USN | | | | | | | | | | **15ME71**

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Energy Engineering

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. Explain with neat sketch, Spreader Strokers.   **(08 Marks)**
   b. What is Pulvarised coal? What are the advantages and limitations of Pulvarised coal?
                                                                      (08 Marks)

OR

2 a. Explain with neat sketch, Cyclone Burner.   **(08 Marks)**
   b. Explain Forced drought system.   **(08 Marks)**

Module-2

3 a. Explain with neat sketch air intake and exhaust system.   **(08 Marks)**
   b. List the advantages , limitation and application of Diesel Power Plant.   **(08 Marks)**

OR

4 a. How the Hydel power plants are classified and explain with neat sketch Pumped storage plant?   **(07 Marks)**
   b. Define i) Hydrograph   ii) Flow duration curve   iii) Surge tank.   **(09 Marks)**

Module-3

5 a. What is Beam Radiation? Explain working principle of Pyrheliometer for measuring beam radiation.   **(08 Marks)**
   b. The incident beam of sunlight has a power density of $1 kW/m^2$ in the direction of beam. The angle of inclination is 60^0. Calculate the power collected by the surface having a total area of $120 m^2$.   **(08 Marks)**

OR

6 a. Explain with neat sketch, working principle of a solar cell.   **(08 Marks)**
   b. Explain three Basic methods of Thermal Energy Storage.   **(08 Marks)**

Module-4

7 a. Explain with neat sketch, Verticle axis type wind mill.   **(08 Marks)**
   b. Wind at 1 standard atmospheric pressure and 15^0C temperature has a velocity of 15m/s with turbine operating speed of 40 rpm at maximum efficiency. Assume turbine diameter 120m. Calculate i) Total power density in the wind stream   ii) The maximum obtainable power density   iii) A reasonably obtainable power density @ $\eta = 35\%$ iv) Total power.   **(08 Marks)**

OR

8 a. How Tidal power plants are classified and what are the limitations of Tidal power plant?
                                                                      (09 Marks)
   b. Explain Fundamental characteristics of Tidal power plant selection.   **(07 Marks)**

Module-5

9 a. Write short notes on :
    i) Photo synthesis   ii) Energy plantation.   **(08 Marks)**
  b. With neat sketch, explain down draft gasifier.   **(08 Marks)**

OR

10 a. What is Fuel cell? How fuel cells are classified?   **(08 Marks)**
   b. What is Green energy? What are the benefits of green energy?   **(08 Marks)**

* * * * *

USN ☐☐☐☐☐☐☐☐☐☐

15ME72

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Fluid Power Systems

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1   a. What are the desirable properties of hydraulic fluids explain any five?   (08 Marks)
     b. Explain types of filtering methods and filters.   (08 Marks)

OR

2   a. State Pascal's law. Explain Pascal's law applied to hand operated jack.   (08 Marks)
     b. Explain basic structure of hydraulic system.   (08 Marks)

Module-2

3   a. Explain pumping theory and what are factors considered for selecting hydraulic pump.   (08 Marks)
     b. Explain external gear pump.   (04 Marks)
     c. A gear pump has a 75 mm outside diameter a 50 mm inside diameter and a 25 mm width. If the volumetric efficiency is 90% at rated pressure, what is the corresponding actual flow rate? The pump speed is 1000 rpm.   (04 Marks)

OR

4   a. Explain balanced vane motor.   (04 Marks)
     b. Explain Swash plate type piston motor.   (04 Marks)
     c. A hydraulic motor has a displacement of 130 cm^3, operates with a pressure of 105 bar and has a speed of 2000 rpm. If the actual flow rate consumed by the motor is 0.05 m^3/s and the actual torque delivered by the motor is 200 N-m, find
          (i)   Volumetric efficiency
          (ii) Mechanical efficiency
          (iii) Overall efficiency.
          (iv) Power developed by motor in kW.   (08 Marks)

Module-3

5   a. Explain Pilot operated pressure control valve.   (06 Marks)
     b. Explain 4-way spool valve.   (05 Marks)
     c. Explain needle flow control valve.   (05 Marks)

OR

6   a. Explain regenerative circuit.   (06 Marks)
     b. Explain hydraulic circuit with accumulator for any one application.   (05 Marks)
     c. Write symbols for,
          (i)   Pressure relief valve.
          (ii)   Pressure reducing valve.
          (iii) Counter balance valve.   (05 Marks)

Module-4

7 a. What are the advantages of Pneumatic system? (05 Marks)
   b. Explain cylinder cushioning. (05 Marks)
   c. Explain supply air throttling and exhaust air throttling. (06 Marks)

OR

8 a. Explain construction of single and double acting cylinder. (06 Marks)
   b. Explain FRL circuit. (05 Marks)
   c. Explain characteristics of compressed air. (05 Marks)

Module-5

9 a. Explain following functions generated in Pneumatic systems,
      (i) OR gate   (ii) AND gate   (iii) NOT gate. (12 Marks)
   b. Explain quick exhaust valve with symbol. (04 Marks)

OR

10 a. With neat sketch, explain electropneumatic control of double acting cylinder. (08 Marks)
   b. Explain with neat sketch coordinated sequence motion of two cylinders. (08 Marks)

