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17ME71

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Energy Engineering

Time: 3 hrs.

Max. Marks: 100

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

Module-1

1   a. Explain the principle of over feed stokes with neat diagram.   **(10 Marks)**
    b. Explain Hydraulic ash handling process, with a neat sketch.   **(10 Marks)**

OR

2   a. A chimney is 28m height and temperature of hot gases inside is 320^0C. The temperature of outside air is 23^0C and furnace is supplied with 15kg of air per kg of coal burnt. Calculate
        i) Draught in mm of water   ii) Draught head in meters of hot gases.   **(10 Marks)**
    b. Explain the central or bin system of burning pulverised coal.   **(10 Marks)**

Module-2

3   a. With a neat diagram, explain the general layout of diesel power plant.   **(10 Marks)**
    b. Explain the general layout of hydroelectric power plant, with a neat diagram.   **(10 Marks)**

OR

4   a. Classify the hydroelectric power plants on the basis of head. Explain each type of plant in detail.   **(10 Marks)**
    b. With a neat diagram, explain Pump Fuel injection system.   **(10 Marks)**

Module-3

5   a. Explain Pyranometer with neat sketch to measure beam and diffused radiations.   **(10 Marks)**
    b. With a neat diagram, explain typical solar flat plate collector.   **(10 Marks)**

OR

6   a. What are the main advantages of solar – cell? Explain the conversion of solar energy to electricity through photovoltaic cell.   **(10 Marks)**
    b. Explain Phase change (Latent heat) heat storage concept. Explain the properties of materials used in latent heat storage. Comment on Latent heat storage materials.   **(10 Marks)**

Module-4

7   a. Derive an expression for the power of wind mill with condition.   **(10 Marks)**
    b. With neat diagram, explain Single basin storage Tidal Power Plant and also comment on the advantages of Tidal Power Plant (Tidal).   **(10 Marks)**

OR

8   a. Explain the typical horizontal axis wind mill, with a neat sketch.   **(10 Marks)**
    b. What are the different resources that can be used as Biomass for biogas generation?
                                                                                         (10 Marks)

Module-5

9   a. Describe the photosynthesis process with relevant chemical reactions. Also explain the importance of photosynthesis in biofuel generation.   **(10 Marks)**
    b. Explain closed Rankine cycle OTEC system with neat sketch.   **(10 Marks)**

OR

10 a. Explain with a neat sketch, the water dominated Geothermal system.   **(10 Marks)**
    b. What is the work of fuel cell? Explain typical H_2O_2 fuel cell with a neat sketch. **(10 Marks)**

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Seventh Semester B.E. Degree Examination, Jan./Feb.2021
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. What are the various applications of fluid power systems? (05 Marks)
   b. State Pascal's law and mention the various advantages of fluid power systems. (05 Marks)
   c. Explain the various components used in hydraulic systems and its symbol. (10 Marks)

OR

2 a. Describe the various functions of hydraulic fluids and its types. (05 Marks)
   b. Define the fluid properties such as viscosity, viscosity index, pour point, fire point, flash point. (05 Marks)
   c. Explain the working of return line and suction line filtering with the aid of sketches. (10 Marks)

Module-2

3 a. What are the various types of positive displacement pump used in fluid power system? (05 Marks)
   b. Explain with a sketch the construction and working of bladder type accumulator used in fluid power system. (05 Marks)
   c. Explain the construction and working of external gear pump with a neat sketch. (10 Marks)

OR

4 a. Explain the construction and working of double acting cylinder with a neat sketch. (05 Marks)
   b. An 8 cm diameter hydraulic cylinder has a 4 cm diameter rod. If the cylinder receives flow at 100 LPM and 12 MPa. Find the
      (i) Extension and retraction speeds.
      (ii) Extension and retraction load carrying. (05 Marks)
   c. Explain the construction and working of a hydraulic cylinder cushioning with a neat sketch. Also draw symbol. (10 Marks)

Module-3

5 a. List various types of control valves. (03 Marks)
   b. With a neat sketch explain the working of pressure relief valve. (07 Marks)
   c. Explain the hydraulic regenerative circuit with a neat sketch. (10 Marks)

OR

6 a. With a neat sketch, explain the working of ball type check valve. (05 Marks)
   b. With a neat sketch, explain the working of the 4/2 manually operated direction control valve. (05 Marks)
   c. Explain the hydraulic cylinder sequencing circuits with a neat sketch. (10 Marks)

Module-4

7 a. Describe the various components used in pneumatic power systems and its symbol.
(05 Marks)

   b. Explain the working of a single acting type of pneumatic cylinder with a neat sketch.
(05 Marks)

   c. Explain the construction and working of lubricator used in pneumatic system with a neat sketch. (10 Marks)

OR

8 a. Explain the working of a shuttle valve used in pneumatic system with a neat sketch.
(05 Marks)

   b. What are the various ways the pneumatic cylinders are mounted? (05 Marks)

   c. Explain the working of solenoid operated valve with a neat sketch. (10 Marks)

