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10ME61

Sixth Semester B.E. Degree Examination, June/July 2017
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define automation and CIM with the aid of conceptual model of manufacturing. **(06 Marks)**

b. Briefly explain the various "Automation Strategies" that can be adopted to improve the productivity. **(10 Marks)**

c. Define the term plant capacity with a mathematical relation. **(04 Marks)**

2 a. The average part produced in a certain batch manufacturing plant must be processed through an average of 8 machines. 20 new batches are launched each week. Operating time is 8 min, average setup time is 8 hrs, batch size is 30 units, average non-operation time is 15 hr/machine. Number of machines available in the plant is 20. The plant operates on an average of 80 production hrs/week. Determine
(i) MLT (ii) R_P (iii) PC (iv) U (v) WIP (vi) WIP ratio (vii) TIP ratio. **(10 Marks)**

b. Illustrate the configuration of an automated flow line. **(04 Marks)**

c. With the aid of sketches, explain any two rotary transfer mechanisms. **(06 Marks)**

3 a. Analyze the flow line performance by means of three basic measures. **(06 Marks)**

b. Explain the limits of storage buffer effectiveness. **(04 Marks)**

c. A 20 station line is divided into 2 stages of 10 stations each. The ideal cycle time of each stage is 1.2 min. All the stations in the line have the same probability of stoppage equal to 0.005. When breakdown occurs, it takes an average of 8 min, using the upper bound approach, compute the flow line efficiency for the following buffer capacity
(i) b = 0, (ii) b = ∞, (iii) b = 10, (iv) b = 100. **(10 Marks)**

4 a. Write a note on: (i) Precedence diagram (ii) Minimum rational work element. **(04 Marks)**

b. Explain Kilbridge and Wester's method. **(06 Marks)**

c. The precedence relationships and element time for a new model toy are as follows:

Element	T_e min	Immediate precedence
1	0.5	-
2	0.3	1
3	0.8	1
4	0.2	2
5	0.1	2
6	0.6	3
7	0.4	4, 5
8	0.5	3, 5
9	0.3	7, 8
10	0.6	6, 9

Using largest candidate rule method, compute (i) Number of stations required (ii) Balance delay, if the ideal cycle time is 1.0 minute. **(10 Marks)**

PART – B

5 a. Indicate the classification of an automated assembly system. **(04 Marks)**

b. Illustrate the elements of part delivery system at an assembly station. **(08 Marks)**

c. List the types of AGV's and write a note on vehicle guidance technology adopted to AGV's. **(08 Marks)**

6 a. Indicate the benefits of CAPP and explain retrieval type CAPP. **(12 Marks)**

b. What are the inputs required for carrying out an efficient MRP? Explain. **(08 Marks)**

7 a. What are NC words? Explain. **(08 Marks)**

b. Differentiate between absolute and incremental coordinate system. **(04 Marks)**

c. Write a manual part program to drill 5 holes of ϕ15 mm for the shown part in Fig.Q7(c). The plate size is 100×100×20 mm. Assume suitable data. **(08 Marks)**

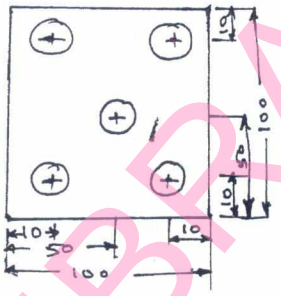

Fig.Q7(c)

8 a. With suitable sketches explain the different robot physical configurations. **(08 Marks)**

b. Explain the following :

(i) Robot anatomy

(ii) Precision of movement

(iii) Programming of robot. **(12 Marks)**

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10ME62

Sixth Semester B.E. Degree Examination, June/July 2017
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. Design data handbook is permitted.
3. Missing data, if any, may be suitably assumed.

PART – A

1 a. Give the differences between a straight and curved beam. **(04 Marks)**

b. Compute the combined stresses at the inner and outer fibres in the critical cross section of a crane hook which is required to lift load upto 25 kN. The hook has trapezoidal cross section with parallel sides 60mm and 30mm, the distance between them being 90mm. The inner radius of the hook is 100mm. The load line is nearer to the inner surface of the hook by 25mm than the centre of curvature at the critical section. What will be the stresses at inner and outer fibre, if the beam is treated as straight beam for the given load? **(16 Marks)**

