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10ME61

Sixth Semester B.E. Degree Examination, June/July 2013
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. What do you mean by automation? With suitable examples, distinguish between fixed and programmable automation. **(09 Marks)**

b. Discuss briefly the arguments in favour of automation. **(05 Marks)**

c. A production machine is operated 65 hr/week at full capacity, its production rate is 20 units/hour. During a certain week, the machine produced 1000 good parts and was idle in the remaining time.

i) Determine the production capacity of machine.

ii) What was the utilization of the machine during the week under consideration? **(06 Marks)**

2 a. Enlisting the objectives of automated flow lines, Discuss the two configurations used in practice. **(08 Marks)**

b. Explain three main functions that are utilized to control the operation of an automatic transfer system. **(07 Marks)**

c. Differentiate between intermittent verses power and free transfer methods of transport. **(05 Marks)**

3 a. A 20 station transfer line is divided into two stages of stations and each has an ideal cycle time of 1.2 mins. The probability of station breakdown per cycle is equal for all stations and P = 0.005 breakdowns/cycle downtime constant Td = 8.0 min compute the following for the buffer capacities: b = 0 and b = ∞.

i) Frequency of line stop per cycle.

ii) Average actual production rate.

iii) Line efficiency. **(08 Marks)**

b. What is the purpose of buffer storage? Mention two extreme cases of buffer effectiveness in automated flow lines. **(04 Marks)**

c. What are the two reasons for partial automation? Analyze the performance of partial automation along with suitable assumptions. **(08 Marks)**

4 a. Explain with mathematical expressions, different terms in line balancing. **(04 Marks)**

b. With suitable example explain the method of computing balance delay using KILBRIDGE and WESTER method and ranked positional weight method. **(16 Marks)**

PART – B

5 a. Explain different types of automated assembly system based on physical configuration. **(08 Marks)**

b. Explain briefly the automated guided vehicle system (AGV's). **(05 Marks)**

c. Explain briefly the recommendations and principles that can be applied in product design to facilitate automated assembly. **(07 Marks)**

6 a. With a neat sketch, explain variant CAPP system. **(07 Marks)**

b. List out the benefits of CAPP. **(05 Marks)**

c. What do you mean by MRP? What are the MRP outputs and benefits? **(08 Marks)**

7 a. Describe the salient features of CNC systems. **(10 Marks)**

b. Discuss the classification of CNC machine tools, with block diagrams. **(10 Marks)**

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

b. Explain four types of programming methods. **(08 Marks)**

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10ME62

Sixth Semester B.E. Degree Examination, June/July 2013
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. ***Use of design data hand book is permitted.***

PART – A

1 a. The cross section of a steel crane hook is a trapezium with an inner side of 50 mm and outer side of 25 mm. The depth of the section is 64 mm. The centre of curvature of the section is at a distance of 64 mm from the inner edge of the section and the line of action of load is 50 mm from the same edge. Determine the maximum load hook can carry if the allowable
b. strength is limited to 60 MPa. **(10 Marks)**
A cast iron cylindrical pipe of outside diameter – 300 mm and inside diameter 200 mm is subjected to an internal pressure of 20 N/mm^2 and external fluid pressure of 5 N/mm^2. Determine the tangential and radial stresses at the inner, middle and outer surface. Sketch the tangential and radial distribution across its thickness. **(10 Marks)**

2 a. Select a V-belt drive to transmit 10 kW power from a pulley of 200 mm diameter mounted on an electric motor running at 720 rpm to another pulley mounted on compressor running at 200 rpm. The service is heavy duty varying from 10 hrs to 14 hrs per day and distance between centre of pulley is 600 mm. **(10 Marks)**
b. A roller chain is to transmit 66.24 kW from a 17 tooth sprocket to a 34 tooth sprocket at a pinion speed of 300 rpm. The loads are moderate shock. The equipment is to run 18 hrs/day. Specify the length and size of the chain required for a centre distance of about 25 pitches. **(10 Marks)**