Module-5

9 a. Explain the speed control pneumatic circuits with a suitable sketch. (10 Marks)

   b. Explain the OR function of controlling the single acting pneumatic cylinder with a neat circuit. (10 Marks)

OR

10 a. Explain the controlling of pneumatic cylinders in a sequence as $A^+ B^+ B^- A^-$ by cascading method. (10 Marks)

   b. Explain electro pneumatic control of double acting cylinder with a suitable circuit. (10 Marks)

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Control Engineering

Time: 3 hrs.   Max. Marks: 100

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

Module-1

1 a. What is closed loop control system? **(02 Marks)**
   b. Explain the closed loop control system with an example. **(08 Marks)**
   c. Describe proportional + Integral + Derivative control system with its characteristics. **(10 Marks)**

OR

2 a. What are the requirements of an ideal control system? Explain any three in detail. **(10 Marks)**
   b. Explain :
       i) Proportional control system
       ii) Proportional and integral control system. **(10 Marks)**

Module-2

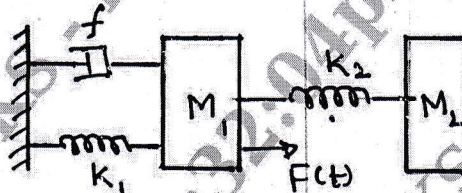3 a. Find the transfer function of mechanical system shown in Fig.Q3(a).

Fig.Q3(a) **(10 Marks)**

   b. Draw the signal flow graph for the following set of equations and obtain the transfer function:

$x_2 = a_{12} x_1 + a_{32} x_3 + a_{42} x_4 + a_{52} x_5$

$x_3 = a_{23} x_2$

$x_4 = a_{34} x_3 + a_{44} x_4$

$x_5 = a_{35} x_3 + a_{45} x_4$ **(10 Marks)**

OR

4 a. Derive the differential equation of first order electrical system. **(05 Marks)**
   b. A gas filled thermometer has a thermal resistance of R and is filled with a gas whose thermal capacitance is C. Obtain the transfer function relating the temperature of the gas inside the thermometer to the temperature of the medium in which the thermometer is inserted. Neglect capilarity of the thermometer. **(05 Marks)**
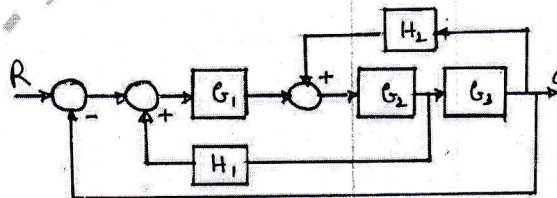   c. Determine the transfer function of the system shown in Fig.Q4(c), by block diagram reduction method.

Fig.Q4(c) **(10 Marks)**

Module-3

5 a. A unity feedback control system has $G(s) = \dfrac{25}{s(s+5)}$. Determine the following quantities if it is subjected to unit step input
   i)   Rise time
   ii) Peak time
   iii) Maximum over shoot
   iv) Settling time for 2% tolerance. (08 Marks)

   b. Define : i) Absolute stability. ii) Relative stability. (04 Marks)

   c. Investigate the stability of the control system using R–H criteria. The characteristic equation is $s^4 + 2s^3 + 11s^2 + 18s + 18 = 0$. (08 Marks)

OR

6   Sketch the root locus plot for a system whose open loop transfer function :
   $$G(s)H(s) = \frac{K[s^2 + 6s + 25]}{s[s+1][s+2]}$$
   Show that the system is absolutely stable. (20 Marks)

Module-4

7   Draw the BODE plots for the system having the open loop transfer function :
   $$G(s)H(s) = \frac{K}{s[s^2 + 2s + 5]}.$$
   Determine the value of K to obtain
   i)   A phase margin of 50° ii) A gain margin of 10db. (20 Marks)

OR

8   Determine the stability of the open loop control system
   $$G(s)H(s) = \frac{10[s+1]}{s[s-1][s+5]}$$ using Nyquist method. (20 Marks)

Module-5

9 a. Explain phase lead compensation. (08 Marks)

   b. Define : i) State variables ii) State vector. (04 Marks)

   c. Evaluate the observability of the system with $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ and $C = [3 \ 4 \ 1]$
   Using Gilbertz test. (08 Marks)

OR

10 a. Explain phase lag compensation. (08 Marks)

   b. What are the advantages of state variable analysis? (04 Marks)

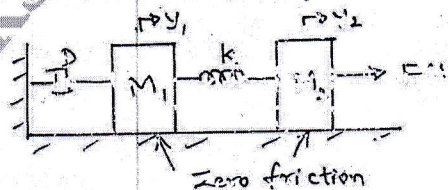   c. Obtain the state equation for the mechanical system shown in Fig.Q10(c).

