USN | | | | | | | | | | |

10ME61

Sixth Semester B.E. Degree Examination, June/July 2014

Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define automation. Explain different types of automation system with examples. **(10 Marks)**

b. Explain the terms: i) Utilization; ii) Manufacturing lead time **(04 Marks)**

c. The average part produced in a certain batch manufacturing plant must be processed through an average of 6 machines. There are 20 new batches parts launched each week. Data for the average problem are as follows:

Average operation time = 6 min
Average setup time = 5 hours
Average non-operation time = 10 hours
Average batch size = 25 parts

There are 18 machines in the plant. The plant operates an average of 70 hours/week. Determine: i) Manufacturing lead time, ii) Plant capacity, iii) Plant utilization. **(06 Marks)**

2 a. What are the symbols used in an automated flow line? **(05 Marks)**

b. Sketch and explain the following work part transfer mechanism:

i) Linear walking beam
ii) Geneva wheel
iii) Dial indexing machine **(15 Marks)**

3 a. In a eleven (11) station transverse line the probability of station breakdowns will occur for a given work part is equal to 0.02. This probability is same for all the 11 stations. Determine the frequency line stop/cycle on this flow line using upper bound approach and lower bound approach with an average production time = 1.6 min. Determine production rate. **(10 Marks)**

b. What is the purpose of buffer storage? State its effectiveness in automated flow line. **(06 Marks)**

c. Write a short note on partial automation. **(04 Marks)**

4 a. A project has the following tasks. Its immediate predecessor and the task times are given below. Using largest candidate rule balance the line and determine:

i) Number of work stations ii) Balance delay of line iii) Line efficiency.

Take T_c = 1 min.

Tasks	1	2	3	4	5	6	7	8	9	10	11	12
Preceded by	-	-	1	1, 2	2	3	3	3, 4	6, 7, 8	5, 8	9, 10	11
T_e (min)	0.2	0.4	0.7	0.1	0.3	0.11	0.32	0.6	0.27	0.38	0.5	0.12

(12 Marks)

b. Explain the following terms in line balancing;

i) Minimum rotational work element.
ii) Total work content time
iii) Cycle time
iv) Line efficiency. **(08 Marks)**

PART – B

5 a. Explain the design for automated assembly system. **(07 Marks)**

b. Explain with a neat sketch the elements of part feeding device. **(08 Marks)**

c. List the applications of AGVs. **(05 Marks)**

6 a. With a neat sketch explain retrieval 'CAPP' system. **(10 Marks)**

b. What is a material requirement planning? Explain various inputs and outputs to MRP system. **(10 Marks)**

7 a. Describe the advantages, disadvantages and applications of CNC machine tools. **(10 Marks)**

b. Explain the fundamental steps involved in development of part programming for milling and turning. **(10 Marks)**

8 a. Explain with sketches the common robot configuration. **(10 Marks)**

b. Explain the following:

i) Work volume

ii) Precision of movement

iii) End effectors in robots

iv) Repeatability **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10ME62

Sixth Semester B.E. Degree Examination, June / July 2014
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Design data handbook is permitted.***

PART – A

1 a. Determine the maximum tensile stress and maximum shear stress of the component shown in Fig. Q1(a) and indicate the location. **(10 Marks)**

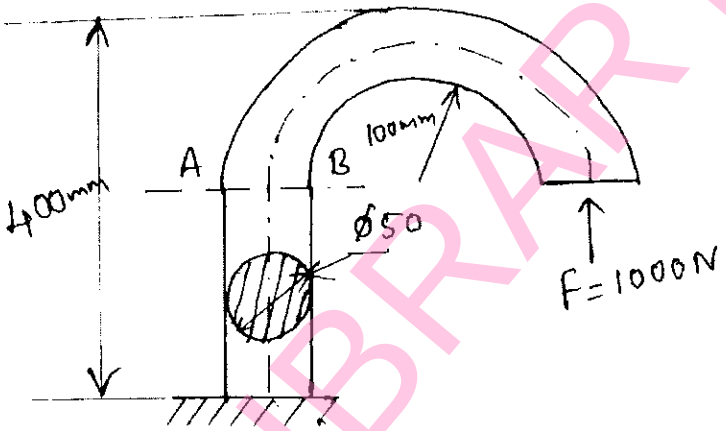


Fig. Q1 (a)

b. A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm^2. Calculate the tangential and radial stresses at the inner, middle and outer surface. **(10 Marks)**

