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7E7011

B.Tech. VII Semester(Main&Back) Examination,November - 2019

Mechanical Engg.

7ME1A Finite Element Methods

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly). Units of quantities used/calculated must be stated clearly.*

Unit - I

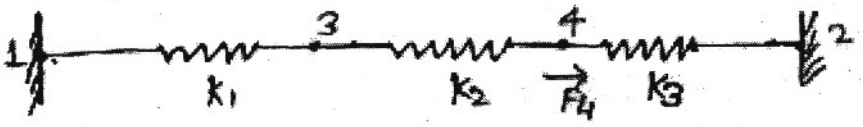
1. a) Solve following equations by using Gauss Elimination method **(12)**

$$X_1 + 2X_2 + 3X_3 = 1$$
$$2X_1 + 3X_2 + 2X_3 = 2$$
$$3X_1 + 3X_2 + 4X_3 = 1$$

b) Write five properties of stiffness matrices. **(4)**

(OR)

1. a) For the given spring system with arbitrary numbered nodes, obtain : **(12)**



k_1 = 1000 lb/in, k_2 = 2000 lb/in k_3 = 3000 lb/in

The force at node 4 = 5000 lb.

i) The Global stiffness matrix

ii) The displacement of nodes 3 and 4.

iii) The reaction forces at nodes 1 and 2.

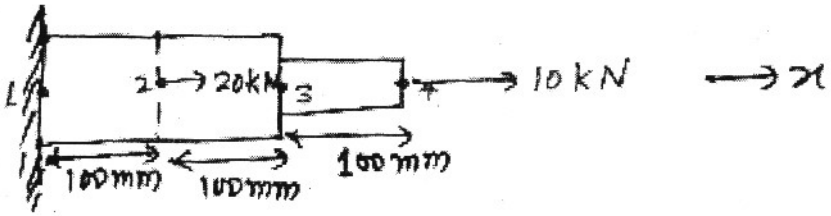
b) Define Bandwidth and write any matrix of bandwidth of 2. **(4)**

Unit - II

2. a) Using MPE approach for the given system. Calculate : **(12)**

i) Displacements at node 2, 3 and 4.

ii) Reaction force at node 1.



$A_1 = 20\ mm^2$ $E_1 = 50\ GPa$

$A_2 = 10\ mm^2$ $E_2 = 100\ GPa$

b) Sketch and name the different types of 1D, 2D and 3D elements used in FEA. **(4)**

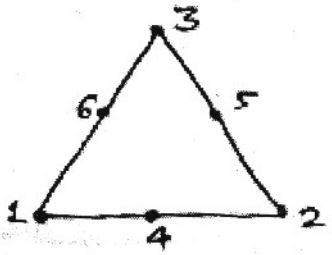
(OR)

2. a) Derive the shape functions for the three noded line element and plot the variation of interpolation functions of it. **(12)**

b) Discuss FE model concept/discretization. **(4)**

Unit - III

3. a) Derive the shape functions for the all the 6 nodes for following triangular element. **(8)**



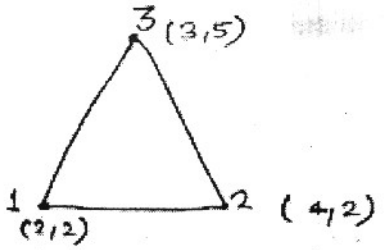
Node 4,5 and 6 are mid point nodes.

b) Evaluate the following integral I, by using 2 point Gauss quadrature, also compare the result with exact solution.

$$I = \int_{-1}^{1} \left(3e^x + x^2 + \frac{1}{(x+2)} \right) dx$$ **(8)**

(OR)

3. a) Calculate the shape functions matrix [N] at node 1,2,3 and also at the centroid of the triangle. **(8)**



b) Explain plane stress and plane strain problems with suitable examples. **(8)**

Unit - IV

4. Obtain a two term Galerkin solution for the problem

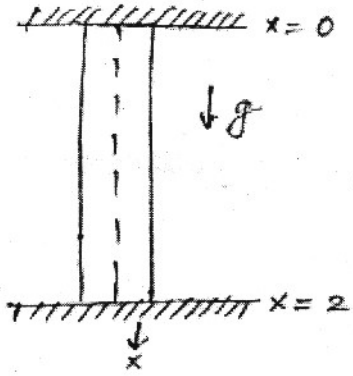
$$\frac{d^2y}{dx^2} - 10x^2 = 5 \ , \quad 0 \le x \le 1$$

With boundary conditions y (0) = y(1) = 0.

