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10ME61

Sixth Semester B.E. Degree Examination, June/July 2019

Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define automation. Briefly explain different types of automation. **(10 Marks)**

b. What are the reasons for automation? **(02 Marks)**

c. Explain the following terms:
i) Manufacturing lead time ii) Production rate
iii) Production capacity iv) Utilization and availability **(08 Marks)**

2 a. What do you mean by automated flow line? Classify and explain the automated flow line system configuration. **(10 Marks)**

b. Sketch and explain the following transfer mechanisms:
i) Walking beam transfer mechanism
ii) Geneva wheel mechanism **(10 Marks)**

3 a. Explain the upper bound approach and lower bound approach in analyzing automated flow line without storage buffer. **(08 Marks)**

b. The following data applied to a 12-station In-line transfer machine. P = 0.01 (All station have an equal probability of failure)
$T_c = 0.3$ min
$T_d = 3$ min
Using upper bound and lower bound approaches compute the following for the transfer machine:
i) The frequency of line stops
ii) The average production rate
iii) The line efficiency **(08 Marks)**

c. What is mean by storage buffer? Mention two extreme cases of storage buffer effectiveness. **(04 Marks)**

4 a. Explain the following terms in line balancing:
i) Minimum rotational work element ii) Precedence diagram
iii) Cycle time iv) Balance delay **(08 Marks)**

b. The following list defines the precedence relationships and element times for a new model toy.

Element	1	2	3	4	5	6	7	8	9	10
Time "Te" min	0.5	0.3	0.8	0.2	0.1	0.6	0.4	0.5	0.3	0.6
Immediate predecessors	-	1	1	2	2	3	4, 5	3, 5	7, 8	6, 9

Using largest candidate rule method:
i) Construct the precedence diagram
ii) If the ideal cycle time is to be 1 min what is the minimum number of workstations required?
iii) Calculate the balance delay. **(12 Marks)**

PART – B

5 a. Explain with sketches, the elements of the parts delivery system for an automated assembly line. **(10 Marks)**

b. List the principles used in product design for automated assembly. **(05 Marks)**

c. What is an automated guided vehicle system? List the applications of AGVS. **(05 Marks)**

6 a. Briefly explain:
i) Retrieval CAPP system
ii) Generative CAPP system **(10 Marks)**

b. What is material requirement planning? Explain the stricture of a MRP system. **(10 Marks)**

7 a. Describe salient features of CNC system along with a block diagram. **(10 Marks)**

b. Discuss the advantages, disadvantages and application of CNC machines. **(10 Marks)**

8 a. With neat figures, briefly explain the common robot configurations. **(12 Marks)**

b. Briefly explain the end effectors and sensors with respect to robots. **(08 Marks)**

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10ME62

Sixth Semester B.E. Degree Examination, June/July 2019
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Missing data may be suitably assumed.
3. Use of data handbook is permitted.

PART – A

1 a. Determine the value of 'b_1' of a unsymmetrical I-beam cross-section of a curved beam shown in Fig.Q1(a) such that the extreme fibre stresses due bending are numerically equal. **(12 Marks)**

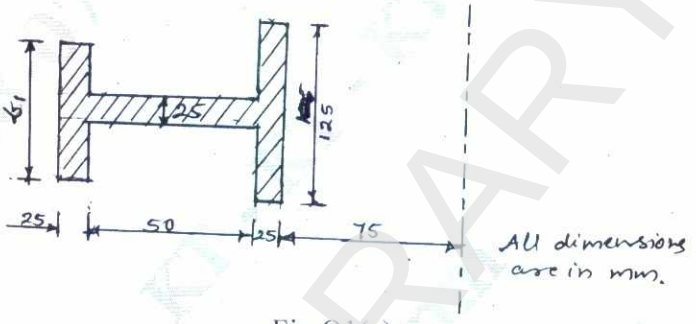

Fig.Q1(a)

b. A cast iron cylinder of internal diameter 200mm and the thickness 50mm is subjected to a pressure of 5 MPa. Calculate the tangential and radial stresses at inner, middle and outer surface. **(08 Marks)**

2 a. Design a flat belt to drive a compressor by means of an electric motor of 12 kW having a speed ratio of 3. The speed of the motor shaft is 900 rpm. Assume a service factor of 1.5 **(10 Marks)**

b. Select a wire rope of an elevator in the building using the following details:
(i) Weight of elevator = 30 kN, (ii) Weight of passenger = 12 kN, (iii) Total lift = 250m, (iv) Rope velocity = 5 m/s to be reached in a distance of 10 meters (v) FOS = 7. **(10 Marks)**