2 a. A compressor is driven by a motor of 2.5 kW, running at 1200 rpm to a 400 rpm compressor. Select a suitable V-belt. **(10 Marks)**

b. Explain Hoisting tackle mechanism to raise and lowering load for a rope. **(10 Marks)**

3 a. Derive an expression for the stres induced in a helical spring with usual notations. **(10 Marks)**

b. Design a leaf spring for the following specification for a truck total load = 120 KN, number of springs = 4, material for the spring is chrome-vanadium steel permissible stress in 0.55 GPa. Span of spring = 1100 mm, width of central band = 100 mm and allowable deflection = 80 mm, number of full length leaves are 2 and graduated leaves 6. **(10 Marks)**

4 Design a pair of spur gear to transmit a power of 18 kW from a shaft running at 1000 rpm to a parallel shaft to be run at 250 rpm maintaining a distance of 160 mm between the shaft centres. Suggest suitable surface hardness for the gear pair. **(20 Marks)**

PART – B

5 A pair of bevel gear wheels with 20° pressure angle consists of 20 teeth pinion meshing with 30 teeth gear. The modulus is 4 mm while is 20 mm. The surface hardness of both pinion and gear is 400 BHN. The pinion rotates at 500 rpm and receives power from an electric motor. The starting torque of the motor is 150 percent of the rated torque. Determine the safe power that can be transmitted considering the dynamic load wear strength and endurance strength. The allowable bending stress may be taken as 240 MPa. **(20 Marks)**

6 a. A plate clutch with a maximum diameter of 600 mm has maximum lining pressure of 0.35 MPa. The power to be transmitted at 400 rpm is 135 kW and μ= 0.3. Find inside diameter and spring force required to engage the clutch, if the spring with spring index 6 and material of spring the wire diameter if 6 springs are used. **(10 Marks)**

b. The torque absorbed in the band break shown in Fig. Q6 (b) is 400×10^3 Nmm. Design the band and lever taking μ = 0.27 and diameter of drum as 400 mm. The allowable stress in band may be taken as 70 N/mm^2. **(10 Marks)**

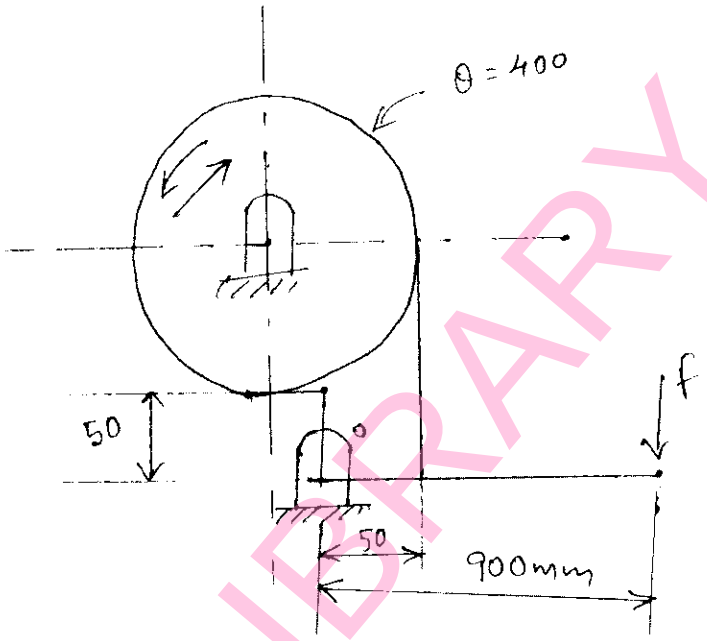


Fig. Q6 (b)

7 a. Derive Petroff's equation for co-efficient of friction in journal bearings. **(08 Marks)**

b. Design the main bearing of a steam turbine that runs at 1800 rpm and 70°C . The load on the bearing is estimated to be 2500 N. **(12 Marks)**

8 Design a cast iron piston for a single acting four stroke diesel engine from the following data:
Cylinder bore = 100 mm
Length of stroke = 125 mm
Speed = 2000 rpm
Brake mean effective pressure = 0.5 MPa,
Maximum gas pressure = 5 MPa,
Fuel consumption = 0.25 kg/ Brake Power in kW/hour
Assume any further data required for the design. **(20 Marks)**

* * * * *

USN | | | | | | | | | | |

10ME63

Sixth Semester B.E. Degree Examination, June/July 2014
Heat and Mass Transfer

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of heat and mass transfer data handbook is permitted.***