2 a. Two shafts 1meter apart are connected by a v-belt to transmit 90 KW at 1200 rpm of a driver pulley of 300mm effective diameter. The driven pulley rotates at 400 rpm. The angle of groove is 40° and the coefficient of friction between the belt and the pulley rim 0.25. The area of the belt section is 400mm^2 and the permissible stress is 2.1 MPa. Density of the belt material is 1100 kg/m^3. Calculate the number of belts required and the length of the belt. **(10 Marks)**

b. Select a wire rope for a vertical mine hoist to lift a load of 55kN from a depth of 300 meters. A rope speed of 500m/min is to be attained in 10 seconds. **(10 Marks)**

3 a. Design a helical spring used in a recoil system so as to absorb 120 Nm of energy with a maximum force of 3000N. Assume spring index 8 and factor of safety is 2. **(10 Marks)**

b. A multi leaf spring with camber is fitted to the chassis of an automobile over a span of 1.2m to absorb shocks due to a max load of 20 kN. The spring material can sustain a max. Stress of 0.4 GPa. All the leaves of the spring were to receive the same stress. The spring is required at least 2 full length leaves out of 8 leaves. The leaves were assembled with bolts over a span of 150mm width at the middle. Design the spring for a max. deflection of 50mm. **(10 Marks)**

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

PART – B

5 Design a pair of bevel gears to transmit a power of 25 kW from a shaft rotating at 1200 rpm to a perpendicular shaft to be rotated at 400rpm. **(20 Marks)**

6 a. Determine the dimensions of a simple cone clutch to transmit 20 KW at 1000 rpm. The minimum diameter is to be 300mm and the cone angle 20°. Assume $\mu = 0.2$ and permissible pressure = 0.1 N/mm^2. Also determine the axial force required to engage the clutch. **(10 Marks)**

b. A simple band broke of drum diameter 600mm has a band passing over it with an angle of contact of 225°, while one end is connected to the fulcrum, the other end is connected to the brake lever at a distance of 400mm from the fulcrum. The brake lever is 1 m long. The brake is to absorb a power of 15 KW at 720rpm. Design the brake lever of rectangular cross-section, assuming depth to the thrice the width. Take allowable stress 80 MPa. **(10 Marks)**

7 a. Derive Petroff's equation for co-efficient of friction for hydro dynamic bearing. **(08 Marks)**

b. Design a journal bearing for a centrifugal pump running at 1200rpm. Diameter of journal is 100mm and load on bearing is 15 kN. Take L/d = 1.5, bearing temperature 50°C and ambient temperature 30°C. Find whether artificial cooling is required. **(12 Marks)**

8 Design a suitable aluminium alloy piston with two compression rings and one oil ring for a petrol engine of following particular :

Cylinder diameter	= 0.10m
Peak gas pressure	= 3.2MPa
Mean effective pressure	= 0.8 MPa
Average side thrust	= 2400N
Skirt bearing pressure	= 0.22MPa
Bending stress in piston crown	= 36MPa
Crown temperature difference	= 70°C
Heat dissipated through crown	= 157 kJ/m^2 s
Allowable radial pressure	= 0.04MPa
Binding piston in rings	= 90MPa
Heat conductivity K	= 160 W/m/°C

Assume any further data required for the design. **(20 Marks)**

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10ME63

Sixth Semester B.E. Degree Examination, June/July 2017
Heat & 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 transfer data hand book is permitted.***

PART – A

1 a. Explain the three types of boundary conditions used in conduction heat transfer. **(06 Marks)**

b. Derive general three dimensional conduction equation in Cartesian co-ordinate. **(08 Marks)**

c. A furnace wall is made up of three layers of thickness 250 mm, 100 mm and 150 mm with thermal conductivities of 1.65 K and 9.2 W/m°C respectively. The inside is exposed to gases at 1250°C with a convection co-efficient of 25 W/m²°C and the inside surface is at 1100°C, the outside surface is exposed to air at 25°C with convection co-efficient of 12 W/m²°C. Determine

(i) The unknown thermal conductivity K

(ii) The overall heat transfer co-efficient. **(06 Marks)**

2 a. Define critical thickness of insulation and explain its significance. **(04 Marks)**

b. Obtain an expression for temperature distribution and heat flow through a rectangular fin, when the end of the fin is insulated. **(08 Marks)**

c. A steel rod (K = 30 W/mK) 1 cms diameter and 5 cms long with insulation end is to be used as a spine. It is exposed to the surrounding temperature of 65°C and heat transfer co-efficient of 50 W/m²K. The temperature of the base is 98°C. Determine (i) Fin efficiency (ii) Temperature at the end of spine (iii) Heat dissipation from spine. **(08 Marks)**

3 a. Explain the physical significance of Biot number and Fourier number. **(04 Marks)**

b. Derive an expression for temperature distribution in a lumped system. **(08 Marks)**

c. A steel ball 5 cms diameter and initially at 900°C is placed in still air at 30°C. Find

(i) Temperature of the ball after 30 seconds.