And using the trail functions $N_1(x) = x(x-1) and\ N_2(x) = x^2(x-1)$. **(16)**

(OR)

4. Using Rayleigh - Ritz method, find the displacement of the mid - point of the rod as shown in figure. **(16)**



Body force per unit volume, Pg = 1 E = A = 1.

Unit - V

5. Discuss

a) Convergence and Aspect ratio.

b) Concept of element mass matrix in dynamic analysis. **(8+8)**

(OR)

5. Write notes on

a) Static condensation and Polynomial interpolation. **(8)**

b) Methods of mesh refinement. **(8)**

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B.Tech. VII Semester(Main/Back) Examination, November - 2019

Mechanical Engineering

7ME2A Refrigeration and Air Conditioning

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following suitable material is permitted during examination. (Mentioned in form no. 205)

1. Psychrometric charts - 2 nos.

Unit - I

1. a) Define one tonne of refrigeration. Derive relationship between C.O.P. of refrigerator and heat pump working on reversed carnot cycle and show the schematic diagram. **(8)**

b) Following results were obtained in a test conducted on a vapour compression refrigerator : Evaporator temperature = -28°C, Condenser pressure = 2.75 bar, Refrigerant leaving the condenser is 3°C superheat, refrigerant leaving the condenser is at 12.8°C. Determine the C.O.P. The following parameters are given : **(8)**

Pressure	Saturation	Enthalpy		Entropy	Specific heat (KJ/Kg-K)	
(bar)	temp. (°C)	(KJ/Kg)		(KJ/Kg)	at Constant pressure	
		Liquid	Vapour		Liquid	Vapour
2.75	14	438.48	802.9	5.5287	1.381	0.669
0.412	-28.5	381.58	783.24	5.6852	-	-

(OR)

1. a) Explain the effect of following on the performance of VCRS with the help of T - s and p - h chart.

   i) Decrease in evaporator pressure

   ii) Increase in condenser pressure

   iii) Suction vapor superheat

   iv) Sub - cooling of saturated liquid. **(8)**

   b) Explain with the help of neat sketch, the working of a refrigeration system having three evaporators at different temperatures with individual compression and multiple expansion valves. **(8)**

Unit - II

2. a) A dense air refrigeration cycle operates between 5 bar and 20 bar. The air temperature after heat rejection to surroundings is 37°C and air temperature at exit of refrigerator is 7°C. The isentropic efficiencies of compressor and turbine are 0.84 and 0.82 respectively. Determine

   i) Compressor and turbine work per tonne of refrigeration

   ii) C.O.P. **(10)**

   b) The higher we go, the cooler we find, then why aircrafts are air conditioned when they cruise at an altitude of 8500 metre. **(6)**

(OR)

2. a) An aircraft refrigeration plant has to handle a cabin load of 25 tonnes. The atmospheric temperature is 16°C. The atmospheric air is compressed to a pressure of 0.96 bar and temperature of 29°C due to ram action. This air is then further compressed in a compressor to 4.8 bar, cooled in a heat exchanger to 66°C, expanded in a turbine to 1 bar pressure and supplied to the cabin. The air leaves the cabin at a temperature of 26°C. The isentropic efficiency of both compressor and turbine are 0.9. Calculate

   i) The mass of air circulated per minute

   ii) C.O.P. (for air Take $c_p = 1.005$ KJ/Kg and $\gamma = 1.4$) **(10)**

   b) Draw schematic diagram of regenerative air refrigeration system and show it on T-s graph. **(6)**

Unit - III

3. a) With the help of neat sketch, Explain the principal and working of Electrolux Refrigerator. **(8)**

   b) Draw a neat sketch of simple vapour absorption refrigeration system. Derive formula for C.O.P. of an ideal vapour absorption system. **(8)**

(OR)

3. a) What are the desirable properties of an ideal refrigerant. Write the chemical formula for the refrigerant R - 11 and R 717. **(8)**

b) A single - stage single - acting reciprocating receiver has a bore of 180 mm and stroke of 270 mm. It receives vapor refrigerant at 1 bar and delivers it at 5 bar. If the compression and expansion follow the law $pV^{1.25}$ = constant and clearance volume is 5% of the stroke volume. Determine

i) The power required to derive the compressor if it runs at 600 r.p.m.; and

ii) The volumetric efficiency of the compressor. **(8)**

Unit - IV

4. a) Write a short note on the following :

i) Specific humidity

ii) Dew point temperature

iii) Wet bulb depression

iv) Adiabatic saturation process. **(8)**

b) In a cooling application, moist air enters a refrigeration coil at the rate of 100 Kg/min. at 35°C and 50% relative humidity. The apparatus dew point of coil is 5°C and bypass factor is 0.15. Using psychrometric chart, Determine

i) Outlet state of moist air

ii) Cooling capacity of coil in tones of refrigeration. **(8)**

(OR)

