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7E1747

Roll No. \_\_\_\_\_

Total No. of Pages: 3

7E1747

B. Tech. VII - Sem. (Main / Back) Exam., January - 2022  
Mechanical Engineering  
7ME5 -11 I. C. Engines

Time: 3 Hours

Maximum Marks: 120  
Min. Passing Marks: 42

Instructions to Candidates:

*Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.*

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

1. NIL

2. NIL

### PART - A

(Answer should be given up to 25 words only)

[10×2=20]

All questions are compulsory

- Q.1 List the various factors that influence the flame speed in S.I. combustion.
- Q.2 What are the objectives to be kept in mind during design of combustion chamber?
- Q.3 What is pre-ignition?
- Q.4 List some of the important requirements of automobile carburetors.
- Q.5 What are the factors effecting carburetion?

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- Q.6 Differentiate between supercharger and turbocharger.
- Q.7 What do you mean by IHP, BHP and FHP?
- Q.8 List the advantages and disadvantages of natural gas.
- Q.9 What is the effect of delay period on knock in CI engines?
- Q.10 What are the fundamental differences between SI and CI engines?

### **PART – B**

**(Analytical/Problem solving questions)**

**[5×8=40]**

**Attempt any five questions**

- Q.1 Explain the method of supercharging and its advantages in four stroke engines.
- Q.2 Describe mist lubrication system in 2-stroke engines.
- Q.3 Explain the combustion stages of CI engines.
- Q.4 Write short note on alternative fuel in IC engine.
- Q.5 Explain the working of a battery ignition system with the help of neat sketch.
- Q.6 Discuss the differences between ideal and actual valve timing diagrams of a two and four stroke petrol engine.
- Q.7 Describe with the help of suitable diagram of common rail direct injection system.



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## **PART - C**

**(Descriptive/Analytical/Problem Solving/Design Questions)**

**[4×15=60]**

**Attempt any four questions**

Q.1 Following data is available for a 4-stroke petrol engine –

Air fuel ratio – 15.5:1

Calorific value of fuel 16000 kJ/kg

Air standard efficiency = 53

Mechanical efficiency = 80%

Indicated thermal efficiency = 37%

Volumetric efficiency = 80%

Stroke/Bore ratio = 1.25

Suction pressure = 1 bar

Suction temperature = 27° C, RPM = 2000

Brake power = 72 kW

Calculate the followings –

(i) Brake specific fuel consumption

(ii) Bore and stroke

Q.2 Explain the working of a 2-stroke, naturally aspirated SI engine with a neat sketch.

Q.3 Explain the working of free piston and rotary engine.

Q.4 Explain the suitability of a diesel engine to run on dual fuel. Why the preferred fuel for a diesel engine is natural gas?

Q.5 Why is cooling of IC engine required? Explain various methods in detail.

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7E1748

Roll No. \_\_\_\_\_

Total No. of Pages: 4**7E1748****B. Tech. VII - Sem. (Main / Back) Exam., January - 2022****Mechanical Engineering****7ME5 -12 Operations Research****Time: 3 Hours****Maximum Marks: 120****Min. Passing Marks: 42***Instructions to Candidates:**Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.**Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.**Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*1. NIL2. NIL**PART – A****(Answer should be given up to 25 words only)****[10×2=20]****All questions are compulsory**

Q.1 Define operation research.

Q.2 What do you mean by unbounded solution?

Q.3 What is unbalanced transportation problem?

Q.4 Write three limitation of game theory.

Q.5 Write down the assumptions of queuing theory.



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- Q.6 Differentiate slack and surplus variables.
- Q.7 Discuss need of simulation.
- Q.8 Write down the important applications of queuing theory.
- Q.9 What is the importance of maintaining an inventory?
- Q.10 What is 'EOQ' in inventory control?

### **PART – B**

**(Analytical/Problem solving questions)**

**[5×8=40]**

**Attempt any five questions**

- Q.1 Describe the transportation problem and give its mathematical module.
- Q.2 Explain cutting plane method in integer model.
- Q.3 What is game theory? Discuss the various approaches in solving for strategies and game value.
- Q.4 Explain the different costs that are involved in inventory problems with suitable examples.
- Q.5 What is decision theory? Describe some methods which are useful in decision – making under uncertainty.
- Q.6 Explain the application of simulation technique to the inventory techniques.
- Q.7 Write short note on probabilistic inventory model.

## PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [4×15=60]

Attempt any four questions

Q.1 Maximize  $z = 2x_1 + 4x_2 + x_3 + x_4$

Subject to  $x_1 + 3x_2 + x_4 \leq 4$

$$2x_1 + x_2 \leq 3$$

$$x_2 + x_3 + x_4 \leq 3$$

$$x_1, x_2, x_3, x_4 \geq 0$$

Q.2 A manufacture is offered two machines A and B. A is priced at ₹ 500 and running costs are estimated at ₹ 800 for each of the first five years, increasing by ₹ 200 per year in the sixth and subsequent years. Machine B is having cost of ₹ 1200 per year for sixth year increasing by ₹ 200 per year thereafter. If the time value of money is 10% per year, which machine should be purchased?

Q.3 Ships arrive at a port at the rate of one in every 4 hours with exponential distribution of inter arrival times. The time of a ship occupies a berth for unloading has exponential distribution with an average of 10 hours. If the average delay of ships waiting for berths is to be kept below 14 hours, how many berth should be provided at the port?



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Q.4 A drug store orders copies of a popular monthly magazines at a cost of 75 cents per copy.

At the end of the month, when the next issue is delivered any leftover copies can be returned to the distributor for a credit of 25 cents each. The cover price of the magazine is \$ 1.50.

Monthly demand for the magazine can be regarded as normally distributed with a mean of 50 copies and a standard deviation of 15. How many copies should the store order?

Q.5 A bakery keeps stock of a popular brand of cake. As per previous experience shows that

the daily demand pattern for the item associated with probability is given below –

Daily Demand	0	10	20	30	40	50
Probability	0.10	0.20	0.15	0.50	0.12	0.02

Use the following sequence of random nos. to simulate the demand for the next 10 days, also find out the average demand per day.

Random nos. → 25, 39, 65, 12, 73, 05, 49, 19, 89, 76

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7E1749

Roll No. \_\_\_\_\_

Total No. of Pages: 4**7E1749****B. Tech. VII - Sem. (Main / Back) Exam., January - 2022****Mechanical Engineering  
7ME5 -13 Turbomachines****Time: 3 Hours****Maximum Marks: 120  
Min. Passing Marks: 42***Instructions to Candidates:**Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.**Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.**Use of following supporting material is permitted during examination.  
(Mentioned in form No. 205)*1. NIL2. NIL**PART - A****(Answer should be given up to 25 words only)****[10×2=20]****All questions are compulsory**

Q.1 Define the specific speed of a fluid machine.

Q.2 Write down the continuity equation.

Q.3 What is the Euler's pump equation?

Q.4 Write down the Newton's law of viscosity.

Q.5 Write down the formulae of manometric efficiency, mechanical efficiency and overall efficiency for centrifugal pump.



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- Q.6 Define Reynolds number and write expression for it.
- Q.7 What is the "Degree of reaction" for a Turbomachine?
- Q.8 Write down the steady flow equation of First law of thermodynamics.
- Q.9 State the difference between impulse and reaction turbine.
- Q.10 What is the stagnation state of fluid? Write expression for Stagnation Enthalpy.

### PART – B

(Analytical/Problem solving questions)

[5×8=40]

Attempt any five questions

- Q.1 Derive and explain Euler equation for turbine and pump. Draw a velocity triangles and state the assumptions.
- Q.2 With the help of inlet and outlet velocity triangles, show that the degree of reaction for an axial flow compressor is given by -

$$R = \frac{V_a}{u \times 2} (\cot \beta_1 + \cot \beta_2)$$

Where;  $V_a$  = axial flow velocity and  $u$  = blade velocity.