3 a. The laminated leaf spring has an overall length of 1.1 m and has a central load of 160 kN. The spring has 3 full length leaves and 15 graduated leaves with a central band of 100 mm wide. All the leaves are to be stressed to 400 N/mm^2, when fulley loaded. The ratio of total spring depth to width is approximately 2. Determine
i) The width and thickness of the leaves.
ii) Initial space must be provided between full length and graduated leaves.
iii) What load is exerted on the band when the leaves are assembled? **(10 Marks)**
b. Design a value spring for an automobile engine, when the valve is closed, the spring produces a force of 45 N and when it opens produces a force of 55 N. The spring must fit over the valve bush which has an outside diameter of 20 mm and must go inside a space of 35 mm. The lift of the valve is 6 mm. The spring index is 12. The allowable stress may be taken as 0.33 GPa. Modulus of rigidity 80 GPa. **(10 Marks)**

4 It is required to transmit 15 KW power from a shaft running at 1200 rpm to a parallel shaft with speed reduction of 3. The centre distance of shafts is to be 300 mm. The material used for pinion is steel ($\sigma_d = 200$ MPa) and for gear is CI ($\sigma_d = 140$ MPa). Service factor is 1.25 and tooth profile is 20° full depth involute. Design the spur gear and check the design for dynamic and wear. **(20 Marks)**

PART – B

5 Complete the design and determine the input capacity of worm gear speed reducer unit which consists of hardened steel worm and phosphor bronze gear having 20° stub involute teeth. The centre distance is to be 200 mm and transmission ratio is 10, speed of the worm is 2000 rpm. **(20 Marks)**

6 a. A multiplate clutch has steel on bronze is to transmit 8 kW at 1440 rev/min. The inner diameter of the contact is 80 mm and the outer diameter of contact is 140 mm. The clutch operates in oil with expected co-efficient of friction of 0.1. The average allowable pressure is 0.35 MPa. Assume uniform wear theory and determine the following:
i) Number of steel and bronze plates.
ii) Axial force required.
iii) Actual maximum pressure. **(10 Marks)**

b. A simple band brake of drum diameter 600 mm 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 400 mm from the fulcrum. The brake lever is 1 m long. The brake is to absorb a power of 15 kW at 720 rpm. Design the brake lever of rectangular cross section assuming depth to be thrice the width. Take allowable stress 80 MPa. **(10 Marks)**

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

b. The main bearing of a steam turbine runs at 1500 rpm and has a diameter of 40 mm. The load on a bearing is estimated to be 3 kN. Assume clearance ratio of 0.001 mm, length to diameter ratio is 1.5 and well ventilated. The operating temperature of the oil fill is 60°C and oil used is turbine oil SAE10. Determine wether,
i) Fluid film lubrication can be expected.
ii) Is artificial cooling is necessary.
iii) The amount of oil flow. **(12 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 = 0.60 MPa, maximum gas pressure = 4 MPa, fuel consumption = 0.25 kg per BP per hour. μd ratio for bush in small end of connecting rod = 1.5. **(20 Marks)**

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10ME63

Sixth Semester B.E. Degree Examination, June / July 2013
Heat and Mass Transfer

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. Write down 3 – dimensional conduction equation in Cartesian coordinates. Explain the meaning of each term. **(06 Marks)**

b. What do you mean by initial conditions and boundary conditions of I, II & III kind? **(06 Marks)**

c. A composite wall consists of 10cm layer of building brick ($0.7 W/m^0C$) and 3cm plaster ($0.5 W/m^0C$). An insulating material of K = 0.08 W/m^0C is to be added to reduce the heat transfer through the wall by 70%. Determine the thickness of insulating layer. **(08 Marks)**

2 a. Obtain an expression for heat transfer through a plane wall in which thermal conductivity is given by $K = K_0(1+ \alpha T)$, where α is constant, K_0 thermal conductivity at reference temperature T is the temperature. **(06 Marks)**

b. Derive an expression for critical thickness of insulation for a cylinder. **(06 Marks)**

c. A wire of 8mm diameter at a temperature of 60^0C is to be insulated by a material having K = 0.174W/m ^0C. Heat transfer coefficient $h_a = 8 W/m^2K$ and ambient temperature $T_a = 25^0C$. For max heat loss find the minimum thickness of insulation. Find increase in heat dissipation due to insulation. **(08 Marks)**