* * * * *

USN ☐☐☐☐☐☐☐☐☐☐ **15ME73**

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
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.   Define control system. Explain open and closed loop control systems with examples.
                                                                         (08 Marks)

     b.   With block diagram, explain:
           i)   Proportional controller
           ii)   Integral controller
           iii)   Proportional plus differential controller.   **(08 Marks)**

OR

2   a.   List the advantages and disadvantages of open loop and closed loop control system.
                                                                         (08 Marks)

     b.   Explain requirements of automatic control system.   **(08 Marks)**

Module-2

3   a.   Obtain differential equation and hence get transfer function for mechanical system shown in Fig.Q.3(a).
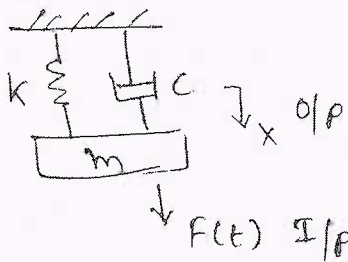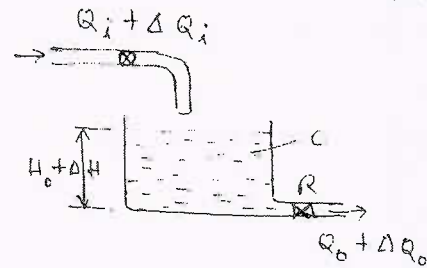   **(08 Marks)**

Fig.Q.3(a)   Fig.Q.3(b)

     b.   Obtain transfer function of liquid level control system shown in Fig.Q.3(b).   **(08 Marks)**

OR

4   a.   Obtain the overall transfer function for the block diagram shown in Fig.Q.4(a).   **(08 Marks)**
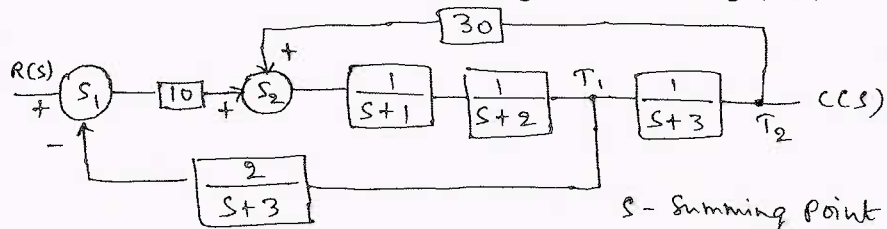

S – Summing Point
T – Take off point

Fig.Q.4(a)

b. Find the transfer function for the signal flow graph shown in Fig.Q.4(b) by using Mason's gain formula. (08 Marks)
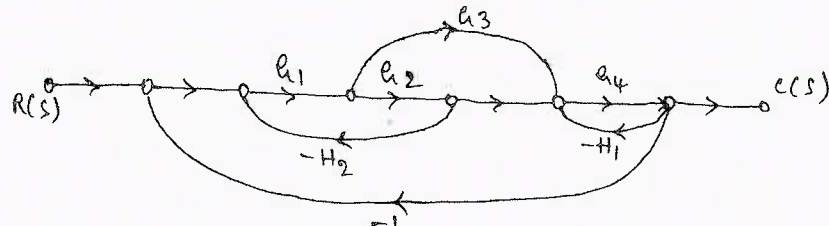

Fig.Q.4(b)

Module-3

5 a. A unity feed back system has $G(s) = \dfrac{40(s+2)}{s(s+1)(s+4)}$. Determine: i) Type of system
   ii) All error coefficients   iii) Error for ramp input with magnitude 4. (08 Marks)

   b. The time response of a second order system for unit step input is $c(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$. Determine: i) Closed loop transfer function   ii) Undamped natural frequency and damping ratio. (08 Marks)

OR

6 Sketch the root locus for the system with
   $$G(s)H(s) = \frac{K(s+4)}{s(s^2 + 2s + 2)}.$$
   (16 Marks)

Module-4

7 Draw the Bode plot for a system having
   $$G(s)H(s) = \frac{100}{s(s+1)(s+2)}$$
   Find: i) Gain margin   ii) Phase margin   iii) Gain crossover frequency
   iv) Phase cross over frequency. (16 Marks)

OR

8 a. Draw the polar plot and ascertain the nature of stability for OLTF.
   $$G(s)H(s) = \frac{12}{(s+1)(s+2)(s+3)}.$$
   (08 Marks)

   b. For a system with open loop T.F. $G(s)H(s) = \dfrac{1}{s(1+2s)(1+s)}$. Comment on stability of the system by Nyquist plot. Also find gain margin in dB. (08 Marks)

Module-5

9 a. Explain series and feed back compensation with block diagrams. (08 Marks)
   b. Write note on gain and phase cross over frequency gain and phase margin in polar plot. (08 Marks)

OR

10 a. Define the terms: i) State   ii) State variables   iii) State vector   iv) State space. (08 Marks)
    b. Determine the state controllability and observability of the system described by
    $$\dot{x} = \begin{bmatrix} -3 & 1 & 1 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} x + \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 2 & 1 \end{bmatrix} u \qquad y = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} x$$
    (08 Marks)

* * * * *

CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **15ME742**

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Tribology

Time: 3 hrs. 　　　　　　　　　　　　　　　　　　　Max. Marks: 80

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

Module-1

1　a. Briefly explain the history of Tribology. **(08 Marks)**
　b. With a neat sketch, explain any two practical importance of Tribology. **(08 Marks)**