(ii) The rate of cooling in (°C/min) after 30 seconds.

Assume h = 20 W/m²°C

K(steel) = 40 W/m°C

ρ(steel) = 7800 kg/m³

C_p(steel) = 460 J/kg°C **(08 Marks)**

4 a. Explain briefly with sketches:

(i) Boundary layer thickness (ii) Thermal boundary layer thickness **(08 Marks)**

b. Explain the significance of Grashoff number. **(02 Marks)**

c. The water in a tank at 20°C is heated by passing the steam through a pipe of 50 cms long and 5 cms dia. If the pipe surface temperature is maintained at 80°C (i) find the heat loss from the pipe per hour if the pipe is kept horizontal (ii) If the pipe is kept vertical, then also find out the heat loss from the pipe per hour. **(10 Marks)**

PART – B

5 a. Obtain an empirical expression in terms of dimensionless numbers for heat transfer co-efficient in the case of forced convection heat transfer. **(08 Marks)**

b. Explain the significance of Nusselt number. **(02 Marks)**

c. A tube 5 m long is maintained at 100°C by steam jacketing. A fluid flows through the tube at the rate of 175 kg/hr at 30°C. The dia of the tube is 2 cms. Find out the average heat transfer co-efficient.

Take the following properties of the fluid :

$\rho = 850\ kg/m^3$

$C_p = 2000\ J/kg^\circ C$

$\gamma = 5.1\times10^{-6}\ m^2/S$

$K = 0.2\ W/m^\circ C$ **(10 Marks)**

6 a. Obtain an expression for the effectiveness of parallel flow heat exchanger by NTu method. **(10 Marks)**

b. The velocity of water flowing through a tube of 2.2 cms dia is 2 m/s. Steam condensity at 150°C on the outside surface of the tube heats the water from 15°C to 60°C over the length of the tube. Find the heat transfer co-efficient and the length of the tube neglecting the tube and steam side film resistance. Take the following properties of water at mean temperature $\rho = 990\ kg/m^3$; $K = 0.5418\ W/m^\circ C$; $C_p = 4.2\ kJ/kg^\circ C$; $\mu = 700\times10^{-6}\ kg/m.S$ **(10 Marks)**

7 a. State and explain the Fick's law of diffusion. **(04 Marks)**

b. Distinguish between the nucleate boiling and film boiling. **(06 Marks)**

c. Steam at 0.065 bar condenses on a vertical plate of 0.6 m square. If the surface temperature of the plate is maintained at 15°C, estimate the rate of condensation, $T_S = 37.7^\circ C$,

hfg (at 0.065 bar) $= 2412\times10^3\ J/kg$

The properties of water at mean temperature 26.4°C are listed below.

$\rho = 1000\ kg/m^3$;

$K = 0.913\ W/mK$;

$\mu = 864\times10^{-6}\ kg/m.S$ **(10 Marks)**

8 a. State and prove the Kirchoff's law of radiation. **(06 Marks)**

b. Explain the following terms:

(i) Black body and gray body.

(ii) Radiosity and irradiation **(04 Marks)**

c. The concentric spheres 20 cms and 30 cms in diameter are used to store liquid O_2 (-153°C) in a room at 300 K. The space between the spheres is evacuated. The surfaces of the spheres are highly polished as $\epsilon = 0.04$. Find the rate of evaporation of liquid air per hour. **(10 Marks)**

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10ME64

Sixth Semester B.E. Degree Examination, June/July 2017
Finite Element Methods

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Missing data may suitably be assumed.***

PART – A

1 a. Explain with neat sketch, plain stress and plain strain. **(06 Marks)**

b. Sketch the different types of 1D, 2D and 3D elements used in the finite element analysis. **(06 Marks)**

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

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

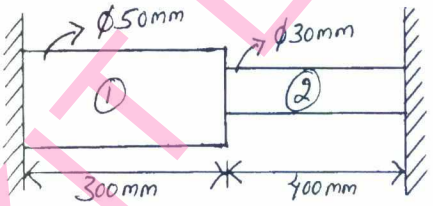
b. A cantilever beam of span 'L' is subjected to a point at free end. Derive an equation for the deflection at free end by using Rayleigh Ritz method. Assume polynomial displacement function. **(10 Marks)**