- Q.3 Sketch the velocity triangles at inlet and outlet for a centrifugal pump with radial inlet for-
- (a) Forward curved
  - (b) Radial
  - (c) Backward curved vanes

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Q.4 Derive the relation -

$$S = \frac{D}{1-R}$$

Where: S = static component of energy transfer

D = dynamic component of energy transfers in any turbomachine

R = degree of reaction

Q.5 An air compressor has the following data: Inlet pressure = 1.02 bar, exit pressure = 1.5 bar, inlet temperature = 300 K, outlet temperature = 340 K. Determine -

- (a) Isentropic compression efficiency and
- (b) Polytropic efficiency

Q.6 A centrifugal compressor with an overall diameter of 100 cm having speed of 5000 rpm.

Air is supplied to the compressor at 20 °C and at 1 bar. The air is flow at rate of 25 kg/s.

Isentropic pressure ratio is 2.5. Calculate -

- (a) the isentropic efficiency
- (b) the rotor power and
- (c) the shaft power.

Take slip factor is 0.9

Q.7 Derive the following terms with respect to axial compressor -

- (a) Work done factor
- (b) Flow coefficient
- (c) Pressure coefficient



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## PART – C

(Descriptive/Analytical/Problem Solving/Design Questions)

[4×15=60]

Attempt any four questions

Q.1 Sketch the velocity diagram for an axial flow compressor and derive the following relation –

$$\frac{P_{02}}{P_{01}} = \left[ 1 + \frac{\eta_{ct-t} u(\Delta v_w)}{g_c C_p T_{01}} \right]^{\frac{\gamma}{\gamma-1}}$$

Q.2 Derive an expression for the overall pressure ratio developed in the centrifugal compressor.

Q.3 Explain the phenomenon of cavitation as it happens in centrifugal pump. Can it be prevented? Explain with reasons.

Q.4 Explain the construction and working of single and double acting reciprocating compressor with suitable diagrams.

Q.5 Explain the followings –

- (a) Working principle of air vessels
- (b) Causes and mitigation of slip in reciprocating pumps
- (c) Combined velocity diagram for 50% reaction and maximum utilization for a turbine.

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7E1750

Roll No. \_\_\_\_\_

Total No. of Pages: 2

7E1750

B. Tech. VII - Sem. (Main / Back) Exam., January - 2022

Open Elective - I

7ME6 – 60.1 Finite Element Analysis

Time: 3 Hours

Maximum Marks: 120  
Min. Passing Marks: 42*Instructions to Candidates:**Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.**Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.**Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*1. NIL2. NIL**PART – A****(Answer should be given up to 25 words only)****[10×2=20]****All questions are compulsory**

- Q.1 Explain Industrial aspect of FEM.  
 Q.2 Define Local Stiffness matrix in FEM.  
 Q.3 Explain stress and strain tensor.  
 Q.4 Explain shape function and its working using in Finite Element Analysis.  
 Q.5 Explain outcome of Finite Analysis.  
 Q.6 Define one-dimensional structural problem in Finite Element Analysis.  
 Q.7 Define Plane stress in FEM.  
 Q.8 Explain CST in FEM.  
 Q.9 Define Aspect ratio.  
 Q.10 Explain the advantages of FEM.



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## **PART – B**

**(Analytical/Problem solving questions)**

**[5×8=40]**

**Attempt any five questions**

- Q.1 What is objective to Finite Elements Analysis?
- Q.2 Define Global Stiffness Matrix.
- Q.3 Define Boundary conditions for FEM.
- Q.4 What is one-dimensional heat transfer problem? Explain.
- Q.5 Explain convergence of solution.
- Q.6 Define node numbering and connectivity.
- Q.7 Explain Banded Symmetric Matrix and Bandwidth.

## **PART – C**

**(Descriptive/Analytical/Problem Solving/Design Questions)**

**[4×15=60]**

**Attempt any four questions**

- Q.1 Derive Governing Differential equation for Finite Element formulation.
  - Q.2 Derive Finite Element equation using potential energy for linear element.
  - Q.3 Derive Lagrange's interpolation formula for shape function.
  - Q.4 Explain Finite Element Model Concept.
  - Q.5 Define 2-D structural analysis problem in FEM.
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7E1751

Roll No. \_\_\_\_\_

Total No. of Pages: **3****7E1751****B. Tech. VII - Sem. (Main / Back) Exam., January - 2022****Open Elective - I****7ME6 – 60.2 Quality Management****Time: 3 Hours****Maximum Marks: 120****Min. Passing Marks: 42***Instructions to Candidates:**Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.**Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.**Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*1. NIL2. NIL**PART – A****(Answer should be given up to 25 words only)****[10×2=20]****All questions are compulsory**

Write briefly -

Q.1. Define quality assurance.