OR

2　a. What is the importance of Lubricant? Explain the requirements of a good lubricant. **(10 Marks)**
　b. At the bottom of a uniform cylindrical vessel of 30cm height a horizontally capillary tube of 2mm inner diameter and 10cm length is connected to discharge the liquid. Calculate the rate of discharge of the liquid. If the vessel contains
　　i) Water of viscosity 0.01 poise and　ii)　Oil of viscosity 0.84 poise to 2/3 capacity. Take density of water and oil as 1 gm/cc and 0.9 gm/cc respectively. **(06 Marks)**

Module-2

3　a. What are the theories friction and explain any two theories and test measurement? **(08 Marks)**
　b. How do you classify mechanism of wear and explain any one measurement of Test method? **(08 Marks)**

OR

4　a. What is Delamination theory and explain? **(08 Marks)**
　b. Write short notes on friction of metals and non – metals. **(08 Marks)**

Module-3

5　a. Derive Petroff's equations for lightly loaded journal bearings. State assumptions. **(08 Marks)**
　b. Determine Load carrying capacity, Frictional force and power loss due to friction for an Ideal full Journal bearing for the following specifications :
　　Diameter of Journal = 5 cm ;　Speed of Journal = 1200 rpm ;　Length of bearing = 6.5cm
　　Radial clearance = 0.0025cm ;　Average viscosity = 1.6×10^{-6} Renolds ;　Attitude = 0.8. **(08 Marks)**

OR

6　a. With a neat sketch, explain Partial Journal Bearing and Effect of End leakage. **(06 Marks)**
　b. A Journal bearing of width 1m operates with a shaft of 100mm diameter which rotates at 1200 rpm. The diametral clearance is 200 μm and absolute viscosity of the lubricating oil is an at inlet temperature of 20^0C is 40 Cp for an eccentricity ratio of 0.7. Calculate the minimum film thickness, Attitude angle, Maximum film pressure , location load capacity and co-efficient friction. **(10 Marks)**

Module-4

7 a. Derive an equation for maximum pressure distribution for a plane slider bearing given by
$P_m = \dfrac{\eta u \, \ell}{h_0^2} \overline{P}_m$, with usual notations. **(08 Marks)**

   b. A fixed inclined pad thrust bearing of length 100mm and width 500mm, with a minimum film thickness of 50 µm, operates at a sliding velocity of 1m/s with a mineral oil of absolute viscosity of 30 Cp. Calculate the i) Maximum pressure and location   ii)   Normal load capacity and   iii)   Stiffness of the oil. Take m = 1.889. **(08 Marks)**

OR

8 a. Derive an equation for load carrying capacity of Hydro static lubrication. **(08 Marks)**

   b. A Hydrostatic thrust bearing with a circular step pad has an outside diameter of 400mm and recess diameter of 250mm.
   i) Calculate the pressure for a thrust load of 100kN.
   ii) Find the volumetric flow rate of the oil which will be pumped to maintain the film thickness of 150 µm with an viscosity of 30Cp and
   iii) Calculate the film stiffness. **(08 Marks)**

Module-5

9 a. Name the commonly used Bearing materials and explain any two bearing material properties. **(08 Marks)**

   b. What are the advantages and disadvantages of Bearing materials? **(03 Marks)**

   c. Write a note on Scope of Surface Engineering. **(05 Marks)**

OR

10 Write a short note on the following :
   a. Surface modification.
   b. Thermo chemical process.
   c. Vapor phase process.
   d. Wear and Corrosion resistance. **(16 Marks)**

* * * * *

CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   **15ME753**

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Mechatronics

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. What is mechatronics? Brief evolution of mechatronics.   (08 Marks)
   b. Write short notes on: (i) Proximity switch   (ii) Hall effect sensor   (08 Marks)

OR

2 a. Define transducer and classify it. Sketch and explain capacitive transducer.   (08 Marks)
   b. Elaborate mechatronics a multidisciplinary scenario. State any two merits and demerits of mechatronics.   (08 Marks)

Module-2

3 a. What is a Register? Sketch and explain Program Counter.   (08 Marks)
   b. Discuss the Basic Elements of Microprocessor based control system.   (08 Marks)

OR

4 a. Sketch and explain a typical memory device of a microprocessor.   (08 Marks)
   b. List out any four differences between Microcontroller and Microprocessor. (08 Marks)

Module-3

5 a. Describe different parts of an Industrial fixed robot controller.   (08 Marks)
   b. Define PLC. Sketch and explain the Basic PLC structure.   (08 Marks)

OR

6 a. Discuss the functional requirements of a robot and state how sensors play a vital role in functioning of robots.   (08 Marks)
   b. Write short notes on: (i) Pneumatic actuators   (ii) Latching circuit   (08 Marks)

Module-4

7 a. Sketch and explain the working principle of an variable reluctance Stepper motor and state the specification of it.   (08 Marks)
   b. Define the following and state any two application of it:
      (i) RELAY   (ii) SOLENOID   (iii) MOSFETS   (iv) MOTOR   (08 Marks)

