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15ME71

Seventh Semester B.E. Degree Examination, July/August 2021
Energy Engineering

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions*

1 a. With a neat diagram, explain the working of spreader stoker. **(08 Marks)**
   b. With a neat diagram, explain the working of Central system of pulverized type of fuel handling system. **(08 Marks)**

2 a. With a neat diagram, explain forced draught system. **(08 Marks)**
   b. With a neat diagram, explain air - preheater. **(08 Marks)**

3 a. Explain the applications of Diesel engines in the power field. **(07 Marks)**
   b. Explain the different methods of starting diesel engines. **(06 Marks)**
   c. List the function of fuel system. **(03 Marks)**

4 a. With a neat diagram, explain the layout of Hydel power plant. **(12 Marks)**
   b. With a neat diagram, explain pumped storage plant. **(04 Marks)**

5 a. With a neat diagram, explain Flat Plate collector. **(08 Marks)**
   b. With a neat diagram, explain Solar Photovoltaic cell. **(08 Marks)**

6 a. With a neat diagram, explain Parabolic trough reflector. **(08 Marks)**
   b. With a neat diagram, explain Solar Array System. **(08 Marks)**

7 a. With a neat diagram, explain Horizontal Axis Wind Machine. **(10 Marks)**
   b. Discuss the problems associated with wind power generation. **(06 Marks)**

8 a. With a neat diagram, explain Double Cycle tidal power plant. **(08 Marks)**
   b. Discuss the advantages and limitations of Tidal power generation. **(08 Marks)**

9 a. Define Anaerobic Digestion. Explain the three steps of Anaerobic digestion. **(08 Marks)**
   b. Define Gasification. Explain the chemical reactions involved in the gasification process. **(08 Marks)**

10 a. With a neat diagram, explain working of Open Cycle Magneto hydrodynamic System (MHD). **(08 Marks)**
   b. Explain "Zero Energy Concepts". **(08 Marks)**

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Seventh Semester B.E. Degree Examination, July/August 2021
Fluid Power System

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions.*

1   a. State Pascals law. Explain in brief the advantages and applications of fluid power systems.
                                                                            (08 Marks)
    b. Explain in brief any EIGHT desirable properties of hydraulic fluids.   **(08 Marks)**

2   a. Explain the following:
        (i)   Static and Dynamic seals.
        (ii)   Sealing materials.
        (iii)   Effect of temperature on hydraulic fluid.   **(09 Marks)**
    b. What is a strainer? With a neat sketch explain proportional type filter. **(07 Marks)**

3   a. Explain the construction and working of balanced vane pump with neat sketch. Also explain
        the performance characteristics of a vane pump.   **(12 Marks)**
    b. A hydraulic motor has a volumetric displacement of 125 cm^3 and a pressure rating of 150
        bar. It receives flow rate of 0.0015 m^3/s from a pump. Find the (i) Motor speed
        (ii) Theoritical torque and   (iii) Theoritical power.   **(04 Marks)**

4   a. What is hydraulic actuator? Explain Telescopic cylinder and cushioning cylinder with the
        help of neat sketch.   **(08 Marks)**
    b. Explain the following :
        (i)   Pump selection factor.
        (ii)   Application of accumulators.   **(08 Marks)**

5   a. Explain the construction and working of compound relief valve with a neat sketch. Give the
        symbolic representation of relief valve.   **(08 Marks)**
    b. Explain the following with neat circuits:
        (i)   Sequencing circuit.
        (ii)   Force multiplication.   **(08 Marks)**

6   a. Explain the pressure compensated flow control valve with neat sketch. **(05 Marks)**
    b. What is synchronization of cylinders? Explain how synchronization of cylinders is achieved
        using matched pump and by using flow control valves with neat circuits. **(11 Marks)**

7   a. With the help of a block diagram, explain the pneumatic system. Also mention the
        advantages.   **(08 Marks)**
    b. Write a note on FRL unit.   **(04 Marks)**
    c. Explain the impact cylinder with a neat sketch.   **(04 Marks)**

8   a. Explain the following :
        (i)   Quick exhaust valve.
        (ii)   Time delay valve.
        (iii)   Twin pressure valve.   **(12 Marks)**
    b. Write a note on characteristics of compressed air.   **(04 Marks)**

9   a.   Discuss the supply air throttling and exhaust air throttling types of speed control of cylinders.   **(10 Marks)**

      b.   Explain the use of relay and contactors.   **(06 Marks)**

10   a.   Discuss the motion diagram and control diagram types of functional diagram.   **(12 Marks)**

      b.   Write a note on use of logic gates.   **(04 Marks)**

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15ME73

Seventh Semester B.E. Degree Examination, July/August 2021
Control Engineering

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions.*

1   a.   Define control system. Compare open loop and closed loop control system with an example.
         (08 Marks)
    b.   What are the requirements of an Ideal Control System?   **(08 Marks)**