4. a) Define the term "Human Comfort". Explain the factors affecting human comfort. **(8)**

b) Define the term "Effective Temperature". Explain the factors governing effective temperature. **(8)**

Unit - V

5. a) With the help of neat sketch, explain the central air conditioning system. **(8)**

b) 250 m^3/min of air at atmospheric conditions 12°C DBT and 50% RH is supplied to an air - condifioned hall. The required conditions are 18°C DBT and 60% RH determine :

i) Sensible heat and latent heat removed from the air per minute

ii) Sensible heat factor for the system. **(8)**

(OR)

5. a) With the help of neat sketch, explain unitary air conditioning system. **(8)**

b) The air handling unit of an air conditioning plant supplies a total of 4500 m^3/ min of dry air which comprises by weight 20 percent fresh air at 40°C DBT and 27°C WBT abd 80 percent recirculated air at 25°C and 50% RH. The air leaves the cooling coil at 13°C saturated state. Calculate the total cooling and room heat gain. **(8)**

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7E7013

B.Tech. VII Semester (Main&Back) Examination, Nov. - 2019
Mechanical Engineering
7ME3A Operations Research

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during the examination.(Mentioned in form No. 205)

1. Graph Paper. 2. .....Normal Distribution Table.

Unit - I

1. A manufacturer produces four products, A,B,C,and D, by using two types of machines (lathes and milling machines). The times required on the two machines to manufacture 1 unit of each of the four products, the profit per unit of the product, and the total time available on the two types of machines per day are given below :

Machine	Time required per unit (min) for product				Total time available per day (min)
	A	B	C	D	
Lathe machine	7	10	4	9	1200
Milling machine	3	40	1	1	800
Profit per unit (Rs)	45	100	30	50	

Find the number of units to be manufactured of each product per day for maximizing the profit using simplex method. **(16)**

OR

1. A product is produced by four factories A, B, C and D. The unit production costs in them are Rs. 2, Rs 3, Rs 1, Rs 5 respectively. Their production capacities are Factory A - 50 units, Factory B - 70 units, Factory C - 30 units, Factory D - 50 units. These factories supply product to four stores, demands of which are 25, 35, 105, 20 units respectively. Unit transportation cost in rupees from each factory to each store is given below :

		Stores			
		S_1	S_2	S_3	S_4
	A	2	4	6	11
Factories	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

Determine the extent of deliveries from each factory to each store so that total production and transportation costs are minimized. **(16)**

Unit - II

2. Solve the following problem using Integer linear programming :

Maximize $Z = 5X_1 + 7X_2$

Subject to :

$-2X_1 + 3X_2 \leq 6$

$6X_1 + 2X_2 \leq 30$

where $X_1, X_2 \geq 0$ and integers. **(16)**

OR

2. a) Machine A costs Rs. 9,000. Annual operating costs are Rs 200 for the first year, and then increases by Rs 2000 every year. Determine the best age at which to replace the machine. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine? Assume that the machine has no resale value when replaced and that future costs are not discounted. **(8)**

b) Machine B costs Rs 10,000. Annual operating costs are Rs 400 for the first year, and then increases by Rs 800 every year. You have now a machine of type A which is one year old. Should you replace it with machine B and if so, when? **(8)**

Unit - III

3. A bank has only one typist, Since the typing work varies in length (number of pages to be typed), the typing rate is randomly distributed approximating a Poisson distribution with a mean service rate of 8 letters per hour. The letters arrive at a rate of 5 per hour during the entire 8 - hour work day. If the type writer is valued at Rs. 1.50 per hour, determine

   a) Equipment utilization **(4)**

   b) The percent time that an arriving letter has to wait. **(4)**

   c) Average system time **(4)**

   d) Average cost due to waiting on the part of the typewriter. **(4)**

OR

3. For the following payoff matrix, transform the zero - sum game into an equivalent linear programming problem and solve it by using the simplex method. **(16)**

		Player B		
		B_1	B_2	B_3
Player A	A_1	1	-1	3
	A_2	3	5	-3
	A_3	6	2	-2

Unit - IV

4. A food product company is contemplating the introduction of a revolutionary product with new packaging or replacing the existing product at much higher price (S1). It may even make a moderate change in the composition of the existing product, with a new packaging at a small increase in price (S_2) or may make a small change in composition of the existing product, backing it with the word 'New' and a negligible increase in price (S3). The three possible states of nature or events are:

   i) High increase in sales (N1)

   ii) No change in sales (N2)

   iii) Decrease in Sales (N3).