PART – A

1 a. What is thermal diffusivity? Explain its importance in heat conduction problems. **(04 Marks)**

b. Describe different types of boundary conditions applied to heat conduction problems. **(04 Marks)**

c. Consider a one dimensional steady state heat conduction in a plate with constant thermal conductivity in a region $0 \le x \le L$. A plate is exposed to uniform heat flux q W/m^2 at x = 0 and dissipates heat by convection at x = L with heat transfer coefficient h in the surrounding air at T_∞. Write the mathematical formulation of this problem for the determination of one dimensional steady state temperature distribution within the wall. **(04 Marks)**

d. An industrial freezer is designed to operate with an internal air temperature of -20°C when the external air temperature is 25°C and the internal and external heat transfer coefficients are 12 W/m^2°C and 8 W/m^2°C, respectively. The wall of the freezer are composite construction, comprising of an inner layer of plastic 3 mm thick with thermal conductivity of 1 W/m°C. An outer layer of stainless steel of thickness 1 mm and thermal conductivity of 16W/m°C. Sandwiched between these layers is a layer of insulation material with thermal conductivity of 0.07 W/m°C. Find the width of the insulation required to reduce the convective heat loss to 15 W/m^2. **(08 Marks)**

2 a. What is critical thickness of insulation on a small diameter wire or pipe? Explain its physical significance and derive an expression for the same. **(10 Marks)**

b. A set of aluminium fins (K = 180 W/mK) that are to be fitted to a small air compressor. The device dissipates 1 KW by convecting to the surrounding air which is at 20°C. Each fin is 100 mm long, 30 mm high and 5 mm thick. The tip of each fin may be assumed to be adiabatic and a heat transfer coefficient of 15 W/m^2K acts over the remaining surfaces. Estimate the number of fins required to ensure the base temperature does not exceed 120°C. **(10 Marks)**

3 a. What are Biot and Fourier numbers? Explain their physical significance. **(06 Marks)**

b. What are Heisler charts? Explain their significance in solving transient convection problems. **(06 Marks)**

c. The temperature of a gas stream is measured with a thermocouple. The junction may be approximated as a sphere of diameter 1 mm, K = 25 W/m°C, ρ = 8400 kg/m^3 and C = 0.4 kJ/kg°C. The heat transfer coefficient between the junction and the gas stream is h = 560 W/m^2°C. How long will it take for the thermocouple to record 99% of the applied temperature difference? **(08 Marks)**

4 a. Establish a relation between Nusselt, Prandtl and Grashof numbers using dimensional analysis. **(08 Marks)**

b. Explain velocity and thermal boundary layers. **(06 Marks)**

c. A 30 cm long glass plate is hung vertically in the air at 27°C while its temperature is maintained at 77°C. Calculate the boundary layer thickness at the trailing edge of the plate. Take properties of air at mean temperature K = 28.15×10^{-3} W/mK, $\gamma = 18.41 \times 10^{-6}$ m^2/s, $P_r = 0.7$, $\beta = 3.07 \times 10^{-3}$ K^{-1}. **(06 Marks)**

PART – B

5 a. Explain the significance of: i) Reynolds number, ii) Prandtl number, iii) Nusselt number, iv) Stanton number. **(08 Marks)**

b. Atmospheric air at 275 K and free stream velocity 20 m/s flows over a flat plate of length 1.5 m long maintained at 325 K. Calculate:

i) The average heat transfer coefficient over the region where the boundary layer is laminar.

ii) Find the average heat transfer over the entire length 1.5 m of the plate.

iii) Calculate the total heat transfer rate from the plate to the air over the length of 1.5 m and width 1 m. assume transition occurs at a Reynolds number 2×10^5. Take air Properties at mean temperature of 300 K.

K = 0.026 W/m°C, $P_r = 0.708$, $\gamma = 16.8 \times 10^{-6}$ m^2/s, $\mu = 1.98 \times 10^{-5}$ kg/m-s. **(12 Marks)**

6 a. Derive an expression for the effectiveness of a parallel flow heat exchanger. **(10 Marks)**

b. Engine oil is to be cooled from 80°C to 50°C by using a single pass counter flow, concentric-tube heat exchanger with cooling water available at 20°C. Water flows inside a tube with an internal dia of 2.5 cm with a flow rate of 0.08 kg/s and oil flows through the annulus at a rate of 0.16 kg/s. The heat transfer coefficient for the water side and oil side are respectively 1000 W/m^2°C and 80 W/m^2°C. The fouling factors are 0.00018 m^2°C/W and 0.00018 m^2°C/W, the tube wall resistance is negligible. Calculate the tube length required. Take specific heat of water as 4180 J/kg°C and for oil, 2090 J/kg°C. **(10 Marks)**