Q.2. What is customer's perception of quality?

Q.3. What is the mean time between failures?

Q.4. State the utility of quality circles.



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- Q.5 Discuss quality cost.
- Q.6 State the graphical tools for data representation.
- Q.7 State seven basic QC tools.
- Q.8 What are the different dimensions of quality?
- Q.9 What do you mean by acceptance sampling?
- Q.10 Define Lean philosophy.

### **PART – B**

**(Analytical/Problem solving questions)**

**[5×8=40]**

**Attempt any five questions**

- Q.1 Briefly explain the six basic concepts of Quality Management.
- Q.2 Explain Taguchi method for product quality improvement.
- Q.3 Explain the elements, benefits of equipment layout for JIT system.
- Q.4 What are the control charts? How are they made and used in controlling a process?
- Q.5 Explain, how six sigma helps an organization to improve quality of process?
- Q.6 Explain with a neat diagram, ISO 9001 requirements for maintaining quality.
- Q.7 Define benchmarking. What are the various types of benchmarking studies undertaken for improving quality? Describe briefly the steps involved in the benchmarking process.



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## **PART - C**

**(Descriptive/Analytical/Problem Solving/Design Questions)**

**[4×15=60]**

**Attempt any four questions**

- Q.1 Discuss the following in detail –
- ISO 14000 and QS 9000
  - Views of different quality gurus
- Q.2 (a) Explain the steps involved in plan formulation and implementation of TQM.  
 (b) Describe the steps involved in construction house of quality in QFD study.
- Q.3 Briefly describe Analysis of Variance (ANOVA) and Design and Analysis of Experiments (DOE) with respect to process quality improvement.
- Q.4 Explain briefly following design failure analysis –
- Process Failure Mode and Effect Analysis (PFMEA)
  - Product Reliability Analysis
- Q.5 In an automatic filling, 175 gms of certain chemicals is to be packed in certain container. The permissible variation is  $\pm 5$  gms. To investigate the capacity of process, samples of 5 each were drawn from 10 successive batches and data were recorded as given below -

Batch	1	2	3	4	5	6	7	8	9	10
Mean, $\bar{X}$	177	177	176	176	174	177	175	176	176	174
Range, R	3	5	3	8	2	8	5	7	3	2

Assuming the process to be control, establish the capacity of process and compute it with the stipulated specification. Take for subgroup of 5 items  $d_2 = 2.326$ .

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7E7011

Roll No. \_\_\_\_\_

Total No. of Pages: **2****7E7011****B. Tech. VII - Sem. (Main / Back) Exam., January - 2022****Mechanical Engineering****7ME1A Finite Element Methods****ME, PI****Time: 3 Hours****Maximum Marks: 80****Min. Passing Marks: 24***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 examination.  
(Mentioned in form No. 205)*

1. NIL2. NIL**UNIT - I**

- Q.1 (i) Explain the steps involved in FEM. [8]  
(ii) Explain the Gauss elimination method. [8]

**OR**

- Q.1 (i) List the advantages and disadvantages of FEM. [8]  
(ii) What do you understand by uniqueness of solution? [8]

**UNIT - II**

- Q.2 (i) Derive the shape functions for quadratic 1D bar element. [8]  
(ii) Explain simplex, complex and multiplex elements with examples. [8]

**OR**

- Q.2 (i) Explain the terms node and mesh. Also explain node numbering and its significance. [6]  
(ii) Derive the strain displacement matrix for a beam element using shape function. [10]