OR

8 a. Explain the construction of a Ratchart and Pawl Mechanisms.   (08 Marks)
   b. Draw and explain the types of belts used in belt drives for power transmission.   (08 Marks)

Module-5

9 a. Sketch and explain the working principle of a Hydraulic system.   (08 Marks)
   b. What is Direction Control Valve? Explain the operations of a single solenoid valve.   (08 Marks)

OR

10 a. With a neat sketch illustrate different valve actuator symbols for hydraulic and pneumatic systems.   (08 Marks)
   b. Write a note on spool valve.   (08 Marks)

* * * * *

CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **15ME71**

Seventh Semester B.E. Degree Examination, June/July 2019
Energy 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 neat sketch, explain the travelling gate strokers. (08 Marks)
   b. Mention the various types of draught system, used at chimneys and explain them with a neat sketch (any one). (08 Marks)

OR

2 a. What are the function of super heaters and economizers? (04 Marks)
   b. List the different types of fuels used in stream generation. (04 Marks)
   c. Estimate the height of the chimney required to produce a static draught of 16 mm of water if the mean temperature of the flue gas in the chimney is 255°C and the temperature of outside air is 25°C. The densities of atmospheric air and flue gas at N.T.P are 1.293 and 1.34 kg/m³ respectively. (08 Marks)

Module-2

3 a. Explain different methods of starting a diesel engine. (06 Marks)
   b. Draw a line diagram to show the layout of diesel power plant and describe in brief. (10 Marks)

OR

4 a. With a neat sketch explain the pumped storage plant. (06 Marks)
   b. The discharge through monsoon stream as tabulated below:

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Discharge(m³/s)	2.0	1.5	1.0	0.6	0.0	0.0	8.0	10.0	12.0	6.0	4.0	3.0

   i) Draw the hydrograph and calculate the average flow.
   ii) Determine the capacity of reservoir for the obtained average flow if a dam is constructed across the stream.
   iii) If the mean level of water on the upstream side is 100 m above the tail races find the power in kW that could be generated assuming 80% generator efficiency. (10 Marks)

Module-3

5 a. Sketch and explain the solar flat plate collector. (08 Marks)
   b. Name solar radiation measuring instruments, and explain any one with neat sketch. (08 Marks)

OR

6 a. Give the classification of solar cells, and explain the working principle of solar cell. (08 Marks)
   b. Calculate the angle made by the beam radiation with normal to a flat plate collector December 21 at 0900h (LAT). The collector is located at in New Delhi (28°35'N, 77°12'E) and is fitted at an angle of 36° with the horizontal and is pointing due south. (08 Marks)

Module-4

7 a. Give a brief note on horizontal and vertical axis wind mill system. **(08 Marks)**

   b. Wind blows with a velocity of 16 m/s at 15°C. The turbine diameter is 115 m with rotating speed of 40 rpm at maximum efficiency. Assume one standard atmospheric pressure and propeller wind turbine. Calculate the following:
   i) Total power density in the wind stream
   ii) Maximum obtainable power density
   iii) Reasonably obtainable power density
   iv) Total power **(08 Marks)**

OR

8 a. Draw a neat sketch and explain the working of double basin tidal power plant. **(08 Marks)**

   b. What are the advantages and disadvantages of tidal power plant? **(08 Marks)**

Module-5

9 a. What are the stages in anaerobic digestion process? Explain. **(08 Marks)**

   b. With a neat sketch, explain the updraft gasifier. Mention the temperature ranges. **(08 Marks)**

OR

10 a. Write short notes on the following:
   i) Fuel cell thermodynamics principles
   ii) Nuclear energy applications **(08 Marks)**

   b. With a neat sketch, explain the closed cycle OTEC system (Anderson cycle). **(08 Marks)**

* * * * *

USN | | | | | | | | | | | 15ME72

Seventh Semester B.E. Degree Examination, June/July 2019
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.   Sketch and explain the structure of hydraulic control system.   (10 Marks)
    b.   State Pascal's law? Explain the significance of Pascal's law in applying fluid power.
                                                                               (06 Marks)

OR

2   a.   What is the importance of seals in hydraulic system? list the functions of seals?   (08 Marks)
    b.   What are the desirable properties of fluids in hydraulic system?   (08 Marks)

Module-2

3   a.   What are the important considerations taken while selecting a pump for particular applications? Explain procedure.   (06 Marks)
    b.   A pump having displacement of 14cm³ is driven at 1440rpm and operates against a maximum pressure of 150bar. The volumetric efficiency is 0.9 and the overall efficiency is 0.80. Find :
         i)   Pump delivery in LPM
         ii)   The input power required in kW
         iii) The Torque at the pump shat   (10 Marks)

OR

4   a.   What is an actuator? How are they classified? Explain each one of them briefly.   (08 Marks)
    b.   A double acting cylinder with a single rod (differential cylinder) has to produce a thrust and 100kN at a speed of 0.4 cms/sec during extension. The operating pressure is 120 bar. Calculate the diameter of the cylinder and flow rate. If the cylinder has a piston rod of 20mm diameters. What would be the force and speed during retraction for the same operating pressure and discharge?   (08 Marks)

Module-3

5   a.   Explain briefly he construction, working principle along with graphic symbol of the following: i) Sequencing valve   ii) Counter balance valve.   (10 Marks)
    b.   Explain with a neat sketch, the principle of working of a pilot operated pressure relief valve. Also draw the graphic symbol for the valve.   (06 Marks)

