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10ME61

Sixth Semester B.E. Degree Examination, June/July 2018
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define Manufacturing Lead Time (MLT). How is it computed for batch production and job shop situations? **(06 Marks)**

b. Sketch and explain the model showing information processing activities required for a typical manufacturing firm. **(06 Marks)**

c. A part is processed in a batch production plant must be processed through average of 6 machines. There are 20 new batches of parts launched each week.
Given:

Average operation time	= 6 min
Average setup time/batch	= 5 hr,
Average batch size	= 25 parts,
Average non operation time/batch	= 10 hr,
Number of machines in the plant	= 18, and

Plant operates average of 70 hours/week,
Determine:
i) Manufacturing lead time.
ii) Plant capacity.
iii) Plant utilization and
iv) Work in process. **(08 Marks)**

2 a. What are pallet fixtures? Discuss the advantages and applications of pallet fixtures in automated flow lines. **(06 Marks)**

b. Distinguish between synchronous and asynchronous methods of transfer of work parts in flow lines. What are their relative advantages and applications? **(06 Marks)**

c. List and explain control functions used in an automated flow line. **(08 Marks)**

3 a. Explain with examples upper bound and lower bound approaches used to analyze the transfer lines. Derive appropriate relations to compute frequency of line stops in above approaches. **(12 Marks)**

b. Discuss the problems faced by flow lines without work part storage buffers and how it is minimized by storage buffer. **(08 Marks)**

4 a. Briefly explain the following terms in line balancing:
i) Zoning constraint
ii) Precedence constraint
iii) Total work content
iv) Minimum rational work element. **(08 Marks)**

b. The following table defines the precedence relationships and element times:

Element	1	2	3	4	5	6	7	8
Time (min)	10	5	8	3	12	2	5	15
Immediate predecessor	-	-	1, 2	2	3	3, 4	4	5, 6, 7

Using Ranked positional weights method.

i) Construct precedence diagram and compute RPW.
ii) Assign work elements to stations considering ideal cycle time of 15 mins.
iii) Calculate balance delay. **(12 Marks)**

PART – B

5 a. With neat sketches, explain horizontal and vertical part placement devices used in dial indexing table. **(08 Marks)**

b. What are AGVs? Explain various types of AGVs and their applications. **(12 Marks)**

6 a. With the help of a diagram explain the working of retrieval type CAPP system. How is it different from generative CAPP approach? **(10 Marks)**

b. With the help of a block diagram of structure of MRP system, explain the working of material requirement planning system. Also discuss the benefits of computerized MRP system. **(10 Marks)**

7 a. Distinguish between the following with respect to CNC systems:

i) Absolute and incremental coordinates.
ii) Fixed zero and floating zero.
iii) Contouring and straight cut CNC systems.
iv) Closed loop and open loop CNC systems. **(08 Marks)**

b. Prepare a manual part program to machine the profile of the part shown below. Assume suitable machining parameters.

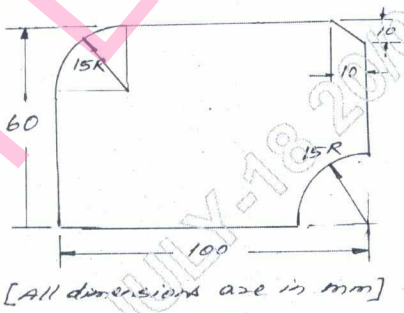

Fig.Q.7(b)

Program should be complete in all respects. Add comments at the end of each block. (Plate thickness is 15mm). **(12 Marks)**

8 a. With the help of a neat sketch. Illustrate six degrees of freedom of a polar Robot. **(06 Marks)**

b. Distinguish between:

i) Walk through and lead through programming.
ii) MCL and VAL programming of Robot. **(08 Marks)**

c. Discuss the Robot applications in ARC welding. **(06 Marks)**

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10ME62

Sixth Semester B.E. Degree Examination, June/July 2018

Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Plot the stress distribution about section A-B of the hook as shown in Fig.Q1(a).