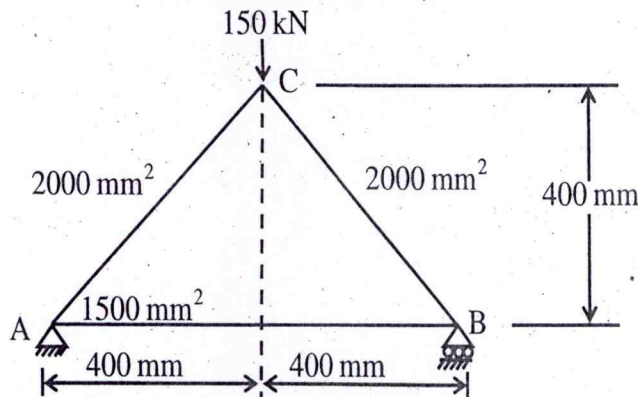


### UNIT - III

- Q.3 (i) Derive the shape functions for CST triangular element in local coordinates. [8]  
(ii) Explain Isoparametric formulation of 1D bar elements. [8]

OR

- Q.3 (i) Describe the formulation for plane stress and plane strain problems. [8]  
(ii) For a three bar truss system shown in figure, determine the nodal displacements and stresses in each member. Find the support reactions also. Take  $E=250 \text{ GPa}$ . [8]



### UNIT - IV

- Q.4 (i) Explain Least Square method with suitable examples. [8]  
(ii) Explain Rayleigh-Ritz method. [8]

OR

- Q.4 (i) Explain the Method of Weighted Residuals. [8]  
(ii) Derive 1D heat transfer equation by using any variational method. [8]

### UNIT - V

- Q.5 (i) Explain P and H methods of mesh refinement. [8]  
(ii) Write applications and advantages of finite element methods. [8]

OR

- Q.5 (i) Explain the concept of element mass matrix in dynamic analysis. [8]  
(ii) What is continuity? Derive their elements. [8]



7E7012

Roll No. \_\_\_\_\_

Total No. of Pages: **3**

**7E7012**

**B. Tech. VII - Sem. (Back) Exam., March - 2022**

**Mechanical Engineering**

**7ME2A Refrigeration and Air - Conditioning**

**Time: 3 Hours**

**Maximum Marks: 80**  
**Min. Passing Marks: 24**

*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 examination. (Mentioned in form No. 205)*

1. Steam table

2. Psychrometric chart

### **UNIT- I**

Q.1 (a) Explain the simple vapour compression cycle with the help of P-h and T-s diagram.

[8]

(b) Explain multiple evaporator with suitable diagram.

[8]

**OR**

Q.1 Explain the followings –

(a) Heat pump

[4]

(b) Reversed carnot cycle

[4]

(c) Second law of thermodynamics

[4]

(d) Cascade system

[4]

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## UNIT- II

Q.2 (a) Explain regenerative air refrigeration system with diagram also write its advantages.

[8]

(b) Explain reversed Brayton cycle with diagrams.

[8]

OR

Q.2 A gas refrigeration system working on reversed Brayton cycle at a temperature of 250K at the inlet of the compressor. If the temperature at the end of constant pressure cooling is 300K and raising the temperature of air in refrigerator is 50K, then find the network out.  
(Take  $C_p = 1 \text{ kJ/kg.K}$ )

[16]

## UNIT- III

Q.3 (a) Explain the principal and working of Electrolux Refrigerator with the help of neat sketch.

[8]

(b) Explain water vapour refrigeration system and also write advantages of the water vapour refrigeration system.

[8]

OR

Q.3 A vapour absorption refrigeration system comes with generator, ambient and evaporator temp. as 360K, 310K and 260K respectively. Find the maximum COP. if the evaporator temperature falls to 250K. What should be the generator temperature in order to operate the system with same COP.

[16]

## UNIT- IV

Q.4 (a) What is Human comfort? Explain the factor affecting of Human comfort.

[8]

(b) Explain By-pass factor, Dew point temperature and cooling coils also write its advantages.