2   Explain with Block diagrams:
         (i)   Proportional controller.   (ii)   Integral controller.
         (iii) Derivative controller.   (iv)   P.I.D controller.   **(16 Marks)**

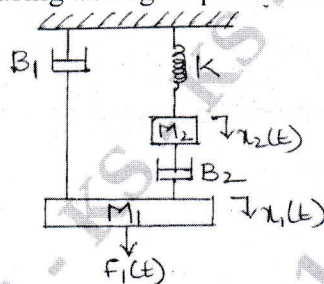3   a.   Draw F-V and F-C circuits using analogue quantities.   **(08 Marks)**

Fig. Q3 (a)

    b.   Determine the overall transfer function of a block diagram shown in Fig. Q3 (b).   **(08 Marks)**
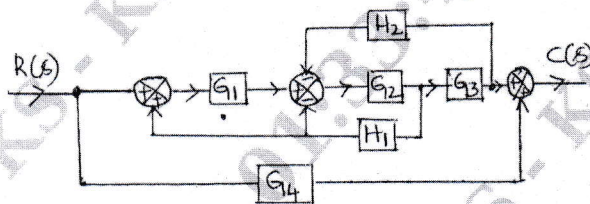

Fig. Q3 (b)

4   a.   Determine the transfer function of field controlled DC motor which relates output angular
         displacement (θ) with input voltage (e_f).   **(08 Marks)**
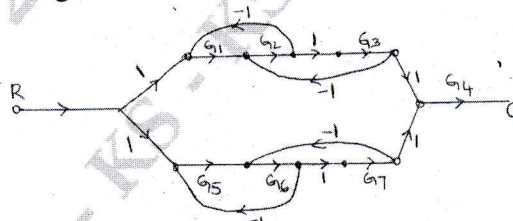   b.   Obtain the overall TF of SFG given:

Fig. Q4 (b)   **(08 Marks)**

5   a.   Discuss the various standard inputs used in control system analysis.   **(04 Marks)**
    b.   Derive the response equation of 1st order system for unit step input.   **(06 Marks)**
    c.   Applying RH criterion, discuss the stability of closed loop system as a function of K for the
         following OLTF,

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}.$$ **(06 Marks)**

6 Sketch the Root locus plot for G(s)H(s) = $\dfrac{K}{s(s+2)(s+4)(s+6)}$. For what values of K, the system becomes UNSTABLE. **(16 Marks)**

7 a. Sketch the Polar plot for the transfer function, $G(s) = \dfrac{1}{(1+s)(1+2s)}$. **(06 Marks)**

   b. Apply Nyquist stability interior to the system with loop transfer function,
   $G(s)H(s) = \dfrac{4s+1}{s^2(1+s)(1+2s)}$.
   Ascertain its stability. **(10 Marks)**

8 For a unity feedback system with OLTF, $G(s) = \dfrac{40(s+5)}{s(s+10)(s+2)}$

   Draw the Bode plot and determine : GM, PM, ω_{gc}, ω_{PC} . Comment on the stability of the system. **(16 Marks)**

9 a. Write down the characteristics of,
       (i)   Lag compensator
       (ii)   Lead compensator.
       (iii) Lag-lead compensator. **(09 Marks)**

   b. Define : (i) State   (ii) State vector   (iii) Controllability   (iv) Observability **(07 Marks)**

10 a. Find the controllability and observability of the system described by the state equation:
    $$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u ;$$
    $y[1 \quad 0]x$. **(08 Marks)**

    b. Explain the design of lead compensator using Root locus (procedure only). **(08 Marks)**

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CBCS SCHEME

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Seventh Semester B.E. Degree Examination, July/August 2021
Tribology

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions.
2. Use of Machine design data hand book is permitted.