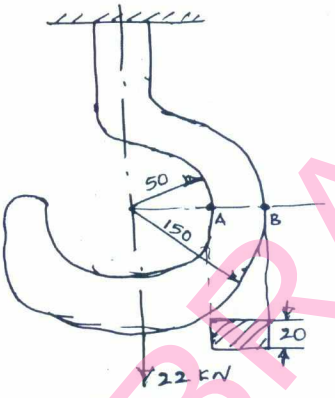

Fig.Q1(a) **(10 Marks)**

b. A carbon steel C50 barrel with diameter 25 mm and 50 mm is to be shrink fitted into another barrel with diameter 50 mm and 75 mm. The tangential stress developed at the inner fiber of the outer barrel due to shrink fitting may be limited to 70 N/mm^2. Determine:
i) Contact pressure
ii) Original diameter at contact before shrink fitting
iii) Resulting stress due to shrink fitting.
Take E = 21 × 10^4 N/mm^2, V = 0.28. **(10 Marks)**

2 a. Two shafts 1 metre apart are connected by a V-belt to transmit 90 KW at 1200 rpm of a driver pulley of 300 mm effective diameter. The driven pulley rotates at 400 rpm. The angle of groove is 40° and the coefficient of friction between the belt and pulley rim is 0.25. The area of cross section is 400 mm^2 and permissible stress is 2.1 MPa. Density of belt material is 1100 kg/m^3. Calculate the number of belts required and length of belt. **(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 hours/day. Specify the length and size of the chain required for a centre distance about 25 pitches. **(10 Marks)**

3 a. Design a helical compression spring for a maximum load of 1200 N for a deflection of 25 mm. Spring index is 5. Permissible shear stress is 400 MPa and G = 85 GPa. **(10 Marks)**

b. A semi-elliptic leaf spring 1.5 m long is composed of 18 graduated leaves and one full length leaf. The leaves are 60 mm wide and is acted upon by a central load of 30 kN which causes a deflection of 100 mm. Determine the thickness of the leaves and the maximum bending stress in the full length leaf, assuming with and without prestressed and also determine stress in the graduated leaf without prestress. Assume E = 210 GPa. **(10 Marks)**

4 A pair of spur gears having 20° full depth involute system is to transmit 12 KW at 300 rpm of the pinion. The allowable static stress for cast iron gear is 60 MPa and for the steel pinion is 105 MPa. Design the gear and check strength for dynamic and wear condition. Assume surface endurance strength as 580 MPa and velocity ratio is 3:1. **(20 Marks)**

PART – B

5 Design a worm gear to transmit 40 KW at 1000 rpm of the worm. The desired velocity ratio is 25:1. The worm is of hardened steel and the worm wheel is of phosphor bronze having allowable stress of 75 MPa. **(20 Marks)**

6 a. A multi-plate clutch is used to transmit 5 KW power at 1440 rpm. The inner and outer diameters of contacting surfaces are 50 mm and 80 mm respectively. The coefficient of friction and the average allowable pressure intensity for the lining may be assumed as 0.10 and 350 kPa respectively. Determine:

i) Number of friction plates and pressure plates
ii) Axial force required to transmit power
iii) The actual average pressure
iv) Actual maximum pressure intensity after wear. **(10 Marks)**

b. A cast iron flywheel rotating at 600 rpm is brought rest by a brake in 2 sec. the flywheel may be considered as a solid circular disc having a diameter 400 mm and thickness 100 mm. The density of cast iron is 7200 kg/m^3. Determine:

i) Energy absorbed by brakes
ii) Number of turns the drum rotates before coming to rest
iii) The braking torque. **(10 Marks)**

7 a. Derive the Petroff's equation and state the assumptions. **(10 Marks)**

b. A 75 mm long full journal bearing of 75 mm diameter supports a load of 12 kN at the shaft speed of 1800 rpm. Assume ratio of diameter to the diametral clearance as 1000. The viscosity of oil is 0.01 Pa.S at the operating temperature. Determine:

i) Summerfield number
ii) The coefficient of friction based on McKee equation
iii) Amount of heat generated **(10 Marks)**

8 Design a cast iron piston for a single acting four stroke engine for the following data:
Cylinder bore = 100 mm
Stroke = 125 mm
Max gas pressure = 5 N/mm^2
Indicated mean effective pressure = 0.75 N/mm^2
Mechanical efficiency = 80%
Fuel consumption = 0.15 kg per brake power per hour
Higher calorific value of fuel = 42 × 10^3 kJ/kg
Speed = 2000 rpm. **(20 Marks)**

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10ME63

Sixth Semester B.E. Degree Examination, June/July 2018
Heat and Mass Transfer

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO full questions from each part.*
2. Use of HMT data book is permitted.