Fig.Q10(c) (08 Marks)

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Tribology

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 history of Tribology. **(06 Marks)**
   b. Discuss the effect of pressure and temperature on viscosity. **(08 Marks)**
   c. Write a note on selection of lubricants. **(06 Marks)**

OR

2 a. State and prove Hasen-Poiseuille Law. **(10 Marks)**
   b. With a neat sketch, explain saybolt viscometer. **(10 Marks)**

Module-2

3 a. Define the term friction. Explain the measurement of friction by tilted plane method. **(10 Marks)**
   b. Explain Bowden and Tabor's adhesion theory of friction. **(10 Marks)**

OR

4 a. Define wear; briefly explain different types of wear. **(10 Marks)**
   b. Explain the Delamination theory of wear. **(10 Marks)**

Module-3

5 a. Derive the Petroff's equations for a lightly loaded journal bearing. Also state the assumptions made. **(10 Marks)**
   b. A full journal bearing have the following specifications, shaft diameter 45mm, bearing length 65mm, radial clearance ratio is 0.0015, speed 2800rpm, radial load 800N, viscosity of the lubricant 8.27×10^{-3} PaS. The bearing is lightly loaded, determine :
      i) Friction torque at the shaft
      ii) Co-efficient of friction
      iii) Power loss. **(10 Marks)**

OR

6 Derive the Reynold's equation in two dimension. Also state the assumption made. **(20 Marks)**

Module-4

7 a. Derive an expression for the load carrying capacity of a plane slider bearing with fixed shoe. **(10 Marks)**
   b. Slider bearing with pivoted shoe has the following specifications, B = 0.0508mts, L = 0.0625mts, U = 5.58 mts/sec, W = 8006.4N, η = 0.03 N-s/m^2. Determine :
      i) Minimum film thickness   ii) Power loss angle of inclination corresponds to minimum co-efficient of frictions. **(10 Marks)**

OR

8 a. Derive the expression for load carrying capacity and rate of flow of oil through a hydro-static step bearing. **(10 Marks)**

   b. A hydrostate circular thrust bearing has the following data. Shaft diameter = 300mm, diameter of packet = 200mm, shaft speed = 100rpm, Pressure at the pocket = 500kN/m^2, film thickness = 0.07mm, viscosity of lubricant = 0.05Pas. Determine :

   i) Load carrying capacity

   ii) Oil flow rate

   iii) Power Loss due to friction. **(10 Marks)**

Module-5

9 a. Briefly discuss any ten desirable properties of a good bearing materials. **(10 Marks)**

   b. Briefly discuss the common bearing materials that are used in practice. **(10 Marks)**

OR

10 a. Briefly explain the various mode by which surface properties can be enhanced. **(10 Marks)**

    b. Briefly explain different techniques to achieve surface modifications. **(10 Marks)**

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CBCS SCHEME

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Mechatronics

Time: 3 hrs.   Max. Marks: 100

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

Module-1

1 a. Why mechatronics is important to industrial automation? Explain the applications of mechatronics. **(10 Marks)**
   b. What are the merits and demerits of mechatronics? **(10 Marks)**

OR

2 a. Define transducer and sensor. List the difference between transducer and sensors. **(08 Marks)**
   b. Explain light sensors, proximity switch and hall effect sensors. **(12 Marks)**

Module-2

3 a. Define microprocessor and microcontrollers. With the help of sketch, explain the application of micro processor to automobile system (car). **(10 Marks)**
   b. What are the elements of control systems? Mention the difference between microcontroller and microprocessor. **(10 Marks)**

OR

4 a. With the help of block diagram, explain microprocessor. **(08 Marks)**
   b. Draw a neat sketch of 8085 microprocessor. Explain different types of registers used in this processor. **(12 Marks)**

Module-3

5 a. Explain principle operation of Programmable Logic Controller (PLC). How PLC is different from microprocessor in control system. **(10 Marks)**
   b. What do you mean by ladder diagram? Explain the same with the help of an example. **(10 Marks)**

OR

6 a. Mention robot configuration. Explain yaw pitch and roll pertaining to robot, with the help of diagram. **(10 Marks)**
   b. Explain background of actuator in mechatronics system. Explain briefly typical hydraulic actuator and pneumatic actuator. **(10 Marks)**

Module-4

7 a. List the mechanical systems that transmits the power in different planes. **(06 Marks)**
   b. With the help of diagram, explain cams used in Internal Combustion (IC) engines. **(10 Marks)**
   c. List the mechanical aspects of motor selection. **(04 Marks)**

<div align="center">OR</div>

8 a. How relays are used in mechatronics application? Explain. Explain the working of solenoid switch. **(08 Marks)**

   b. With the help of sketch, explain synchronous DC motor and servomotor. **(12 Marks)**

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Module-5

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9 a. Classify the valves used in mechatronics systems. With the help of sketch, explain pressure reducing valve. **(10 Marks)**

   b. Explain cylinders types. Explain rotory actuator. **(10 Marks)**

<div align="center">OR</div>

10 a. With the help of diagram and symbol, explain solenoid operated valve. **(10 Marks)**

    b. Briefly explain design and function of various units of hydraulic system. **(10 Marks)**

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