3 a. A carriage weighing 25 kN is moving on a track with velocity of 3.6 km/hr. It is brought to rest by two buffer springs in which the maximum compression is 180 mm. The permissible shear stress in spring material is 450 MPa. Design the spring of index 6 and modulus of rigidity as 81.4 GPa. **(12 Marks)**

b. A laminated spring for truck has an effective length of 1 m and central load of 10 kN is undergoes deflection of 75 mm. The spring has 10 leaves, two of which are full length and have been pre-stressed so that all leaves have same stress of 350 MPa. Calculate the width and thickness of the leaves. **(08 Marks)**

4 a. Derive the Lewis equation for the beam strength of a gear tooth. **(04 Marks)**

b. Design a pair of spur gears to transmit 25 kW of power at a pinion speed 1000 rpm for the velocity ratio is 2.5 : 1. The centre to centre distance of shaft to be about 300 mm. The static design stress for pinion and gear are 200 MPa and 180 MPa respectively. Considering class-II gear with 20° full depth involute tooth. The material for pinion is steel (BHN = 250) and gear is cast iron (BHN = 200). **(16 Marks)**

PART – B

5 A pair of straight bevel gears are to transmit 15 kW at 1500 rpm input speed. The number of teeth on pinion is 20 and the speed ratio is 5. Design the gears assuming 14½ full depth form. **(20 Marks)**

6 a. Design a cone clutch to transmit 40 kW at 750 rpm. Assume f = 0.4, p = 0.2 MPa, $\alpha = 12.5°$, $D_m/b = 6$. **(10 Marks)**

b. A simple band brake as shown in Fig.Q6(b) is to be designed to absorb power of 30 kW at a rated speed of 750 rpm. Determine

(i) The effort required to stop clockwise and anticlockwise rotation of the brake drum.

(ii) The dimensions of rectangular c/s of the brake lever assuming its depth to be twice the width.

(iii) The dimensions of the c/s of the band assuming its width to be ten times the thickness. **(10 Marks)**

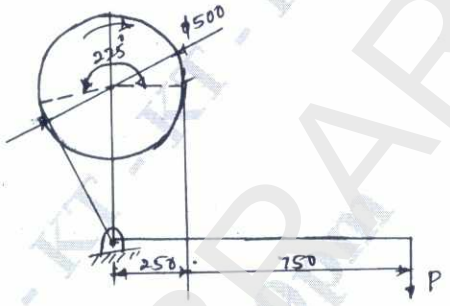

Fig.Q6(b) : All dimensions are in mm

7 a. Derive Petroff's equation, with usual notations. **(06 Marks)**

b. Design a journal bearing for a centrifugal pump running at 1200 rpm. Diameter of journal is 100 mm and load on bearing is 15 kN. Take $\ell/d = 1.5$, bearing temperature 50° and ambient temperature is 30°. Find whether artificial cooling is required. **(14 Marks)**

8 Design a cast iron piston for a single acting four stroke diesel engine with the following data : Cylinder bore = 200 mm, length of stroke = 250 mm, Speed = 600 rpm, Brake mean effective pressure = 0.6 MPa. Maximum gas pressure = 4 MPa. Fuel consumption = 0.25 kg per BP per hour. **(20 Marks)**

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10ME63

Sixth Semester B.E. Degree Examination, June/July 2019
Heat and Mass Transfer

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. *Use of that transfer data Handbook and steam table are permitted.*

PART – A

1 a. Define the following giving units :
i) Overall heat transfer coefficient
ii) Thermal diffusivity
iii) Radiation heat transfer coefficient. **(05 Marks)**

b. Derive the following expression for loss heat from a lagged pipe per square meter of metal surface per degree temperature difference between the metal and the lagging surface.

$$G'' = \frac{K}{r \log R/r}$$

Where K is thermal conductivity of lagging material, r and R are the radii of metal and lagging surface. Neglect thermal resistance due to metal surface **(07 Marks)**

c. A hot metal slab of thickness L and initial temperature T_0 is removed from a heat treating furnace and placed in a quenching oil bath at temperature T_∞. The convective heat treatment coefficient at each face is h. Write the mathematical formulation of the problem. **(08 Marks)**

