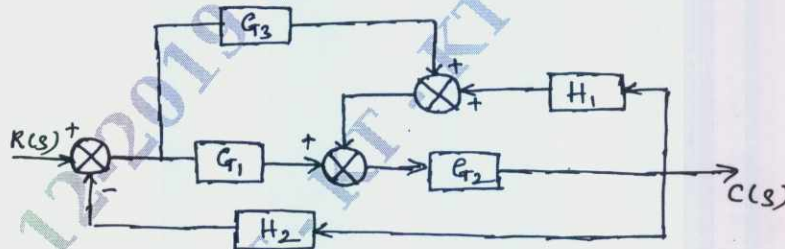


Fig.Q4(a)

- b. Discuss Mason's gain formula and define the following terms used in signal flow graphs.
(i) Node (ii) Branch gain (iii) Forward path (iv) Path gain (v) Feedback loop
(vi) Self loop (06 Marks)

Module-3

- 5 Obtain the expressions for Peak time, Rise time, Maximum overshoot and settling time for a second order control system in terms of damping factor and nature frequency. (16 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 6 Sketch the root locus of unity feedback system whose forward path transfer function is

$$G(s) = \frac{k}{s(s^2 + 5s + 6)}$$

Determine the range of k for the system to be stable.

(16 Marks)

Module-4

- 7 Draw the Bode plot for the following transfer function and determine gain margin and phase margin.

$$G(s)H(s) = \frac{10.5}{(s + 0.2)(s + 0.8)(s + 10)}$$

(16 Marks)

OR

- 8 Using Nyquist criterion, investigate the stability of a system whose open loop transfer function is

$$G(s)H(s) = \frac{k}{(s + 1)(s + 2)(s + 3)}$$

(16 Marks)

Module-5

- 9 Obtain the transfer functions of the following types of compensators:

- (i) Lag compensator
(ii) Lead compensator

(16 Marks)

OR

- 10 a. Explain the following :

- (i) Kalman's test of controllability
(ii) Kalman's test of observability

(06 Marks)

- b. Determine the controllability and observability of the systems represented by

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

$$y = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} x$$

(10 Marks)

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15ME742

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020

Tribology

Time: 3 hrs.

Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Design Data handbook is permitted.

Module-1

- 1 a. What is Tribology? Explain in detail Historical background of Tribology. (08 Marks)
b. Explain the industrial importance of Tribology. (08 Marks)

OR

- 2 a. List out different types of viscometers. Explain any one with neat sketch. (08 Marks)
b. What are the functions of lubricants? Explain. (08 Marks)

Module-2

- 3 a. Define Friction. What are different types of Friction? Explain. (08 Marks)
b. What are the different methods of measuring frictional force? Explain any one. (08 Marks)

OR

- 4 a. List out wear mechanisms. Explain any one wear mechanism? (08 Marks)
b. List out various wear testing methods clearly, mentioning their standards. (08 Marks)

Module-3

- 5 Derive Reynolds 2D equation with assumptions. (16 Marks)

OR

- 6 a. Derive an equation for load carrying capacity for a Idealized Journal bearing. (10 Marks)
b. An Idealized full Journal bearing has the following specifications:
Diameter of the Journal = 50 mm, Length of the bearing = 62.5 mm
Speed of the Journal = 1200 rpm, Radial clearance = 0.025 mm
Viscosity of lubricant = 11 CP, Attitude, $\epsilon = 0.8$
Calculate (i) Load carrying capacity (ii) Co-efficient of friction (iii) Power loss of the bearing (06 Marks)

Module-4

- 7 a. Derive an expression for load carrying capacity of a plane slider bearing with a fixed shoe. (10 Marks)
b. A slider bearing has a pivoted shoe by the following data:
Length of the shoe in the direction of motion = 50 mm
Width of the shoe = 64 mm
Slider velocity = 5.5 m/s
Load on the bearing = 8025 N
Viscosity of the lubricant = 31 CP
Determine minimum oil film thickness, power loss and coefficient of friction of bearing?
The inclination of the surface corresponds to minimum co-efficient of friction? (06 Marks)

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OR

- 8 a. Derive an expression for hydrostatic step bearing pressure distribution. (08 Marks)
b. A hydrostatic step bearing has the following specifications :
Diameter of the shaft = 152 mm
Diameter of the pocket = 102 mm
Vertical thrust on the bearing = 65000 N
External pressure = 0
Shaft speed = 900 rpm
Viscosity of lubricant = 24.15 CP
Oil film thickness = 0.127mm.
Find (i) Supply pressure (ii) Quantity of oil flow (iii) Power loss in the bearing (iv) Frictional force (v) Co-efficient of friction. (08 Marks)