[8]

OR



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Q.4 Explain the following terms -

- (a) Air washers [4]
- (b) Psychrometric charts [4]
- (c) Effective temperature [4]
- (d) Comfort charts [4]

### UNIT- V

- Q.5 (a) What is Heat load? Show the various steps of heat load calculation by taking a suitable example. [8]
- (b) Explain cooling load. Explain the method of estimating heat gain due to infiltration of air. [8]

### OR

- Q.5 (a) Explain air-condition system with neat sketch. [8]
- (b) What is heat gain? Explain heat gain system with diagram. [8]
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7E7013

Roll No. \_\_\_\_\_

Total No. of Pages: 3

7E7013

B. Tech. VII - Sem. (Back) Exam., January - 2022

Mechanical Engineering

7ME3A Operations Research

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks: 24

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 examination.  
(Mentioned in form No. 205)

1. NIL

2. NIL

### UNIT- I

Q.1 Consider the problem –

[16]

Max<sup>m</sup>

$$z = 6x_1 + 8x_2$$

Subjected to

$$x_1 + 2x_2 \leq 104$$

$$2x_1 + x_2 \leq 78$$

$$x_1 \geq 0, x_2 \geq 0$$

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OR

Q.1 Select the following Transportation cost –

[16]

	1	2	3	4	capacity
A	8	4	6	18	25
B	6	8	7	22	35
C	9	3	9	32	105
D	12	4	15	16	20
Demand	50	70	30	50	

UNIT- II

Q.2 Explain Branch and Bound Algorithm with an example.

[16]

OR

Q.2 Let the value of money be assumed to be 10% per year and suppose that Machine A is replaced after every years where as Machine B is replaced every six years. The yearly costs of both the machines are given as under -

Year	1	2	3	4	5	6
(Rs.)→						
M/c (A)	500	1000	200	1000	100	400
M/c (B)	1800	180	120	500	400	200

Determine which machine should be purchased?

[16]

### UNIT- III

Q.3 Solve the following by game theory –

[16]

Player(B)

Player (A)	6	8
	9	6
	12	15

OR

Q.3 Define Queuing theory and exponentially distributed service time.

[16]

### UNIT- IV

Q.4 Explain decision making, risk and uncertainty.

[16]

OR

Q.4 Write short note on -

[16]

- (a) Inventory Control Model
- (b) Two bin system
- (c) P and Q system
- (d) Single period model

### UNIT- V

Q.5 Define instantaneous demand without set up cost and with set up cost.

[16]

OR

Q.5 Explain simulation and method of simulation.

[16]



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Roll No. \_\_\_\_\_

Total No. of Pages: **2**

**7E7014**

**B. Tech. VII - Sem. (Main / Back) Exam., March - 2022**

**Mechanical Engineering**

**7ME4A Turbomachines**

**Time: 3 Hours**

**Maximum Marks: 80**

**Min. Passing Marks: 24**

*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 examination. (Mentioned in form No. 205)*

1. NIL

2. NIL

### UNIT- I

Q.1 Explain the following –

- (i) Newton's second law of motion [4]
- (ii) Second law of thermodynamics [4]
- (iii) Power coefficient [4]
- (iv) Mass flow rate [4]

OR

- Q.1 (a) Write down the expression for the dimensionless power coefficient of a turbine stage. Prove that it is proportional to the loading coefficient. [8]
- (b) A hydraulic turbine has an output of 6000 kW under a head of 30 m and runs at 85 rpm. What are the types of turbine? What would be its speed and power developed when working under a head of 18 m? [8]



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## UNIT- II

Q.2 Explain the centrifugal compressor with its components. Also explain slip factor and draw the velocity diagram of its types and compressor. [16]

OR

- Q.2 (a) Explain the construction features and working principle of single acting reciprocating compressor. [8]
- (b) Draw the sketch of an axial flow compressor with inlet guide vanes and explain working principle and performance coefficients. [8]

## UNIT- III

- Q.3 (a) A centrifugal pump has to deliver 20 liters/sec of water when running of 1200 rpm. The inlet vane angle is  $30^\circ$  and exit vane angle is  $45^\circ$  if the velocity of flow is constant in the impeller the power supplied to run the pump by moter is 40 kW. Assume the mechanical efficiency 90% find the inlet and outlet diameter of the impeller. [Take  $D_2 = 2D_1$ ] [10]
- (b) Explain the working of centrifugal pump with diagram. [6]