3 a. Obtain an expression for instantaneous heat transfer and total heat transfer for lumped heat analysis treatment heat conduction problems. **(08 Marks)**

b. Explain physical significance of Biot and Fourier numbers. **(06 Marks)**

c. A household electric Iron ($\rho = 2700 kg/m^3$, $C_p = 0.896 kJ/kg K$ and $K = 200 W/m^0C$) and weighs 1.5 kg. The total area of iron is $0.06m^2$ and it is heated with 500W heating element. Initially the iron is at 25^0C (ambient Tempr). How long it takes for the iron to reach 110^0C. Take $h_a = 15 W/m^2K$. **(06 Marks)**

4 a. Define Hydrodynamic and thermal Boundary layer incase of flow over a flat plate. **(06 Marks)**

b. An appropriate expression for temperature profile in thermal boundary layer is given by :

$$\frac{T_{(x,y)} - T_w}{T_\infty - T_w} = \frac{3}{2}\frac{y}{\delta_t(x)} - \frac{1}{2}\left(\frac{y}{\delta_t(x)}\right)^3$$, where $\delta_{t(x)} = 4.53\frac{x}{R_{ex}^{1/2}\ P_\gamma^{1/3}}$. Develop an expression for local heat transfer coefficient $h_{(x)}$. **(06 Marks)**

c. A vertical pipe 15cm OD, 1m long has a surface temperature of 90^0C. If the surrounding air is at 30^0C. What is the rate of heat loss by free convection? **(08 Marks)**

PART - B

5 a. Using dimensional analysis, obtain a relation between N_u, R_e and P_r for forced convection heat transfer. **(10 Marks)**

b. Air flows over a flat plate at 30^0C, 0.4m, 0.75m long with a velocity of 20m/s. Determine the heat transfer from the surface of plate assuming plate is maintained at 90^0C. Use

$Nu_L = 0.664\ R_e^{0.5}\ Pr^{0.33}$ for laminar

$= [0.036\ R_e^{0.8} - 836]P_r^{0.333}$. **(10 Marks)**

6 a. Derive an expression for effectiveness of parallel flow heat exchanger. **(08 Marks)**

b. Under what conditions LMTD and effectiveness methods are used in the design of heat exchanger. **(02 Marks)**

c. Oil at 100^0C (C_P = 3.6kJ/kg K) flows at a rate of 30,000 kg/hr and enters a parallel flow heat exchanger. Cooling water (C_P = 4.2kJ/kg K) enters heat exchanger at 10^0C at the rate of 50,000kg /hr. The heat transfer area is $10m^2$ and u = $1000W/m^2K$. Calculate outlet temperature of oil and water. **(10 Marks)**

7 a. With neat sketch, explain the regions of pool boilding. **(08 Marks)**

b. State and explain Fick's law of diffusion. **(04 Marks)**

c. Dry saturated steam at atmospheric pressure condenses on a vertical tube of diameter 5cm and length 1.5m. If the surface is maintained at 80^0C, determine the heat transfer rate and the mass of steam condensed per hr. **(08 Marks)**

8 a. Define : **(08 Marks)**
i) Black body ii) Plank's law iii) Wein displacement law iv) Lambert's law.

b. Prove that emissive power of a black body in a hemispherical enclosure is π times the intensity of radiation. **(08 Marks)**

c. Calculate net heat radiated (exchange) per m^2 for two large parallel plates maintained at 800^0C and 300^0C. The emissivites of two plates are 0.3 and 0.6 respectively. **(04 Marks)**

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10ME64

Sixth Semester B.E. Degree Examination, June/July 2013

Finite Element Methods

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Write equilibrium equations in elasticity subjected to body and traction forces. **(06 Marks)**

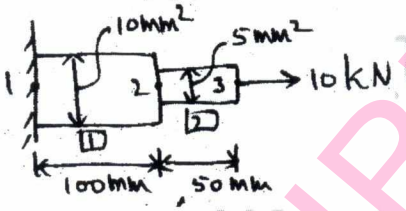
b. Write the stress-strain relationships for both plane stress and plane strain problems. **(06 Marks)**

c. Define finite element method. Explain the various application fields of finite element method. **(08 Marks)**