*-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.

PART – A

1 a. State and explain the governing laws of conduction, convection and radiation heat transfer modes. **(09 Marks)**

b. Write a note on thermal contact resistance. **(03 Marks)**

c. A hollow spherical form is used to determine the thermal conductivity of material. The inner diameter is 20cm and the outer diameter is 50cm. A 30W heater is placed inside and under steady state conditions, the temperature at 15 and 20cm radii were found to be 80 and 60°C. Determine the thermal conductivity of the material. Also find the outside temperature. If the surrounding is at 30°C, determine convection heat transfer coefficient over the surface. **(08 Marks)**

2 a. Show that for a hollow cylinder with variable thermal conductivity and one dimensional steady state heat conduction, the temperature variation is given by

$$T = -\frac{1}{\alpha} + \sqrt{\left(\frac{1}{\alpha} + T_1\right)^2 - \frac{Q \log_e \frac{r}{r_1}}{\pi K_o L \alpha}},$$

where α = constant

K_o = thermal conductivity at zero degree temperature. **(10 Marks)**

b. A rod (K = 200 W/mK) 5mm in diameter and 5cm long has its one end maintained at 100°C. The surface of the rod is exposed to ambient air at 25°C with convection heat transfer coefficient of 100W/m^{2}K. Assuming other end is insulted, determine:

i) The temperature of the rod at 20mm distance from the end at 100°C.
ii) Heat dissipation rate from the surface of the rod.
iii) Effectiveness.
iv) Efficiency of fin. **(10 Marks)**

3 a. Derive the expressions of temperature variation, instantaneous heat transfer and total heat transferred for one dimensional transient heat conduction. **(10 Marks)**

b. A thermo couple is used to measure the temperature in a gas stream. The junction is approximated as a sphere with thermal conductivity of 25W/mK. The properties of the junction are ρ = 9000 kg/m^3, C = 0.35 kJ/kg K, h = 250 W/m^{2}K. Calculate the diameter of the junction if thermocouple measures 95% of the applied temperature difference in 3 sec. **(04 Marks)**

c. Water pipes are to be buried underground in a wet soil (α = 2.78 × 10^{-5} m^2/h) which is initially at 4.5°C. The soil surface temperature suddenly drops to -5°C and remains at this value for 10 hrs. Calculate the minimum depth at which the pipes are laid if the surrounding soil temperature is to be maintained above 0°C. The soil may be considered as semi-infinite solid. Treat the present conditions as the condition of an semi infinite solid. **(06 Marks)**

4 a. Derive the correlation for natural convection heat transfer in terns of Grashoff, Prandtle and Nusselt number using dimensional analysis. **(10 Marks)**

b. Air at 20°C and atmospheric pressure is flowing over a flat plate at a velocity of 3m/s. If the plate is 30cm wide and at a temperature of 60°C, calculate at x = 0.3m.

i) Thickness velocity and thermal boundary layers.
ii) Local and average friction coefficients.
iii) Local and average heat transfer coefficients.
iv) Total drag force on the plate. **(10 Marks)**

PART – B

5 a. Define and mention the significance of following dimensionless numbers:

i) Reynolds Number
ii) Prandtle Number
iii) Nusselt Number
iv) Stanton Number
v) Peclet Number. **(10 Marks)**

b. Consider air at atmospheric pressure and 100°C enters a 2m long tube of 4cm diameter with a velocity of 9m/s. A 1kW electric heater is wound on the outer surface of the tube, find: i) Exit temperature of air ii) Mass flow rate of air iii) Wall temperature. Assume that the rate of heat absorption by air per unit area is uniform throughout the length of the tube. **(10 Marks)**

6 a. Classify heat exchangers. **(04 Marks)**

b. Define the following:

i) Fouling and fouling factor.
ii) Effectiveness of heat exchanger.
iii) Capacity rate and capacity ratio. **(06 Marks)**

c. Calculate the exit temperature of the hot fluid and inlet temperature of the cold fluid for a counter flow heat exchanger having the following specifications.