Module-5

- 9 a. List the characteristics of bearing materials. Explain any two. (08 Marks)
b. Determine the common bearing alloys. Explain any two alloys. (08 Marks)
- OR
- 10 a. What is Surface Engineering? Write a brief history of Surface Engineering? (08 Marks)
b. List out Traditional Coating Techniques? Explain any two. (08 Marks)

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15ME745

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Smart Material and MEMS

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Explain piezoelectric properties. (06 Marks)
b. Derive an equation for actuation of structural components by piezoelectric crystals under Axial motion of Rods considering various loading. (10 Marks)

OR

- 2 a. Explain experimental phenomenology of SMA. (06 Marks)
b. Discuss elaborately vibration control through SMA. (10 Marks)

Module-2

- 3 a. Explain Fluid composition and behavior. (06 Marks)
b. Discuss the application of ER and MR Fluids on two basic types of devices. (10 Marks)

OR

- 4 a. Explain Total Internal Reflection phenomenon. (06 Marks)
b. Write a note on fibre optics strain measurement. (05 Marks)
c. Discuss additional applications of Fiber optics. (05 Marks)

Module-3

- 5 a. Derive an equation of governing condition motion and Amplitude of the main mass to be independent of the damping ratio for parallel Damped vibration absorber. (12 Marks)
b. Discuss perissogyro vibration absorber with neat sketch. (04 Marks)

OR

- 6 a. Explain Fibre – Reinforced organic matrix Natural composites. (08 Marks)
b. Discuss Biomimetic sensing. (08 Marks)

Module-4

- 7 a. Explain thin film deposition techniques. (08 Marks)
b. Explain photolithography. (08 Marks)

OR

- 8 a. Explain cantilever piezoelectric actuator model. (08 Marks)
b. Discuss the concept and principles of magnetic actuation. (08 Marks)

Module-5

- 9 a. Discuss polymers in MEMS. (08 Marks)
b. Elaborate the applications of polymers MEMS. (08 Marks)

OR

- 10 a. Discuss the case studies on BP sensors. (10 Marks)
b. Explain MEMS product development in view of Reliability, Cost, Performance. (06 Marks)

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15ME753

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Mechatronics

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Define Mechatronics. Explain any one application of the mechatronic system with neat sketch. (08 Marks)
b. List the objectives, advantages and disadvantages of mechatronics. (08 Marks)

OR

- 2 a. Illustrate a typical sensor showing transducer and signal conditioning unit. (08 Marks)
b. What is Hall effect? Explain the hall effect with neat sketch. (08 Marks)

Module-2

- 3 a. What are micro-controllers? Distinguish between a microprocessor and microcontrollers. (06 Marks)
b. Explain with a neat sketch the internal architecture of Intel 8085 microprocessor. (10 Marks)

OR

- 4 a. Write a short note on 'BUS' related to 8085 microprocessor. (08 Marks)
b. Define the following terms with respect to microprocessor:
i) Fetch cycle ii) Accumulator iii) Interrupts iv) Stack pointer. (08 Marks)

Module-3

- 5 a. Define programmable logic controller. Briefly explain external structure of PLC. (12 Marks)
b. Enlist applications of programmable logic controllers. (04 Marks)

OR

- 6 a. Mention the different parts of a robot and briefly explain any three parts of a robot. (08 Marks)
b. Explain functional requirement of robot. (08 Marks)

Module-4

- 7 a. With neat sketch explain the Ratchet and power mechanism. (08 Marks)
b. List the applications of cams in mechanical actuations. (04 Marks)
c. Explain the method of transmitting power between two shafts. (04 Marks)

OR

- 8 a. List the mechanical switch classification and explain any one in detail. (08 Marks)
b. Explain with neat sketch permanent magnet stepper motor. (08 Marks)

Module-5

- 9 a. List classification of direction control valves used as fluid flow system. (04 Marks)
b. List the advantages of hydraulic system. (02 Marks)
c. With neat sketch, explain the construction details of hydraulic system. (10 Marks)

OR

- 10 a. With neat sketch explain pressure relief valve. (08 Marks)
b. What are the types of rotary actuators and explain with sketches. (08 Marks)

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