2 a. Explain minimum potential energy principle. **(06 Marks)**

b. Derive the stiffness matrix for a single element bar, using direct stiffness method. **(04 Marks)**

c. A two element two noded bar is shown in Fig.Q2(c). Determine the nodal displacements and the nodal forces. **(10 Marks)**



E = 200 GPa
Fig.Q2(c)

3 a. Write a note on the polynomials involved in linear, quadratic and cubic 1D elements. **(06 Marks)**

b. Derive shape functions for one dimensional two noded bar element. Hence explain the conditions that the shape function has to satisfy. **(06 Marks)**

c. Write the Jacobian matrix for the triangular element shown in Fig.Q3(c). **(08 Marks)**

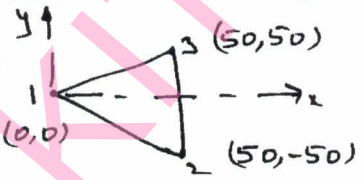


Fig.Q3(c)

4 A stepped bar is shown in Fig.Q4. Determine:

a. The nodal displacements and nodal forces.

b. The stresses in each element.

c. The principal and shear stresses in each element.

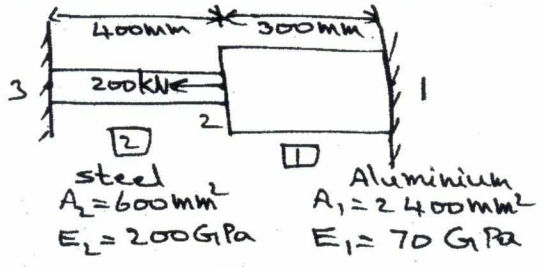


Fig.Q4

Use penalty method to handle the boundary conditions. **(20 Marks)**

PART – B

5 a. Distinguish between lower and higher order elements. **(08 Marks)**

b. Define isoparametric element. What are the advantages? **(04 Marks)**

c. Write a note on 2-point integration rule for 1D and 2D problems. **(08 Marks)**

6 For the two bar truss shown in Fig.Q6, determine the nodal displacements and forces. Assume E = 200 GPa, A = 6×10^{-4} m^2.

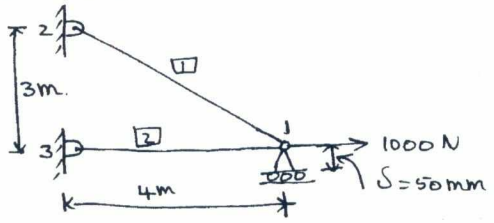


Fig.Q6 **(20 Marks)**

7 a. Define Hermite shape functions. Derive shape functions for the beam element. **(10 Marks)**

b. Derive stiffness matrix for the beam element using Hermite shape functions. **(10 Marks)**

8 A composite wall shown in Fig.Q8 consists of three materials. The outer temperature T_0 is 20°C. Convective heat transfer takes place on the inner surface of the wall with T_∞ = 800°C. The convective heat transfer coefficient hi is 25 W/m^2°C. Determine the temperature distribution in the wall.

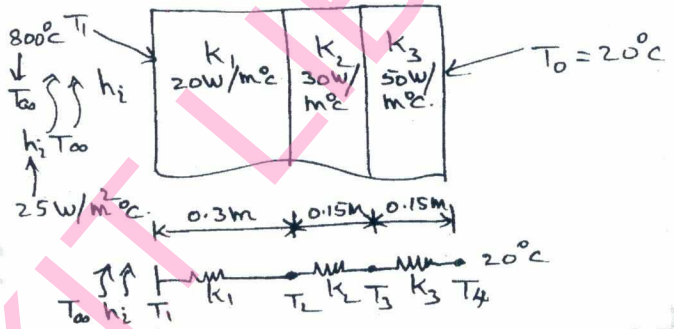


Fig.Q8 **(20 Marks)**

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10ME65

Sixth Semester B.E. Degree Examination, June/July 2013

Mechatronics and Microprocessor

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define mechatronics. Explain the differences between conventional approach and mechatronic approach to product design. **(08 Marks)**