Mass flow rate of hot and cold fluids	= 3 and 0.75 kg/s
C_p for hot and cold fluids	= 1.05 and 4.2 kJ/kg K
Inlet temperature of hot fluid	= 500°C
Exit temperature of cold fluid	= 85°C
Overall heat transfer coefficient	= 450 W/m^2 K
Total surface area	= 1m^2

(10 Marks)

7 a. List out the assumptions made in Nusselt theory of Laminar film condensation on vertical plate. **(05 Marks)**

b. With a neat sketch, explain the regimes of pool boiling. **(08 Marks)**

c. A vertical square plate 30cm × 30cm is exposed to steam at atmospheric pressure. The plate temperature is 98°C. Calculate the heat transfer and mass of steam condensed per hour. **(07 Marks)**

8 a. Briefly explain the concept of black body. **(04 Marks)**

b. For black body show that the intensity of normal radiation is $1/\pi$ times the emissive power. **(10 Marks)**

c. Liquid air boiling at -153°C is stored in a spherical container of diameter 320mm. The container is surrounded by concentric spherical shell of diameter 360mm in a room at 27°C. The space between the two spheres is evacuated. The surface of the sphere are flashed with aluminium (ϵ = 0.3). Taking the latent heat of vapourization of liquid air as 210 kJ/kg, find the rate of evaporation of liquid air. **(06 Marks)**

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10ME64

Sixth Semester B.E. Degree Examination, June/July 2018
Finite Element Methods

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Write the equilibrium equations in elasticity subjected to body force. **(04 Marks)**

b. Describe the steps involved in FEM. **(08 Marks)**

c. Write a note on node numbering and half Band width. **(08 Marks)**

2 a. For the spring system shown in Fig. Q2 (a), using the principle of minimum potential energy. Determine the nodal displacement. **(10 Marks)**

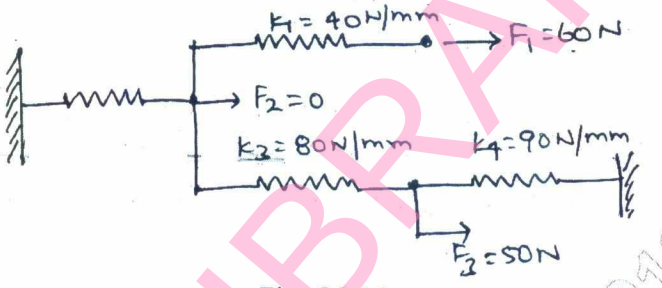


Fig. Q2 (a)

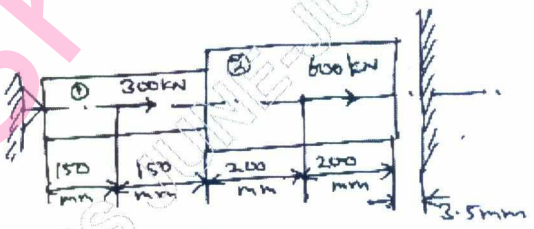
b. A simply supported beam of length 'L' is subjected to UDL of P_0 N/m. Determine the maximum deflection using Galerkin's method. **(10 Marks)**

3 a. Derive the shape functions of CST element in natural coordinate. **(10 Marks)**

b. What is the purpose of Pascal's triangle? Represent the 2D Pascal's triangle upto 5th order. **(05 Marks)**

c. Write a note on simplex, complex and multiplex elements. **(05 Marks)**

4 a. For the Bar shown in Fig. Q4 (a), determine the nodal displacement, element stresses and support reactions. **(12 Marks)**