   The marketing department of the company worked out the payoff in terms of yearly net profits for each strategy of three events as :

Pay off Table

States of Nature

Strategies/alternatives	N1	N2	N3
S1	7,00,000	3,00,000	1,50,000
S2	5,00,000	4,50,000	0
S3	3,00,000	3,00,000	3,00,000

Which strategy should be the concerned executive choose on the basis of :

a) Maximin criteria **(4)**

b) Maximax criteria **(4)**

c) Minimax regret criteria **(4)**

d) Laplace criteria? **(4)**

OR

4. A toy manufacturer uses 48,000 rubber wheels per year for its popular dump truck series. The firm makes its own wheel which it can produce at a rate 800 per day. The toy trucks are assembled uniformly over the entire year. Carrying cost is Rs 1/- per wheel a year. Setup costs for a production run of wheel is Rs 45/-. The firm operates 240 days per year. Determine each of the following.

a) The optimum run size. **(4)**

b) The minimum total annual cost for carrying and setup. **(4)**

c) The cycle time for the optimum run size. **(4)**

d) The run time. **(4)**

Unit - V

5. The housekeeping department of a motel uses approximately 400 washcloths per day. The actual number tends to vary with the number of guests on any given night. Usage can be approximated by a normal distribution that has a mean of 400 and a standard deviation of nine washcloths per day. A linen supply company delivers towels and washcloths with a lead time of three days. If the motel policy is to maintain a stockout risk of 2 percent, what is the minimum number of wash cloths that must be on hand at recorder time, and how much of that amount can be considered safety stock? **(16)**

OR

5. a) How simulation can be used in decision making? Explain with suitable example. **(8)**

b) Explain the various methods for generation of random numbers with examples? **(8)**

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7E7014

B.Tech. VII Semester (Main/Back) Examination, November - 2019
Mechanical Engineering
7ME4A Turbomachines

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

UNIT - I

1. a) Explain the following : **(4×2=8)**

i) Principle of conservation of Mass

ii) First law of thermodynamics

iii) Newton's second law of motion

iv) Second law of thermodynamics

b) One - fifth scale model of a pump was tested in a laboratory at 1000 rpm. The head developed and the power input at the best efficiency was found to be 8 m and 30 kW respectively. If the prototype pump has to work against a head of 25 m, determine its working speed, the power required to drive it and the ratio of flow rates handled by the two pumps. **(8)**

(OR)

1. a) What is similitude? What are the different types of similarities between the model and its prototype? **(8)**

b) The efficiency of a turbomachine depends on density 'ρ', dynamic viscosity 'μ' of the fluid, angular velocity ω, diameter 'D' of the rotor and the discharge 'Q'. Express 'η' in terms of the dimensionless parameters. **(8)**

UNIT - II

2. a) An axial compressor has a mean diameter of 60 cm and runs at 15000 rpm. If the actual temperature rise and pressure ratio developed are 30°C and 1.3 respectively.

Determine :

i) Power required to derive the compressor while delivering 57 kg/s of air, assuming $\eta_m = 86\%$ and initial temperature of 35°C,

ii) The stage efficiency,

iii) The degree of reaction if the temperature at the rotor exit is 55°C. Take $C_p = 1.005$ kJ/kg - K. **(8)**

b) Explain the working principle of a double acting reciprocating compressor. **(8)**

(OR)

2. a) Explain surging, choking and stalling phenomenon in compressor. **(8)**

b) What is meant by a stage and explain in detail the stage velocity triangles of axial flow compressor. **(8)**

UNIT - III

3. a) Derive the expression for minimum starting speed of centrifugal pump. **(8)**

b) An axial flow pump has an impeller of outlet diameter 1 m. The diameter of boss is 0.5 m. If specific speed of pump is 38 and velocity of flow is 2m/s. Suggest a suitable speed of the pump to give a head of 6 m. Also determine vane angle at the entry of the pump, if the flow is axial at inlet. **(8)**

(OR)

3. a) Explain the working of a centrifugal pump with neat diagram. **(8)**

b) Explain cavitation and methods of preventing cavitation. **(8)**

UNIT - IV

4. a) With the aid of the schematic diagram and thermodynamic cycle, explain the working of a turbo prop engine. **(8)**

b) Draw the schematic diagram of a simple gas cycle with a heat exchanger and explain briefly the working principle. **(8)**

(OR)