b. What is measurement and control systems? Explain with examples. **(08 Marks)**

c. Illustrate a closed loop system with an example. **(04 Marks)**

2 a. Define the following terms:
i) Accuracy ii) Resolution iii) Response time iv) Settling time **(06 Marks)**

b. Explain with a neat sketch, an eddy current proximity sensor. **(06 Marks)**

c. Explain how sensing is achieved by an absolute optical encoder. **(08 Marks)**

3 a. Show how bipolar transistor can be used as a switch. **(10 Marks)**

b. What are stepper motors? Explain with a neat sketch, the principle of working of a permanent magnet stepper motor. **(10 Marks)**

4 a. Write the pin connections for a 741 operational amplifier. **(04 Marks)**

b. Explain the principle of ADC of signals. **(08 Marks)**

c. What is pulse modulation? Explain the two types of modulation. **(08 Marks)**

PART – B

5 a. What are universal gates? With the help of symbols and truth table, explain NOR and NAND gates. **(05 Marks)**

b. Using 8 bits, show how a negative number $(-91)_{10}$ is stored in memory. **(07 Marks)**

c. Convert the following:
i) $(4DFA)_{16} = (\ldots\ldots\ldots)_{10}$ ii) $(0.862)_{10} = (\ldots\ldots\ldots)_{2}$
iii) $(2747)_{8} = (\ldots\ldots\ldots)_{10}$ iv) $(1100100101)_{2} = (\ldots\ldots\ldots)_{16}$ **(08 Marks)**

6 a. Explain with a neat sketch, the internal architecture of INTEL 8085 microprocessor. **(12 Marks)**

b. Explain the following terminology, related to microprocessor:
i) Program counter ii) Flag register
iii) Stack pointer iv) Accumulator **(08 Marks)**

7 a. Explain the different types of addressing modes of INTEL 8085 microprocessor, with examples. **(10 Marks)**

b. With a flow chart, write a program for multiplication of two 8-bit numbers located in different memory locations and store the result back into memory. **(10 Marks)**

8 a. Explain the flow of instruction and data in the 8085 microprocessor. **(10 Marks)**

b. Draw and explain the timing diagram for memory write operation. **(10 Marks)**

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10ME662

Sixth Semester B.E. Degree Examination, June/July 2013
Mechanics of Composite Materials

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Give the characteristics of fibrous, particulate, flake and laminated composites. **(08 Marks)**

b. List the applications of the following composites:
i) Aircraft; ii) Automobile; iii) Marine and iv) Sports equipments. **(12 Marks)**

2 a. With a neat sketch, explain the pultrusion process with its advantages. **(10 Marks)**

b. With the help of a neat sketch, explain vacuum bag and pressure bag molding technique. **(10 Marks)**

3 a. Derive an expression for the longitudinal Young's modulus of a composite material using mechanics of materials approach. State the assumptions made. **(08 Marks)**

b. A polymer composite has 70% glass fibre in epoxy matrix. If the elastic modulus of the glass is 85 GPa and that of epoxy is 3.4 GPa. The Poisson's ratio of fibre is 0.2. Compute:
i) Longitudinal elastic modulus.
ii) Transverse elastic modulus.
iii) Shear modulus of the fibre and
iv) The ratio of the load carried by the fibre to that of the composite. **(12 Marks)**

4 a. Explain the relationship between the engineering constants for a linear isotropic material in 3-D state of stress. Write the reduced stiffness and compliance matrices. **(08 Marks)**

b. For a graphite/epoxy unidirectional lamina, find the following:
i) Compliance matrix
ii) Minor Poisson's ratio
iii) Reduced stiffness matrix.
Given $\sigma_1 = 2$ MPa, $\sigma_2 = -3$ MPa, $\tau_{12} = 4$ MPa, $E_1 = 181$ GPa, $E_2 = 10.3$ GPa, $r_{12} = 0.28$, $G_{12} = 7.17$ GPa. **(12 Marks)**