$A_1 = 250\ mm^2$
$A_2 = 400\ mm^2$
$E_1 = E_2 = 200\ GPa$

Fig. Q4 (a)

b. Solve the following equations using Gauss-elimination technique.

$$5x_1 - 4x_2 + x_3 = 0$$
$$-4x_1 + 6x_2 - 4x_3 + x_4 = 1$$
$$x_1 - 4x_2 + 6x_3 - 4x_4 = 0$$
$$x_2 - 4x_3 + 5x_4 = 0$$

(08 Marks)

PART – B

5 a. Obtain the shape functions of 8-noded rectangular element in Lagrangian. **(08 Marks)**

b. Explain the following with neat sketches:-

(i) Iso-parametric element.

(ii) Sub-parametric element.

(iii) Super-parametric element. **(06 Marks)**

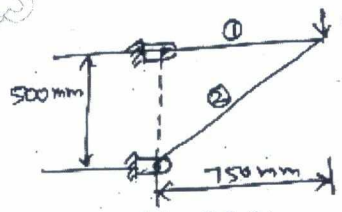
c. Find $I = \int_{-1}^{1} (a_0 + a_1\xi + a_2\xi^2 + a_3\xi^3)\,d\xi$. Use 2-point formula a's are constants. **(06 Marks)**

6 a. Derive the stiffness matrix for a truss element. **(10 Marks)**

b. A truss shown in Fig. Q6 (b), is made of 2 bars, determine

(i) Nodal displacement.

(ii) Stresses in each element. **(10 Marks)**



$E_1 = E_2 = 200$ GPa
$A_1 = 1000$ mm^2
$A_2 = 1200$ mm^2

Fig. Q6 (b)

7 a. Derive the Hermite shape function for a beam element. **(12 Marks)**

b. A Cantilever beam subjected to point load of 250 KN as shown in Fig. Q7 (b). Determine deflection at tip and support reactions.
$E = 200$ GPa, $I = 4\times10^6$ mm^4, $l_e = 0.8$m. **(08 Marks)**

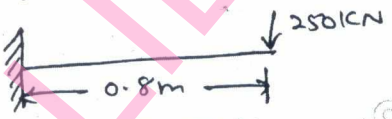


Fig. Q7 (b)

8 a. Calculate the temperature distribution in a 1-D fin with the physical properties given in Fig. Q8 (a). There is a uniform generation of heat inside the wall of $\bar{Q} = 400$ W/m^3. **(10 Marks)**

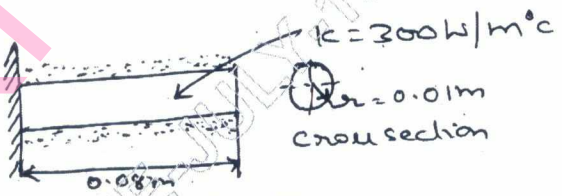


Fig . Q8 (a)

b. Determine the temperature distribution through the composite wall as shown in Fig. Q8 (b). Convection heat loss occurs on the right surface. Assume a unit area. **(10 Marks)**

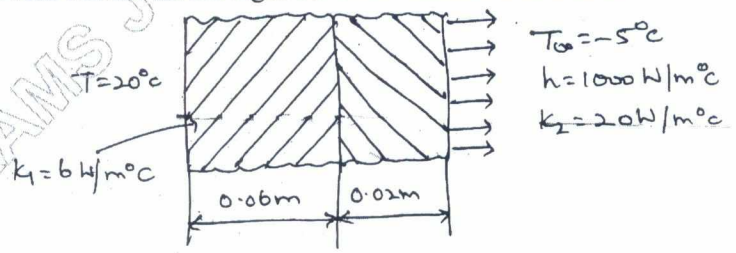


Fig. Q8 (b)

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10ME65

Sixth Semester B.E. Degree Examination, June/July 2018
Mechatronics and Microprocessor

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is Mechatronics? What are the advantages, disadvantages and applications of mechatronics? **(08 Marks)**

b. What is sequential controller and explain with a block diagram the working of an domestic washing machine. **(12 Marks)**

2 a. Define the following terms: i) Accuracy ii) Hysteresis error iii) Repeatability iv) Drift v) Speed of response. **(10 Marks)**