OR

6   a.   Explain briefly with a neat sketch, the cylinder synchronizing circuit operated together with a pair of cylinders in series in a synchronized manner to lift the load?   (08 Marks)
    b.   Describe i) Meter – in circuit   ii) Meter out circuit for controlling the speed of cylinder? List their merits and limitations?   (08 Marks)

Module-4

7 a. List the advantages and limitations of Pneumatic system. (08 Marks)
   b. Explain with a neat sketch 3/2 way spool type dc valve to control flow of air in pneumatic system. (08 Marks)

OR

8 a. Differentiate between hydraulic and pneumatic system. (06 Marks)
   b. Explain the following with a neat sketches.
       i)   Magnetic type rodless cylinder
       ii) Cable operated rodless cylinder. (10 Marks)

Module-5

9 a. Using two-way, two-position DCV, show how the following logic-functions can be achieved in pneumatics? i) AND   ii) OR (08 Marks)
   b. Explain direct and indirect actuation of pneumatic cylinder. (08 Marks)

OR

10 a. Explain the principle of cascade control system. (08 Marks)
   b. What are Sensors? How many types of sensors are used in electro-pneumatic systems? (08 Marks)

* * * * *

CBCS SCHEME

Seventh Semester B.E. Degree Examination, June/July 2019
Tribology

Time: 3 hrs.

Max. Marks: 80

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

Module-1

1 a. Define the term Tribology. Discuss industrial importance of tribology. (06 Marks)
  b. Discuss major properties of an ideal lubricant. (10 Marks)

OR

2 a. Define Viscosity. State and explain Newton's law of viscosity, with a neat sketch. (06 Marks)
  b. Explain Construction and Operating principle of Falling Sphere Viscometer and Flower's Viscometer, with neat sketches. (10 Marks)

Module-2

3 a. Define the term friction. Explain measurement of friction by an inclined plane test rig. (08 Marks)
  b. Explain Bowden and Tabor's Adhesion theory of friction. (08 Marks)

OR

4 a. Define the term Wear. Explain in brief classification of wear in relation to wear mechanism. (08 Marks)
  b. Explain Delamination theory of wear in brief. (08 Marks)

Module-3

5 Derive the Reynold's equation in two dimensions. (16 Marks)

OR

6 a. A full journal bearing has an equal length and diameter of 0.05m. The diametral clearance ratio is 0.001 and the operating viscosity of the lubricant is 0.05 par sec. If the journal speed is 950 rpm and if the bearing sustains a load of 100kN, determine eccentricity ratio and thickness of the lubricant. (08 Marks)
  b. A full journal bearing operates under a load of 1.75 kN at a speed of 900 rpm. The diameter of journal is 37.5mm and the length of bearing is 46.8mm. The minimum oil film thickness must not be less than 0.009375mm. Assume diametral clearance ratio to be 0.001 and average operating temperature as 95^0C. Determine the type of lubricant and power loss in the bearing by considering end leakages into account. (08 Marks)

Module-4

7 a. Derive an equation for load carrying capacity of an idealized plane slider bearing with pivoted shoe. (08 Marks)
  b. A square shape pivoted shoe slider bearing has the following specifications. Load carrying capacity = 13344 N , Velocity of moving member = 5.08 m/s , Viscosity of oil used = 15Cp. Permissible minimum oil film thickness = 0.01905mm. Assume q = 1.2 and determine coefficient of friction and power loss. Neglect effect of end flow from the bearing. (08 Marks)

OR

8 a. Derive an equation for rate of flow of oil through a hydro static step bearing.   **(08 Marks)**

    b. A hydro static step bearing has the following specifications. Journal diameter = 100mm , Diameter of pocket = 50mm , Vertical thrust on bearing = 18.16 kN , External pressure = 1.013 bar , Journal speed = 60 rpm , Desirable oil film thickness = 0.1mm , Viscosity of lubricant = 8.5 Cp. Determine energy lost in pumping and coefficient of friction. **(08 Marks)**

Module-5

9 a. Explain major properties of typical bearing materials.   **(08 Marks)**

    b. Explain principal methods of physical vapour deposition in surface coating with a neat sketch.   **(08 Marks)**

OR

10 a. Explain the basic requirements to be satisfied by any component for selection of a particular surface coating.   **(06 Marks)**

    b. Explain in brief any five common surface hardening processes.   **(10 Marks)**

* * * * *

Seventh Semester B.E. Degree Examination, June/July 2019
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 about multidisciplinary scenario.   (10 Marks)
    b.   List advantages, limitations and applications of mechatronics.   (06 Marks)

OR

2   a.   Sketch and explain hall effect sensor.   (06 Marks)
    b.   Define sensor and transducer. Give the classification of transducers.   (10 Marks)

Module-2

3   a.   Define microprocessor. Explain organization of microprocessor based control system.
                                                                                 (10 Marks)
    b.   List the differences between microprocessor and microcontroller.   (06 Marks)

OR

4   Sketch and explain Intel's 8085A microprocessor architecture.   (16 Marks)

Module-3

5   a.   Sketch and explain basic structure of Programmable Logic Controller (PLC).   (12 Marks)
    b.   Explain the basic standard symbols used in ladder diagram for programming PLC. (04 Marks)