2 a. A carbon steel pipe (k = 45 W/mK), 78mm in diameter and 5.5mm thick has eight longitudinal fins 1.5mm thick. Each fin extends 30mm from the pipe wall. If the wall temperature, ambient temperature and surface heat transfer coefficients are 150°C, 28°C and 75W/m^2 K is respectively. Calculate the percentage increase in heat transfer rate for the finned tube over the plain tube. **(10 Marks)**

b. The current carrying capacity of an electrical cable of 1.2cm in diameter is increased to a maximum of 15%by providing an insulation but without increasing its surface temperature of 70°C. The ambient air temperature is of 30°C. Determine the conductivity of the insulating material. Assume heat transfer coefficient on bare cable and insulated cable as 14W/m^2K. **(10 Marks)**

3 a. Obtain an expression for the instantaneous heat transfer and total heat transfer for lumped heat analysis treatment of heat conduction problem. **(10 Marks)**

b. A metallic sphere of radius 10mm is initially at a uniform temperature of 400°C. It is heat treated by first cooling it in air (h = 10W/m^2K) at 20°C until its central temperature reaches 335°C. It is then quenched in a water bath at 20°C with h = 6000W/m^2K, until the centre of the sphere cools from 335°C to 50°C. Compute the time required for cooling in air and water for the following physical properties of the sphere.

$\rho = 3000\,Kg/m^3$, C = 1000 J/kg K, K = 20W/mK, $\alpha = 6.66 \times 10^{-6}$ m^2/Sec

Also calculate the surface temperature at the end of cooling in water. **(10 Marks)**

4 a. Explain briefly with sketch
i) Hydrodynamic boundary layer
ii) Thermal boundary layer **(06 Marks)**

b. Derive Reynolds – Colburn analogy relating the drug coefficient and Stanton number. **(06 Marks)**

c. A square plate 0.5m × 0.5m with one surface insulted and other surface maintained at a uniform temperature of $T_w = 385$ K which is placed in quiescent air at atmospheric pressure and $T_\infty = 315$K. Calculate the average heat transfer coefficient for free convection for the following orientation of the hot surface.
   i) The plate is horizontal and the hot surface faces up
   ii) The plate is horizontal, and the hot surface faces down

The physical properties of atmospheric air at $T_f = \frac{1}{2}(385 + 315) = 350$K are taken as

$\gamma = 2.076 \times 10^{-5}$ m^2/Sec, $P_r = 0.697$, K = 0.03 W/mK. **(08 Marks)**

PART – B

5 a. Explain the physical significance of
(i) Prandtl number (ii) Reynold number (iii) Nusselt number iv) Groshoff number. **(08 Marks)**

b. Air at 16°C and a pressure of 1 bar is flowing over a plate at a velocity of 3m/Sec. If the plate is 30cm wide and at 60°C, find the following quantities using exact method.
   i) Hydrodynamic and thermal boundary layer thickness at x = 30cm and at the distance corresponding to the transition point.
   ii) Average shear stress and total drag force upto first 30cm of the plate.
   iii) Total heat transfer in the laminar portion of the boundary layer properties of air at the bulk mean temperature 16 + 60/2 = 38°C are

$\rho = 1.1374$ Kg/m^3, $C_p = 1.005$ kJ/Kg K, K = 2.372×10^{-2} W/m K, $\gamma = 16.768 \times 10^{-6}$m^2/Sec. **(12 Marks)**

6 a. Obtain an expression for the effectiveness of a counter flow heat exchanger in terms of Number of Transfer units and heat capacity ratios (R). **(10 Marks)**

b. A heat exchanger has 17.5m^2 available for heat transfer. It is used for cooling oil at 200°C by using water available at 20°C. The mass flows rate and specific heat of oil are 10,000 kg/hr and 1.9 kJ/Kg K and mass flow rate and specific heat of water are 3000 kg/hr and 4.187 kJ/kg K. If the overall heat transfer coefficient is 300 W/m^2 K. Estimate the outlet temperatures of oil and water for parallel flow and counter flow arrangement by using NTU method. **(10 Marks)**

7 a. Clearly explain the regimes of pool boiling with a neat sketch. **(06 Marks)**

b. What do you understand by
   i) Mass transfer coefficient
   ii) Diffusion coefficient Give their units. **(04 Marks)**

c. Steam at 100°C is condensing on cylindrical drum having a diameter of 20cm and a temperature of 90°C. If the drum is vertical how long must it to be to condense 100kg of steam per hour. The properties of the condensing water at mean temperature are given as $\rho = 965.1$ kg/m^3, K = 0.673 W/mK, $\mu = 0.315 \times 10^{-3}$ kg/ms, $\gamma = 0.312 \times 10^{-6}$ m^2/Sec, $h_{fg} = 2270$ kJ/kg. **(10 Marks)**