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

c. Explain the following:
i) Input and output transducer.
ii) Primary and secondary transducer. **(04 Marks)**

3 a. Differentiate between a diode, thyristor and transistor. **(06 Marks)**

b. What are stepper motors? State the advantages and applications. **(08 Marks)**

c. Write short notes on relays. **(06 Marks)**

4 a. Explain the wheat stone circuit used for strain measurement. **(06 Marks)**

b. Write a note on data acquisition system. **(06 Marks)**

c. Define protection. Explain how high voltages and wrong polarity may be protected against, by the use of a zener diode circuit. **(08 Marks)**

PART – B

5 a. With the help of a block diagram, explain briefly the organization of a microprocessor. **(06 Marks)**

b. What are logic gates? Discuss AND and OR gates with their truth tables and symbols. **(08 Marks)**

c. Explain different methods of representing negative number. **(06 Marks)**

6 a. Explain in detail with a block diagram, the architecture of Intel 8085A microprocessor. **(10 Marks)**

b. Define the following: i) Write cycle ii) Interrupts. **(04 Marks)**

c. What are microcontrollers? Distinguish between a microprocessor and a microcontroller. **(06 Marks)**

7 a. Explain the classification of instructions for the Intel's 8085 microprocessor. **(10 Marks)**

b. With a neat flow chart, discuss the programming process. **(10 Marks)**

8 a. Explain with a block diagram the flow of instruction word and flow of data word in a microprocessor. **(12 Marks)**

b. List the four operations commonly performed by a CPU. **(04 Marks)**

c. Explain the following: i) System timing ii) Accumulator. **(04 Marks)**

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10ME665

Sixth Semester B.E. Degree Examination, June/July 2018
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. How do you classify Non-traditional Machining processes? Discuss briefly. **(08 Marks)**
b. Compare the Traditional and Non-Traditional machining processes. **(06 Marks)**
c. Write a short note on Abrasive slurry. **(06 Marks)**

2 a. With a neat sketch, explain the working principle and operation of USM process. **(08 Marks)**
b. Discuss the effects of the following parameters on MRR applicable to USM process:
(i) Amplitude and frequency of vibration.
(ii) Applied static load.
(iii) Ratio of workhardness to Tool hardness. **(06 Marks)**
c. Mention any two advantages, disadvantages and applications of USM process. **(06 Marks)**

3 a. With a neat sketch, explain the working principle and operation of AJM process. **(08 Marks)**
b. Derive an expression for MRR of brittle materials in case of AJM process. **(06 Marks)**
c. Mention any two advantages, disadvantages and applications of Water Jet Machining process. **(06 Marks)**

4 a. Briefly explain the electrolytes used in ECM process. **(08 Marks)**
b. Briefly explain the Chemical Reactions that occur in ECM process. **(06 Marks)**
c. With a schematic diagram, explain the Electro-Chemical Honing process. **(06 Marks)**

PART – B

5 a. List out the various process parameters and briefly explain their effects on Chemical Machining process. **(08 Marks)**
b. With the help of a flow chart, briefly explain the Chemical Milling process. **(06 Marks)**
c. Write a short note on Chemical Blanking. **(06 Marks)**

6 a. With a neat sketch, briefly explain the Feed control in EDM process. **(08 Marks)**
b. What is flushing? Explain any two methods of flushing in EDM process. **(06 Marks)**
c. What are the requirements of Dielectric fluid? Mention any two dielectric fluids used in EDM process. **(06 Marks)**

7 a. With a neat sketch, explain the working principle of ECG process. **(08 Marks)**
b. With a neat sketch, briefly explain the PAM process. **(06 Marks)**
c. Discuss some of the important considerations in the design of Plasma Torch in PAM. **(06 Marks)**

8 a. With a neat sketch, briefly explain the principle and working of Laser Beam Machining process. **(08 Marks)**
b. With a neat sketch, briefly explain the principle and working of Electron Beam Machining. **(06 Marks)**
c. Mention any two advantages, disadvantages and applications of Laser Beam Machining. **(06 Marks)**

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