7 a. Explain film wise and drop wise condensation. **(04 Marks)**

b. Draw the boiling curve and discuss the different regimes of boiling. **(08 Marks)**

c. Derive an expression for the total mass of water vapour diffused from a water column to the air passing over the water container. **(08 Marks)**

8 a. Explain briefly the concept of a black body. **(04 Marks)**

b. State: (i) Kirchoff's law, ii) Plank's law, iii) Wien's displacement law. **(06 Marks)**

c. Calculate the net radiant heat exchange per m^2 area for two large parallel plates at temperature of 427°C and 27°C respectively ϵ for hot plates is 0.9 and for cold plate it is 0.6. If polished aluminum shield is placed between them, find percentage reduction in the heat transfer. Assume ϵ for shield = 0.4. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10ME64

Sixth Semester B.E. Degree Examination, June/July 2014
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. What is FEM? Sketch the different types of elements used based on geometry in finite element analysis. (1D, 2D and 3D). **(04 Marks)**

b. Explain with a sketch plane stress and plane strain. **(06 Marks)**

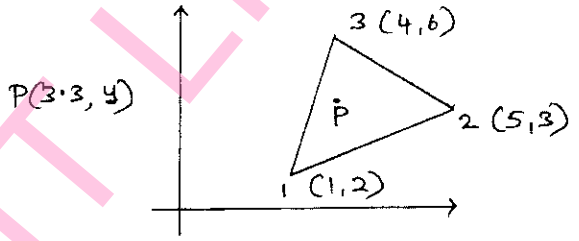
c. Derive the equilibrium equation in elasticity subjected to body force and traction force. **(10 Marks)**

2 a. A cantilever beam of span 'L' is subjected to a point load at free end. Derive an equation for the deflection at free end by using RR method. Assume polynomial displacement function. **(10 Marks)**

b. Write the properties of stiffness matrix and derive the element stiffness matrix (ESM) for a 1D bar element. **(10 Marks)**

3 a. A modal co-ordinate of the triangular element is shown in Fig.Q.3(a). At the interior point 'P' the co-ordinate is 3.3 and $N_1 = 0.3$. Determine 'N_2' and 'N_3' and the y co-ordinate at point P. **(05 Marks)**

Fig.Q.3(a)



b. What is convergence requirement? Discuss the 3 conditions of convergence requirement. **(05 Marks)**

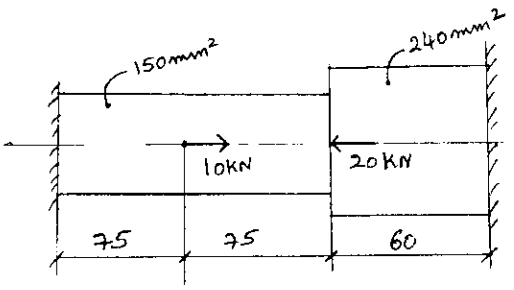
c. Derive the shape function of a 4 noded quadrilateral element. **(10 Marks)**

4 a. Consider the bar shown in Fig.Q.4(a). Using elimination method of handling boundary conditions. Determine the following:

i) Nodal displacements.
ii) Stress in each element.
iii) Reaction forces.

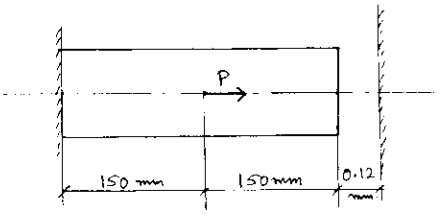
Take E = 200GPa. **(10 Marks)**

Fig.Q.4(a)



b. Consider the bar shown in Fig.Q.4(b). An axial load P = 60×10^3N is applied at its midpoint. Using penalty method of handling boundary condition. Determine: i) Nodal displacements; ii) Stress in each element; iii) Reaction at supports. Take A = 250mm^2; E = 200GPa. **(10 Marks)**

Fig.Q.4(b)



PART – B

5 a. Derive the shape function for a quadratic bar element using Lagrange's interpolation. **(05 Marks)**

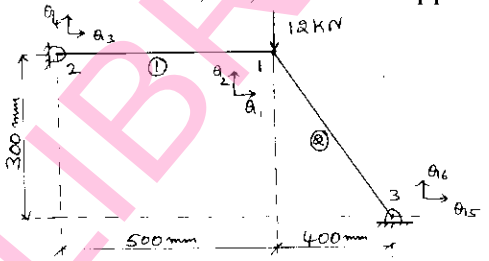
b. Evaluate $I = \int_{-1}^{+1} \left(3e^{\xi} + \xi^2 + \frac{1}{\xi + 2} \right) d\xi$ using 1P and 2P Gaussian quadrature. **(06 Marks)**

c. Derive Lagrange quadratic quadrilateral element (9 noded quadrilateral element). **(09 Marks)**

6 a. List out the assumptions made in the derivation of a truss element. **(04 Marks)**

b. For the truss shown in Fig.Q.6(b), determine:
i) Nodal displacement; ii) Stress in each element; iii) Reaction supports.