PART – B

5 a. State and explain the maximum stress and maximum strain theories. **(10 Marks)**

b. State and explain Tsai-Hill failure theory. **(05 Marks)**

c. Find the maximum value of $S > 0$ if a stress of $\sigma_x = 2S$, $\sigma_y = -3S$ and $\tau_{xy} = 4S$ is applied to a 60° graphite/epoxy lamina. Use Tsai-Hill failure theory. Given $\sigma_1 = 1.714S$, $\sigma_2 = -2.714S$, $\tau_{12} = -4.165S$, $\left(\sigma_1^T\right)_{Ult} = 1500\,\text{MPa}$, $\left(\sigma_2^T\right)_{Ult} = 40\,\text{MPa}$ and $\left(\tau_{12}\right)_{Ult} = 68\,\text{MPa}$. **(05 Marks)**

6 a. Explain the types of laminates and write the lamination codes. **(08 Marks)**

b. Compute all terms of [A], [B] and [D] matrices for a [0/90] laminate with the following lamina properties: $E_1 = 140$ GPa, $E_2 = 10$ GPa, $E_6 = 5$ GPa, $\gamma_{12} = 0.3$. **(12 Marks)**

7 a. List the various reinforcement materials used in MMC's. Explain the characteristics of any two materials. **(08 Marks)**

b. What are the applications of MMC's? **(04 Marks)**

c. Explain the powder metallurgy technique of producing MMC's. **(08 Marks)**

8 a. Explain the wear and machinability properties of MMC's. **(10 Marks)**

b. Explain the effect of size, shape and distribution of particulates in MMC's. **(10 Marks)**

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10ME665

Sixth Semester B.E. Degree Examination, June/July 2013
Non-Traditional Machining

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Justify the need of unconventional manufacturing process in todays industries. **(06 Marks)**

b. Distinguish between conventional and unconventional manufacturing process. **(04 Marks)**

c. What are the basic factors upon which the unconventional manufacturing processes are classified? Explain. **(10 Marks)**

2 a. Explain with help of a neat sketch the working principle of ultra sonic machining process, and also mention its advantages. **(10 Marks)**

b. Explain how various process parameters influence the material removal rate in ultrasonic machining process. **(10 Marks)**

3 a. Explain how the following parameters influence the metal removal rate in abrasive jet machining process: i) Nozzle tip distance; ii) Velocity of abrasive; iii) Abrasive flow rate; iv) Gas pressure. **(10 Marks)**

b. Explain the desired properties of abrasive materials used in abrasive jet machining. **(05 Marks)**

c. Which are the abrasive materials used in water jet machining? **(05 Marks)**

4 a. With suitable sketches, explain the metal removal mechanism in electro chemical grinding. **(08 Marks)**

b. Why are chemical machining and electro chemical machining considered as chipless machining? Explain the mechanisms of metal removal on both cases and compare it with conventional grinding process. **(12 Marks)**

PART – B

5 a. Explain in brief the following in chemical machining process:
i) Maskants; ii) Etchants. **(08 Marks)**

b. With the help of neat sketches, explain the different steps involved in chemical blanking. **(12 Marks)**

6 a. Discuss the factors influencing the choice of electrode material in EDM. **(05 Marks)**

b. Explain with help of a neat sketches any two types of flushing. Methods used in EDM. **(05 Marks)**

c. Explain with help of neat sketches, the mechanism of metal removal in EDM process, and also mention its advantages and disadvantages. **(10 Marks)**

7 a. With a neat sketch, explain the plasma arc machining (PAM) process and also mention its applications. **(10 Marks)**

b. Which are the important considerations are to be made in the design of plasma torch? **(06 Marks)**

c. Mention any two advantages and disadvantages of plasma arc machining. **(04 Marks)**

8 a. With a neat sketch, explain the mechanism of metal removal in LBM process. **(08 Marks)**

b. State the advantages, disadvantages and application of EBM. **(06 Marks)**

c. Explain how the electron beam is generated in electron beam machining (EBM) process. **(06 Marks)**

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.