8 a. Define solid angle and intensity of radiation. For a blacks body enclosed in a hemispherical space, prove that emissive power of the black body is π times the intensity of radiation. **(10 Marks)**

b. A spherical tank with diameter of 50cm is filled with a cryogenic fluid at 70K is placed inside a spherical container of diameter 75cm and is maintained at 300K. The emmissivities of inner and outer tanks are 0.1 and 0.2 respectively. Calculate the rate of evaporation of cryogenic fluid. Take $h_{fg} = 2.1 \times 10^5$ J/kg. **(10 Marks)**

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10ME64

Sixth Semester B.E. Degree Examination, June/July 2019
Finite Element Methods

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Derive the 3D equations of equilibrium in elasticity subjected to body force and traction force. **(08 Marks)**

b. What is FEM? Explain the basic steps involved in FEM. **(08 Marks)**

c. Explain node numbering scheme and its effect on the half band width. **(04 Marks)**

2 a. Determine the deflection of a cantilever beam of length 'L' and loaded with a vertical load 'P' at the free end by Rayleigh Ritz method use a trial function $Y = a\left(1 - \cos\frac{\pi x}{2h}\right)$. **(10 Marks)**

b. Use Galerkin's method and obtain an approximate solution of differential equation.

$$\frac{d^2y}{dx^2} - 10x^2 = 5, \qquad 0 \le x \le 1$$

with boundary conditions $y(0) = y$ and $y(1) = 0$. **(10 Marks)**

3 a. Derive shape function for 1D bar element in global co-ordinate system. **(08 Marks)**

b. Derive an expression for Jacobian matrix for a three noded CST element. **(08 Marks)**

c. Explain 2D - Pascal's triangle. **(04 Marks)**

4 Consider the thin plate shown in Fig.Q4. The plate has a uniform thickness t = 1 mm, Young's modulus E = 200 GPa and weight density $\rho = 76.6\times10^{-6}$ N/mm^3. In addition to its weight, the plate is subjected to a point load P = 100N at its mid point.

a. Model the plate with two finite elements.

b. Write down expressions for the elemental stiffness matrices and force vector.

c. Assemble the structural stiffness matrix 'K' and global load vector 'F'.

d. Using elimination approach, solve for the global displacement vector Q.

e. Evaluate the stress in each element.

f. Determine the reaction force at the support. **(20 Marks)**

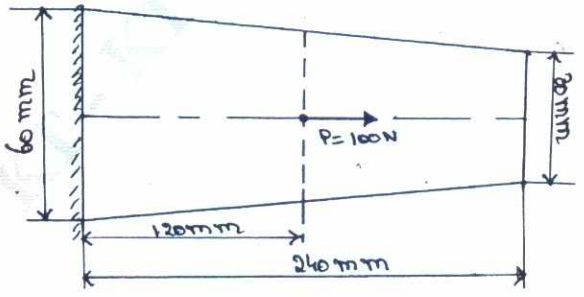

Fig.Q4

PART – B

5 a. With a neat sketch explain isoparametric, sub parametric and super parametric elements. **(06 Marks)**

b. Write a note on higher order elements used in FEM. **(06 Marks)**

c. Using two point Gaussian quadrature formula evaluate the following integral. **(08 Marks)**

$$I = \int_{-1}^{+1}\int_{-1}^{+1}(r^2 + 2rs + s^2)dr.ds$$

6 a. List the assumptions made in analysis of truss and also obtain an expression for stiffness matrix of a truss element. **(10 Marks)**

b. For the two bar truss shown in Fig.Q6(b), determine the nodal displacements and stress in each member. Take E = 200 GPa. **(10 Marks)**

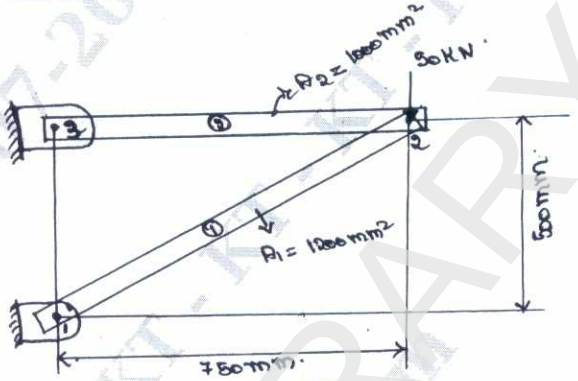

Fig.Q6(b)