OR

6   a.   Write short notes on: (i) Advanced actuators   (ii) Pneumatic actuators   (06 Marks)
    b.   Explain different parts of a robot.   (10 Marks)

Module-4

7   a.   Explain the following mechanisms with neat sketch:
         i) Cam and cam follower   ii) Gear trains   iii) Ratchet and Pawl   (12 Marks)
    b.   What are the mechanical aspects of motor selection? Explain in brief.   (04 Marks)

OR

8   a.   Sketch and explain the working principle of relays with suitable application.   (08 Marks)
    b.   Explain the working principle of DC motor. Give the classification of DC motors.   (08 Marks)

Module-5

9   a.   Sketch and explain: (i) Spool valve   (ii) Poppet valve.   (08 Marks)
    b.   Explain different ways of valve actuation with their symbols.   (08 Marks)

OR

10 a.   With neat sketch, explain various components of a hydraulic system.   (08 Marks)
    b.   Sketch and explain (i) check valve   (ii) needle valve.   (08 Marks)

* * * * *

USN | | | | | | | | | | **15ME81**

Eighth Semester B.E. Degree Examination, June/July 2019
Operations Research

Time: 3 hrs.   Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing*
ONE full question from each module.
2. Use of statistical tables is permitted.

Module-1

1 a. List and explain briefly the phases of operations research.   **(06 Marks)**
   b. A paper manufacturing company produces two grades of papers grade 'R' and grade 'S'. Because of raw material restrictions, not more than 450 tonnes of grade R and 240 tonnes of grade S papers can be produced per week. It requires 0.2 hours to produce 1 tonne of grade R paper and 0.4 hours to produce 1 tonne of grade S paper. There are 108 production hours per week. The profit per tonne of grade R paper is Rs 400 and per tonne of grade S paper it is Rs. 500. Formulate a mathematical model to determine how many tones of grade R and grade S papers the company has to produce per week to maximize its profit. Solve graphically.   **(10 Marks)**

OR

2 a. Discuss the limitations of operations research.   **(06 Marks)**
   b. Solve the following LPP by graphical method and indicate the solution :
      Maximize $Z = 2x_1 + 3x_2$
      Subject to constraints : $x_1 - 2x_2 \leq 0$
      $$2x_1 - x_2 \geq 0$$
      $$x_1 - x_2 \leq 0$$
      with $x_1, x_2 \geq 0$.   **(10 Marks)**

Module-2

3 a. What is the significance of introducing slack, surplus and artificial variables in LPP?
                                                                                                    (04 Marks)
   b. Solve the following LPP by Simplex Method :
      Maximize $Z = 6x_1 + 4x_2$
      Subject to constraints: $-2x_1 + x_2 \leq 2$
      $$x_1 - x_2 \leq 2$$
      $$3x_1 + 2x_2 \leq 9$$
      with $x_1, x_2 \geq 0$.   **(12 Marks)**

OR

4 a. Solve the following LPP by either Big–M method or two phase method :
      Minimize $Z = x_1 - 2x_2 - 3x_3$
      Subject to constraints : $-2x_1 + x_2 + 3x_3 = 2$
      $$2x_1 + 3x_2 + 4x_3 = 1$$
      with $x_1, x_2, x_3 \geq 0$.   **(08 Marks)**
   b. Solve the following by Dual Simplex Method :
      Maximize $Z = -2x_1 - 2x_2 - 4x_3$
      Subject to constrains: $2x_1 + 3x_2 + 5x_3 \geq 2$
      $$3x_1 + x_2 + 7x_3 \leq 3$$
      $$x_1 + 4x_2 + 6x_3 \leq 5$$
      with $x_1, x_2, x_3 \geq 0$.   **(08 Marks)**

Module-3

5 a. What is degeneracy in transportation problem? Discuss its consequence and how it is over come. **(04 Marks)**

   b. Obtain the optimum solution to the following transportation problem to minimize the total transportation cost. Initial solution by Vogel's approximation method. (VAM).

Destination

		D_1	D_2	D_3	D_4	Supply
	O_1	42	48	38	37	16
Origin	O_2	40	49	52	51	15
	O_3	39	38	40	43	19
	Demand	8	9	11	16	

(12 Marks)

OR

6 a. Explain the differences between assignment problem and transportation problem. **(05 Marks)**

   b. A small machine shop has five jobs to be assigned to five machines. The following matrix indicates the cost of assigning each of the five jobs to each of the five machines. Obtain the optimum assignment of jobs to machines, in order to minimize the total assignment cost.

Machines

		1	2	3	4	5
	A	11	17	8	16	20
	B	9	7	12	6	15
Jobs	C	13	16	15	12	16
	D	21	24	17	28	26
	E	14	10	12	11	15

Q6(b) Cost Matrix **(11 Marks)**

Module-4

7 a. Explain the Kendall and Lee's notations for representing queuing models. **(04 Marks)**

   b. A small project consists of activities from 'A' to 'I'. The following table indicates the precedence relationship among activities and the three time estimates – optimistic, most – likely and pessimistic time for each activity in days.