3 a. Define interpolation polynomial, simplex, complex and multiplex element. **(04 Marks)**

b. Explain two Dimensional Pascal's triangle. **(06 Marks)**

c. Derive the shape function for C.S.T element. **(10 Marks)**

4 a. Determine the nodal displacements, elemental stresses and support reactions for the Fig Q4(a). Use elimination approach to handle the Boundary conditions. **(10 Marks)**

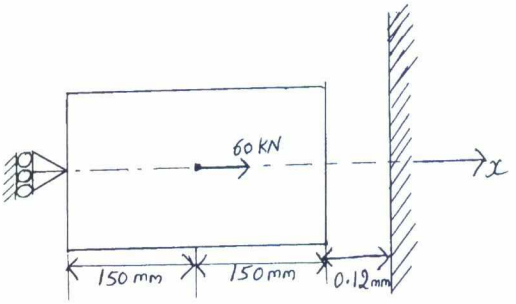


(1) Aluminium, $E_1 = 0.7 \times 10^5$ MPa

(2) Steel, $E_2 = 2 \times 10^5$ MPa

Fig Q4(a)

b. Consider the bar shown Fig Q4 (b). An axial load P = 60 × 10^3N is applied at its mid point. Using penalty method of handling Boundary conditions. Determine the nodal displacement and support reactions. **(10 Marks)**



A = 250mm^2

B = 200 GPa

Fig Q4(b)

PART – B

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

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

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

6 a. Derive the expression for stiffness matrix of a truss element. **(08 Marks)**

b. Find the nodal displacement, stress and reaction of truss element shown in the Fig Q6(b). Take A = 200mm^2, E = 70GPa. **(12 Marks)**

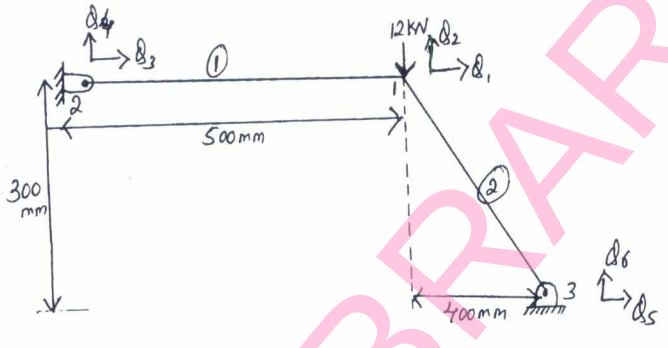


Fig Q6(b)

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

b. For the beam and loading shown in the Fig Q7(b). Determine the end reaction and deflection at midspan. Take E = 200 GPa, I = 4 × 10^6 mm^4. **(12 Marks)**

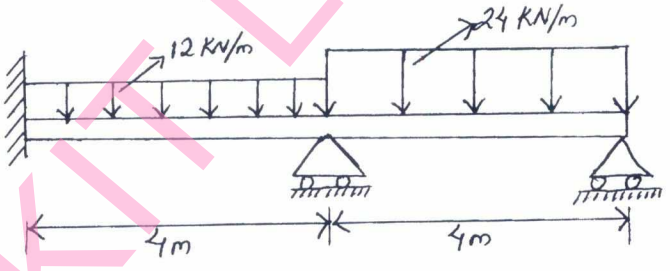
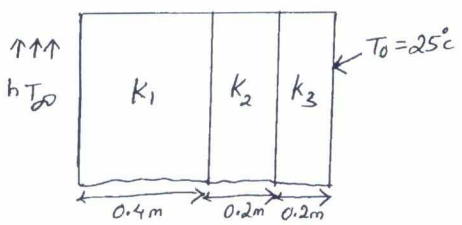


Fig Q7(b)

8 a. Discuss the derivation of one dimensional heat transfer in thin fins. **(08 Marks)**

b. Determine the temperature distribution in the composite wall using 1D heat elements, use penalty approach of handling boundary conditions (Fig Q8(b). **(12 Marks)**



K_1 = 25 W/m °C
K_2 = 35 W/m °C
K_3 = 55 W/m °C
h = 30 W/m^2 °C
T_∞ = 900°C
A = Unit area

Fig Q8(b)

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10ME65

Sixth Semester B.E. Degree Examination, June/July 2017
Mechatronics & Microprocessor