1 a. Explain the following:
   i) Oil bearings
   ii) Gas bearings
   iii) Elastohydrodynamic lubrication. (09 Marks)
   b. With suitable examples discuss the types of lubricants. (07 Marks)

2 a. Discuss the good properties of lubricants. (08 Marks)
   b. With help of neat sketch, explain the working of saybolt viscometer. (08 Marks)

3 a. Explain the friction theories. (08 Marks)
   b. With suitable sketches, explain the friction measurement methods:
   i) Inclined plane Rig   ii) Pin-on-disc Rig. (08 Marks)

4 Explain the following:
   i) Abrasive wear mechanism
   ii) Adhesive wear mechanism
   iii) Surface fatigue wear mechanism
   iv) The delamination theory of wear. (16 Marks)

5 With assumptions derive Reynold's differential equation in Two dimensions for the pressure gradient in a converging oil film with no end leakage. (16 Marks)

6 a. Derive an expression for load carrying capacity of an idealized full journal bearing. (08 Marks)
   b. A fall journal bearing has the following specification; diameter of journal = 75mm, length of bearing = 75mm, journal speed = 900rpm, diametral clearance = 0.0875mm, viscosity = 13cp and attitude = 0.75. Neglecting the effect of end leakage. Determine:
   i) Minimum film thickness
   ii) Load carrying capacity
   iii) Co-efficient of friction
   iv) Power loss. (08 Marks)

7 a. A plane slider with fixed shoe bearing has the following specifications; Bearing length = 90mm, Bearing width = 75mm, Load = 17.5kN, Velocity = 2.5m/s, Inclination = -0.00035 rad and Viscosity = 0.0445 Pa-s. Determine:
   i)   Minimum film thickness
   ii)   Power loss
   iii)   Coefficient of friction.   **(08 Marks)**

   b. A pivoted slider bearing has square shape and has the following specification, load = 15kN, velocity moving member = 5m/s, viscosity = 0.052 Pa-s and permissible minimum film thickness = 0.01875mm. Assume that the dimensionless variable q = 1. Determine,
   i)   Required dimensions of the pad
   ii)   Coefficient of friction
   iii)   Power loss.
Take into account of the influence of end leakages on performance of bearing.   **(08 Marks)**

8 a. Derive the expression for rate of flow of oil through a Hydrostatic bearing.   **(08 Marks)**

   b. A Hydrostatic step bearing for a turbine rotor has the following specifications. Diameter of shaft = 150mm, diameter of pocket = 100mm, vertical thrust on bearing = 70kN, shaft speed = 1000rpm, viscosity of lubricant under operating condition = 0.025 Pa-S and desirable minimum film thickness = 0.125mm. Determine:
   i)   Rate of oil flow through the bearing
   ii)   Power loss due to viscous friction
   iii)   Co-efficient of friction.   **(08 Marks)**

9 a. List the commonly used bearing materials and describe any of the five commonly with respect to their characteristics and advantages.   **(08 Marks)**

   b. Explain the following:
   i)   Nickel coating
   ii)   Chromium coating on wear out surfaces.   **(08 Marks)**

10 Explain with neat sketches the following:
   i)   Plasma spraying
   ii)   Chemical vapour deposition (CVD).   **(16 Marks)**

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Seventh Semester B.E. Degree Examination, July/August 2021
Mechatronics

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions.*

1 a. Define Mechatronics, give its origin.   (04 Marks)
   b. Briefly describe proximity sensor.   (08 Marks)
   c. Explain with the sketch photo emissive transducers.   (04 Marks)

2 a. Define following terms:
           (i)   Accuracy.
           (ii)   Resolution.
           (iii) Response time.
           (iv)   Setting time.   (08 Marks)
   b. Explain the working principal of Hall Effect sensor and its application in fluid level detection with a sketch.   (08 Marks)

3 a. What is microprocessor? Explain its role in mechatronics.   (04 Marks)
   b. Differentiate microprocessor and micro controller.   (04 Marks)
   c. Explain with a block diagram the following with respect to general form of microprocessor system:
           (i)   Databus
           (ii)   Control bus
           (iii) Address bus   (08 Marks)

4 a. With the help of block diagram of 8085 A processor architecture. Explain terminologies related to it.   (12 Marks)
   b. Write a note on classification of microcontroller.   (04 Marks)

5 a. With help of neat sketch, explain pneumatic actuators.   (08 Marks)
   b. Write a note on functional requirement of Robot.   (08 Marks)

6 a. List and explain different parts of Robot controller.   (08 Marks)
   b. What is PLC? Explain with neat sketch basic structure of PLC.   (08 Marks)

7 a. Sketch and explain the working of stepper motor.   (08 Marks)
   b. Explain briefly the following solid state devices which can be used to electronically switch circuits:
           (i)   Diodes   (ii)   MOSFET.   (08 Marks)

8 a. With the help of neat sketch, explain working principle of DC motor. (08 Marks)
   b. What is a mechanical actuator? List the various types of mechanical actuators. (08 Marks)

9 a. With a neat sketch, explain ball type check valve.   (08 Marks)
   b. Explain briefly meter-out circuit.   (08 Marks)

10 a. Explain briefly meter-in circuit.   (08 Marks)
   b. With neat sketch, explain pressure compensated flow control valve. (08 Marks)

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