Activity	Predecessor Relationship	Optimistic time 't_0'	Most likely time 't_m'	Pessimistic time 't_p'
A	---	2	5	8
B	A	6	9	12
C	A	6	7	8
D	B, C	1	4	7
E	A	8	8	8
F	D, E	5	14	17
G	C	3	12	21
H	F, G	3	6	9
I	H	5	8	11

i) Draw the project network. Determine the expected time and variance for each activity

ii) Obtain the total expected duration of the project and critical path

iii) What is the probability of completing the project in 50 days? **(12 Marks)**

2 of 3

OR

8 a. For the following set of activities of a project, draw the network and obtain Early Start [ES], Early Finish [EF], Late Start [LS] and Late Finish [LF] for each activity. Also, indentify the critical path and project duration.

Activity	Predecessor	Duration in days
A	--	5
B	A	8
C	A	6
D	C	5
E	B, D	9

(08 Marks)

   b. The mean arrival rate to a service centre is 3 per hour. The mean service time is found to be 10 minutes per service. Assuming Poisson arrival and exponential service time, find :
   i)   Utilization factor for the service facility
   ii) Probability of two units in the system
   iii) Queue length
   iv) Expected waiting time in the system

(08 Marks)

Module-5

9 a. Apply the rules of dominance to reduce the game to (2×2) and solve the game to obtain game value and optimum strategies for both the players.

Player B

	1	2	3
1	2	-2	4
2	-1	4	2
3	2	1	6

Player A 1, 2, 3

(08 Marks)

   b. Solve the following (2×4) game graphically.

Player B

	1	2	3
1	1	3	12
2	8	6	02

Player A 1, 2

(08 Marks)

OR

10 a. There are seven jobs to be processed on a single machine. The following table indicates the jobs and corresponding processing time in hours. Obtain the optimum sequence of jobs by Shortest Processing Time [SPT] rule that minimizes the mean flow time. Also obtain average in process inventory. (06 Marks)

Jobs (j)	A	B	C	D	E	F	G
Processing time (t_j) in hr	8	3	5	4	3	9	6

   b. There are six jobs to be processed on three machines A, B and C in the order CAB. The following table indicates the processing time in hours for the six jobs on the three machines. Obtain optimum sequence of jobs that minimizes the total elapsed time for completing all the jobs on the three machines. Also indicate the idle time of each machine.

Jobs	1	2	3	4	5	6
Processing time in hours on M/C A	4	6	7	4	5	3
Processing time in hours on M/C B	8	10	7	8	11	8
Processing time in hours on M/C C	5	6	2	3	4	9

(10 Marks)

* * * 3 of 3 * * *

USN | | | | | | | | | | **15ME82**

Eighth Semester B.E. Degree Examination, June/July 2019
Additive Manufacturing

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. Briefly explain the process chain of additive manufacturing. **(08 Marks)**
    b. Explain discrete particle system. **(08 Marks)**

OR

2 a. Explain the steps involved in property enhancement using thermal techniques. **(08 Marks)**
    b. Write any eight applications of AM in Aerospace, Automobile, Medical and general engineering. **(08 Marks)**

Module-2

3 a. With a neat sketch explain the working of hydraulic piston motors. **(08 Marks)**
    b. With a simple pneumatic circuit explain the supply air throttling system. **(08 Marks)**

OR

4 a. Classify Direct Current motors. With a neat sketch, explain the working of a DC motor. **(08 Marks)**
    b. Explain the working of diode in a circuit with neat sketches. **(08 Marks)**

Module-3

5 a. How polymers are classified? **(02 Marks)**
    b. Explain polydispersity and molecular weight distribution in polymers. **(06 Marks)**
    c. Write a short note on compression moulding of polymers with a neat sketch. **(08 Marks)**

OR

6 a. List out the mechanical methods of powder production systems. Explain any one with a neat sketch. **(08 Marks)**
    b. What are the stages of liquid phase sintering? Explain any one stage. **(08 Marks)**

Module-4

7 a. Explain the bottom up and top down methods of synthesis. **(08 Marks)**
    b. Explain the mechanical grinding methods of creating nano structures. **(08 Marks)**

OR

8 a. With a neat sketch, explain the working of transmission electron microscopy. **(08 Marks)**
   b. Explain the working principles of Atomic force microscopy. **(08 Marks)**

Module-5

9 a. List out the advantages of CNC machines over NC machines. **(08 Marks)**
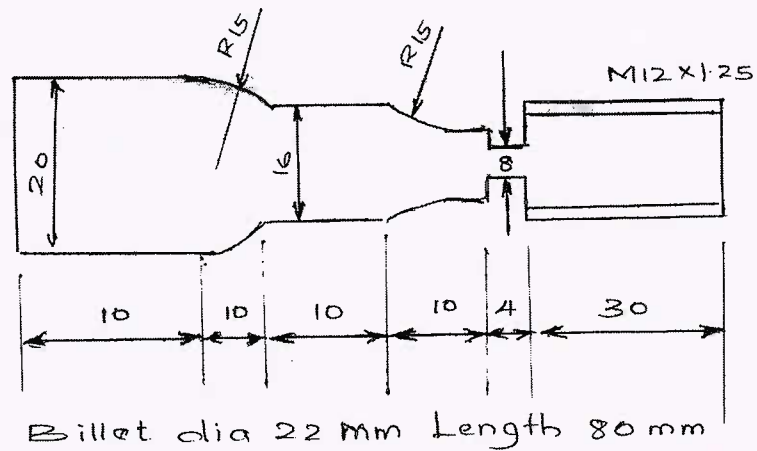   b. Write a part programming for the component shown in the Fig.Q9(b). **(08 Marks)**