7 a. Derive elemental stiffness matrix for a beam element in global coordinate system. **(10 Marks)**

b. Define Hermite shape function and derive the Hermite shape function for a beam element. **(10 Marks)**

8 a. For the brick wall shown in Fig.Q8(a), the inner surface temperature is 28°C and outer surface is exposed to cold air at –15°C. Determine the temperature distribution in steady state, within the wall by considering two elements, one dimensional heat flow elements. What is heat flux through the wall? **(10 Marks)**

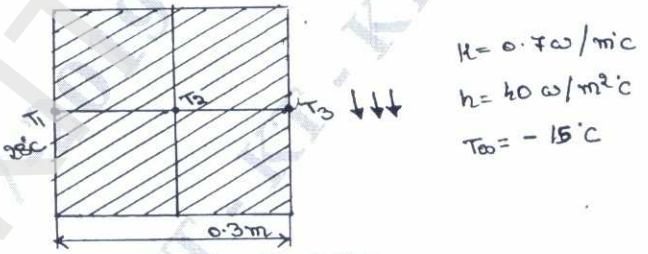

Fig.Q8(a)

b. For the beam element shown in Fig.Q8(b), determine deflection under the given load. Take $E = 2\times10^8$ kN/m² and $I = 4\times10^{-6}$ m⁴. **(10 Marks)**

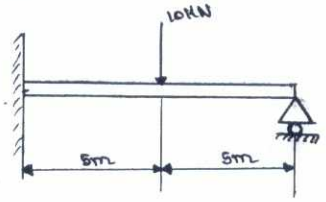

Fig.Q8(b)

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10ME65

Sixth Semester B.E. Degree Examination, June/July 2019
Mechatronics and Microprocessors

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. Classify the control systems of a mechatronic system and explain the components of each class. **(12 Marks)**

b. Define a measurement system. Name the components required to build a measurement system. With a block diagram, explain the working of a digital thermometer. **(08 Marks)**

2 a. With a neat diagram, explain the working of LVDT. **(08 Marks)**

b. Classify optical proximity sensors. With a neat diagram explain through beam proximity sensor. **(08 Marks)**

c. Differentiate between primary and secondary transducers giving any one example. **(04 Marks)**

3 a. With a neat diagram, explain the working of variable reluctance stepper motor. **(08 Marks)**

b. Classify and briefly explain non-permanent magnet type DC motors with equivalent diagrams. **(12 Marks)**

4 a. With a block diagram, explain the components of OPAMP. Write any two characteristic features of OPAMP. **(10 Marks)**

b. With neat figures explain pulse modulation. **(10 Marks)**

PART – B

5 a. Explain exclusive OR gate with a truth table and symbol. How can this logic gate be used for binary addition? **(08 Marks)**

b. Mention any five functions of micro processor. Explain the organization of microprocessor to meet these functions. **(08 Marks)**

c. Logic circuit is displayed in Fig.Q.5(c). Obtain the expression for Y interms of ABCD **(04 Marks)**

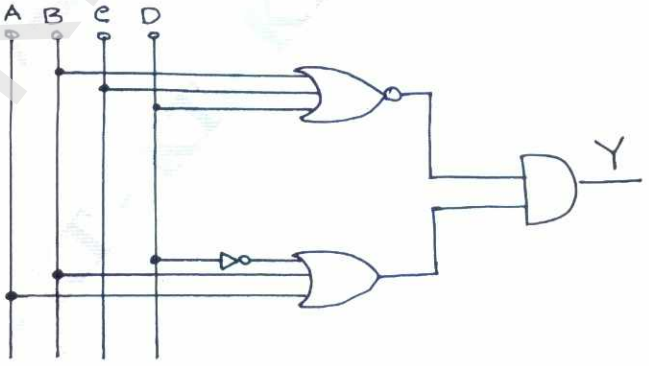

Fig.Q.5(c)

6 a. Explain the stages of instruction cycle carried out by the CPU. Use necessary flow-diagram. **(10 Marks)**

b. Draw the block diagram of microcontroller and tabulate the differences between a micro controller and micro processor. **(10 Marks)**

7 a. Discuss on any four registers used in 8085 microprocessor with a block diagram. **(10 Marks)**

b. Draw the pin configuration of Intel 8085. Discuss on pins 12 to 29. **(10 Marks)**

8 a. With block diagrams, explain instruction and data flow in the CPU. **(10 Marks)**

b. Discuss with necessary figures on:

i) Accumulator **(04 Marks)**

ii) System clock **(04 Marks)**

iii) System timing **(02 Marks)**

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