Fig.Q.6(b)

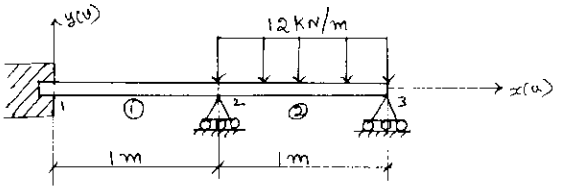


A = 200mm^2; E = 70GPa. **(16 Marks)**

7 a. Derive the Hermite shape function for a beam element. **(08 Marks)**

b. For the beam and loading shown in Fig.Q.7(b). Determine:
i) Slopes at 2 and 3; ii) Vertical deflection at the midpoint of the load.
Take E = 200 GPa; I = 4×10^6mm^4. **(12 Marks)**

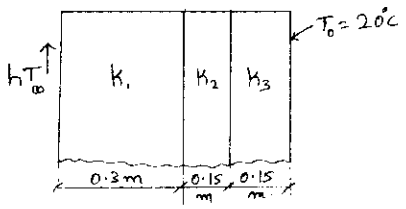
Fig.Q.7(b)



8 a. Bring out the differences between continuum methods and FEM. **(06 Marks)**

b. Solve the temperature distribution in the composite wall using 1D heat elements, use penalty approach of handling boundary conditions. (Fig.Q.8(b)). **(14 Marks)**
K_1 = 20W/m°C; K_2 = 30W/m°C; K_3 = 50 W/m°C; h = 25 W/m^2°C; T_∞ = 800°C

Fig.Q.8(b)



* * * * *

USN | | | | | | | | | | |

10ME65

Sixth Semester B.E. Degree Examination, June / July 2014
Mechatronics & Microprocessor

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Discuss a measurement system and its constituent elements. **(08 Marks)**
b. Explain 'programmable logic controller'. **(04 Marks)**
c. Illustrate the basic elements of a microprocessor based engine management system. **(08 Marks)**

2 Illustrate the following proximity sensors:
a. Capacitive type. **(10 Marks)**
b. Pneumatic type. **(10 Marks)**

3 a. Discuss the construction and operation of permanent magnet DC motor. **(08 Marks)**
b. Illustrate any two types of DC motor configurations. **(08 Marks)**
c. Illustrate the construction and working of an electrical relay. **(04 Marks)**

4 a. Discuss the inverting and non inverting configurations of OPAMPS. **(08 Marks)**
b. Illustrate how OPAMPS can be realized for an adding operation. **(05 Marks)**
c. Illustrate a DAQ system. **(07 Marks)**

PART – B

5 a. Present the Boolean expressions, symbols and truth tables for 3 input NAND gate and 3 input NOR gate. **(10 Marks)**
b. Write the Boolean algebra expressions for the following:
i) Commutative law. ii) Associative law. iii) Distributive law. **(06 Marks)**
c. For the circuit shown in Fig. Q5 (c), obtain the expression for Y in terms of X_0, X_1, A and B inputs. **(04 Marks)**

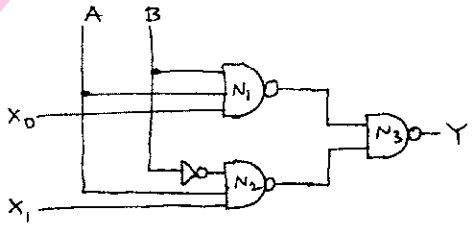


Fig. Q5 (c)

6 Discuss the following with respect to internal architecture of a microprocessor:
a. A typical memory device. **(10 Marks)**
b. Instruction register. **(10 Marks)**

7 a. Discuss the term 'BUS' with reference to the architecture of a microprocessor. **(10 Marks)**
b. Discuss the different addressing modes used in microprocessors with an example for each. **(10 Marks)**

8 a. Explain fetch, execute and instruction cycles with a diagram. **(06 Marks)**
b. Illustrate the data flow from memory to the data register. **(08 Marks)**
c. Illustrate the terms machine cycle and state, associated with microprocessors. **(06 Marks)**

* * * * *