Billet dia 22 mm Length 80 mm

Fig.Q9(b)

OR

10 a. Write down the benefits of automation. **(08 Marks)**
    b. Explain the different levels of automation with examples. **(08 Marks)**

* * * * *

USN |__|__|__|__|__|__|__|__|__|__| **15ME832**

Eighth Semester B.E. Degree Examination, June/July 2019
Experimental Stress Analysis

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1   a.   Explain the various standards for linear measurements.   (08 Marks)
    b.   Explain the types of error which occur during experiments.   (08 Marks)

OR

2   a.   Derive an expression for gauge factor for an electrical resistance strain gauge.   (08 Marks)
    b.   Explain any four types of Adhesives used for construction and installation of strain gauges.   (08 Marks)

Module-2

3   The following readings of strain were obtained in a three element rectangular rosette mounted on aluminium specimen for which E = 70 GPa and Poisson's ratio = 0.32. $\hat{\epsilon}_A = 850$ μm/m, $\hat{\epsilon}_B = -1200$ μm/m and $\hat{\epsilon}_C = 1000$ μm/m. The transverse sensitivity and Poisson's ratio of gauge material is 0.07 and 0.28 respectively. Determine (i) Corrected strains, (ii) Principal strains , (iii) Principal stresses and their directions and (iv) Maximum shear stress.   (16 Marks)

OR

4   a.   With neat sketches explain the measurement of Axial force and Torque using strain gauge transducers.   (12 Marks)
    b.   Briefly discuss the three element rectangular and delta strain gauge rosette arrangement.   (04 Marks)

Module-3

5   a.   Derive an expression for stress-optic law for two dimensional photoelasticity.   (08 Marks)
    b.   Explain with neat sketch any one method for calibration of photoelastic model material.   (08 Marks)

OR

6   a.   Explain shear difference method of separation technique for separation of principal stresses.   (08 Marks)
    b.   Discuss the properties of photoelastic model materials.   (08 Marks)

Module-4

7   a.   With neat sketches explain the stress freezing method in three dimensional photoelasticity.   (08 Marks)
    b.   With neat sketch explain the working of scattered light polariscope.   (08 Marks)

OR

8   a.   Derive an expression for the difference in principal stresses in Birefringent coating is linearly related to the difference in the principal stresses acting on the surface of machine part.   (08 Marks)
    b.   Explain with suitable sketch the separation of principal stresses in Birefringent coating.   (08 Marks)

Module-5

9   a. With neat sketches explain the steps involved in a typical brittle coating application on flat tension model to study incipience of cracks. **(08 Marks)**

b. Explain with neat sketch the calibration of Brittle coating materials. **(08 Marks)**

OR

10 a. Explain the movie fringe analysis by Geometric approach. **(08 Marks)**

b. Explain any one method of Moire technique for out of plane problems. **(08 Marks)**

* * * * *

CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   **15ME835**

Eighth Semester B.E. Degree Examination, June/July 2019
Product Life Cycle Management

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1   a.   Define PLM. List and explain the different phases of Product Life Cycle.   (06 Marks)
    b.   What is PLM Strategy? Explain.   (04 Marks)
    c.   List the benefits of PLM.   (06 Marks)

OR

2   a.   Sketch and explain the PLM has a holistic approach to the management of a product.   (06 Marks)
    b.   List and explain the various opportunities of PLM.   (06 Marks)
    c.   What do you mean by PLM feasibility study? Explain.   (04 Marks)

Module-2

3   a.   What is Engineering design? Explain.   (04 Marks)
    b.   Sketch and explain the product design process.   (06 Marks)
    c.   Sketch and explain the recovery strategies at end of life.   (06 Marks)

OR

4   a.   Sketch and explain the comparison between sequential and concurrent engineering in product development process.   (06 Marks)
    b.   List and explain the most common DFX techniques used in the product design and development process.   (06 Marks)
    c.   Explain the human factors to be considered in product design.   (04 Marks)

Module-3

5   a.   Sketch and explain the various activities of new product development.   (08 Marks)
    b.   How do you estimate the market potential of a new product? Explain.   (08 Marks)

OR

6   a.   What is Decision Support System? How it is helpful in decision making? Explain. (08 Marks)
    b.   With the aid of a flow chart, explain the process of launching and tracking of a new product.   (08 Marks)

Module-4

7   a.   Define Technology Forecasting. Explain why technology forecasting is important.   (08 Marks)
    b.   List and explain any one method of Technology Forecasting.   (08 Marks)

OR

8   a.   Sketch and explain the importance of 'Relevance Tree' by taking Automobile as an example.   (08 Marks)
    b.   List and explain the importance of ideation tools in the innovation process.   (08 Marks)

Module-5

9 a. What is Model building? How do you classify them? Explain. (06 Marks)

   b. Explain the following :
      i) Product structures   ii) Digital mock – up. (10 Marks)

OR

10 Explain the following :
   a. Data model.
   b. Product configuration.
   c. 3D CAD systems.
   d. Variant Management. (16 Marks)

* * * * *