4. a) A gas turbine cycle has a perfect heat exchanger. Air enters the compressor at a temperature and pressure of 300 k and 1 bar and discharges at 475 k and 5 bar. After passing through the heat exchanger the air temperature increases to 655 K. the temperature of air entering and leaving the turbine are 870°C and 450°C. Assuming no pressure drop through the heat exchanger, compute :-

i) the output per kg of air,

ii) the efficiency of the cycle,

iii) the work required to drive the compressor. **(8)**

b) Mention the various advantages and disadvantages of the pulse jet engine. **(8)**

UNIT - V

5. a) Write the difference between impulse turbine and reaction turbine. **(8)**

b) What do you understand by compounding of turbine? Name different types of compounding used. **(8)**

(OR)

5. a) Explain the following :

i) Zero percent reaction stage.

ii) Fifty percent reaction stage. **(8)**

b) A multistage gas turbine is to be designed with impulse stage, and is to operate with an inlet pressure and temperature of 6 bar and 900 k and an outlet pressure of 1 bar. The isentropic efficiency of the turbine is 85%. All the stages are to have a nozzle outlet angle of 75° and equal outlet and inlet blade angles. Mean blade speed of 250 m/s and equal inlet and outlet gas velocities. Estimate the maximum number of stages required. Assume C_p = 1.15 kJ/kg - K, γ = 1.33 and optimum blade speed ratio. **(8)**

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B.Tech. VII - Semester (Main&Back) Examination, Nov. - 2019
Mechanical Engg.
7ME5A Operations Management

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five questions**, selecting **one** question from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

UNIT - I

1. Explain the terms 'operation' and 'operations strategy'. Discuss the scope of operation management. **(8+8)**

(OR)

1. Why forecasting is important for operation of a system? Discuss various long term, medium term and short term forecasting methods. **(4+12)**

UNIT - II

2. Briefly describe the basic types of manufacturing system i.e. Job shop, Batch, Mass production, and continuous production. Give examples of situations in which each would be used. **(8+8)**

(OR)

2. Is capacity planning a strategic decision? Explain how capacity planning decisions are critical for an organization? Discuss the various factors that determine the effective capacity? **(4+4+8)**

UNIT - III

3. a) What factors would you consider to decide the location of a manufacturing unit? How will you evaluate alternate location? **(4+4)**

   b) How is a cellular layout different from product layout and process layout? List its applications and advantages. **(4+4)**

(OR)

3. Explain following terms :

   i) BOM

   ii) MPS

   iii) MRP

   iv) ERP **(4×4=16)**

UNIT - IV

4. Consider the following two machines and six jobs scheduling problem. Using johnson's algorithm, obtain the optimal sequence which will minimize the make span. Also find idle time of both machines and draw Gautt chart.

Job	1	2	3	4	5	6
M1	5	2	13	10	8	12
M2	4	3	14	1	9	11

(16)

OR

4. Explain following terms

   a) JIT

   b) Lean Operations

   c) Synchronous production

   d) Pull and push type systems **(4×4=16)**

UNIT - V

5. What do you understand with the term 'supply chain management'? Why it is important in present era? Discuss Bull whip effect. **(4+4+8)**

OR

5. What is project? Discuss role of a project manager. Explain different phases of project management. Also differentiate between CPM and PERT. **(4+4+4+4)**

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B.Tech. VII - Semester (Main and Back) Examination, Nov. - 2019
Mechanical Engg.
7ME6.2A Robotics
(Common for ME, PE)

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

UNIT - I

1. Describe evolution of robots and robotics. How are robots different from conventional machine tools in terms of design and control? **(16)**

(OR)

1. Explain the mechanical structure of a manipulator using neat sketches. Briefly describe the four basic configurations of arm in manipulators. **(16)**

UNIT - II

2. Classify the end - effectors. Differentiate between various grippers on the basis of design and drive system. **(16)**

(OR)

2. The coordinates of point k in frame {1} are $[3.0 \;\; 2.0 \;\; 1.0]^T$. The position vector k is rotated about z - axis by 45°. Find the coordinates of point L, the new position of point K. **(16)**

UNIT - III

3. Explain the kinematic modeling of a manipulator. Describe various inputs and outputs considered in the modeling. **(16)**

(OR)

3. Explain in detail the two approaches to the solutions to the inverse kinematic model. **(16)**

UNIT - IV

4. What are the various sensors used in robotics? Describe the criteria of selecting sensor for different application. **(16)**

(OR)

4. Describe the architecture of Robotic vision system. Write about its industrial applications. **(16)**

UNIT - V

5. Write about assembly and inspection applications of robots. **(16)**

(OR)

5. Classify the robot languages. Highlight the importance of computer control and robot software. **(16)**