Time: 3 hrs. Max. Marks:100

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

PART – A

1 Discuss any four of the following with neat sketch and an example:
(i) Mechatronics (ii) Open loop control system.
(iii) Closed loop control system (iv) Measurement system.
(v) Transducers. **(20 Marks)**

2 a. Define the following transducers with examples:
(i) Analog transducer. (ii) Digital transducer.
(iii) Active transducer. (iv) Passive transducer.
(v) Mechanical transducer. **(10 Marks)**

b. Explain with a neat diagram, (i) Capacitive proximity sensor.
(ii) Principle of Hall effect. **(10 Marks)**

3 a. What are solid state switches? Discuss any four solid state switches. **(10 Marks)**

b. Explain the working principle of,
(i) Permanent magnet DC motor. (ii) Permanent magnet stepper motor. **(10 Marks)**

4 a. Illustrate how OPAMPS can be realized for,
(i) Integrating amplifier circuit. (ii) Differential amplifier circuit. **(10 Marks)**

b. Define signal processing. Explain with neat diagram Analog Signal processing and Digital signal processing. **(10 Marks)**

PART – B

5 a. State De Morgan's theorem. Draw logic circuits and truth tables. **(06 Marks)**

b. Convert the following:
(i) Decimal number 35 to binary equivalent.
(ii) Binary 1100101 to decimal No.
(iii) Binary real number 1101.11 to decimal real number **(06 Marks)**

c. With help of symbols and truth table, explain,
(i) AND gate (ii) OR gate. (iii) NOT gate. (iv) NAND gate. **(08 Marks)**

6 a. Explain with a neat sketch of architecture 8085A microprocessor. **(12 Marks)**

b. With circuit diagram explain, (i) RAM (ii) ROM **(08 Marks)**

7 a. Write the functional block diagram of INTEL 8085 microprocessor and explain 3 important sections of microprocessors. **(08 Marks)**

b. Briefly explain with sketch:
(i) Instruction register (IR) (ii) Data register (iii) I/O buffers **(12 Marks)**

8 a. Explain with a neat diagram of,
(i) Instruction word. (ii) Data word. **(10 Marks)**

b. Explain with block diagram, the register organization of an INTEL 4004 μP. **(10 Marks)**

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10ME665

Sixth Semester B.E. Degree Examination, June/July 2017
Non Traditional Machining

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Give broad classification of nontraditional machining process. **(06 Marks)**
b. Explain the need for development of nontraditional machining process. **(04 Marks)**
c. With a neat sketch, explain the working principle of ultrasonic machining process. **(10 Marks)**

2 a. Sketch and explain any two type of tool feed system in ultrasonic machining process. **(10 Marks)**
b. Discuss the influence of the following parameters on USM process :
i) Amplitude and frequency of vibration ii) Grain size iii) Effect of slurry
iv) Effect of applied static load v) Effect on work material. **(10 Marks)**

3 a. Explain the process variables that influence the metal removal rate in abrasive jet machining. **(10 Marks)**
b. Explain with help of a neat sketch, working principle of water jet machining process and also mention its advantages. **(10 Marks)**

4 a. With a neat sketch, explain the working principle of Electro Chemical Machining (ECM) process. **(08 Marks)**
b. Describe Chemistry involved in ECM process. **(06 Marks)**
c. Explain with neat sketch, Electro Chemical Grinding (ECG) process. **(06 Marks)**

PART – B

5 a. Explain the process characteristics in Chemical Machining (CHM) process. **(06 Marks)**
b. Explain with neat sketch, the sequence of process steps involved in chemical blanking process. **(08 Marks)**
c. Discuss the factors to be considered for selection of Maskants and types that are used in chemical machining. **(06 Marks)**

6 a. Explain the working principle of EDM process, with neat sketch. **(08 Marks)**
b. List the commonly used dielectric fluid in EDM process. What properties should they posses? **(06 Marks)**
c. Sketch and explain Travelling wire EDM process. **(06 Marks)**

7 a. Briefly explain the parameters that influence PAM performance. **(06 Marks)**
b. Explain the types of torches used in PAM process. **(08 Marks)**
c. Lists the important safety precaution to be considered to PAM process. **(06 Marks)**

8 a. Explain the working principle of LBM, with neat sketch. **(08 Marks)**
b. Explain briefly types of lasers used in LBM process. **(06 Marks)**
c. With a neat sketch, explain the principle of EBM process. **(06 Marks)**

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