OR

- Q.3 Explain the following- [4]
- (a) Cavitation [4]
- (b) Minimum starting speed of centrifugal pump [4]
- (c) Effect of friction on reciprocating pump [4]
- (d) Indicator diagram of a reciprocating pump [4]

## UNIT- IV

- Q.4 (a) Derive the expression for specific work output and the efficiency of a simple gas turbine cycle with heat exchanger. [8]
- (b) Difference between turbo jet engine and turbo prop engine. [8]

OR

- Q.4 (a) Derive an expression for specific thrust and efficiency of Ramjet engine. [8]
- (b) Write the advantages and disadvantages of pulse jet engine. [8]

## UNIT- V

- Q.5 (a) Explain zero percent and hundred percent reaction turbine with suitable diagram. [8]
- (b) What do you mean by velocity compounding of a multistage impulse turbine. [8]

OR

- Q.5 What are the basic difference between an impulse and a reaction turbine? Also explain working of both types of turbine with diagram. [16]



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Total No. of Pages: **7**

**7E7015**

**B. Tech. VII - Sem. (Main / Back) Exam., January - 2022**

**Mechanical Engineering**

**7ME5A Operations Management**

**Time: 3 Hours**

**Maximum Marks: 80**

**Min. Passing Marks: 24**

*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 examination. (Mentioned in form No. 205)*

1. Graph paper

2. NIL

### **UNIT- I**

- Q.1 (a) What are the significant trends in the management of production systems? [4]
- (b) Distinguish between single factor and multi-factor productivity. [4]
- (c) Give some examples to show how the transformation process adds value by [4]
- (i) changing
  - (ii) combining
  - (iii) transporting
  - (iv) preserving resources.
- (d) What is typically required for a firm to achieve competitiveness? [4]

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**OR**

- Q.1 (a) The moving average forecast and the actual demand for a hospital drug are as shown below in the table. Compute the tracking signal and comment on the forecast accuracy. [8]

Month	Actual Demand	Forecast Demand
1	71	78
2	80	75
3	101	83
4	84	84
5	60	88
6	73	85

- (b) Shipments (in tons) of welded tube by an aluminum producer is shown in table below. Compute the linear trend line equation for the data and forecast the demand for the year 16. [8]

Shipments of Welded aluminum tubes											
Year	1	2	3	4	5	6	7	8	9	10	11
Shipments	2	3	6	10	8	7	12	14	14	18	19



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## UNIT- II

- Q.2 (a) The production process dictates how a product will be produced. What are the key considerations involved in selecting a production process? [4]
- (b) How do process planning considerations differ for the continuous and intermittent systems? [6]
- (c) Discuss product – process matrix. [6]

### OR

- Q.2 (a) How do capacity influence productivity? [4]
- (b) A company is planning to manufacture tennis racquets must decide on the location of the plant based on cost – volume analysis. Three locations are being considered viz, Mysore, Bangalore, Hosur. The fixed cost at the three locations are estimated to be ₹ 30 lakhs, 50 lakhs and 25 lakhs respectively. The variable costs are ₹ 300, ₹ 200 and ₹ 350 per unit respectively. The expected sales price of the tennis racquet is ₹ 700 per unit. Find out - [12]
- (i) The range of annual production volume for which each location is the most suitable.
- (ii) Which of the three is the best location at a production capacity/volume of ₹ 18,000 unit.

### UNIT- III

- Q.3 (a) What are the various qualitative and quantitative techniques for deciding facility location? State the advantages of quantitative methods over qualitative methods. [8]
- (b) An enterprising college student has relieved a contract to deliver 300 vegetable sandwiches per day to a cafeteria. The student expects to assemble these sandwiches on an assembly line using the following times and precedence relationships. [8]

Tasks	Description	Seconds	Precedence
A	Spread book buns (butter)	25	-
B	Put on lettuce	15	A
C	Put on vegetables	13	A
D	Put on cheese	15	A
E	Put on tomato	12	A
F	Wrap finished sandwich	20	A, B, C, D, E

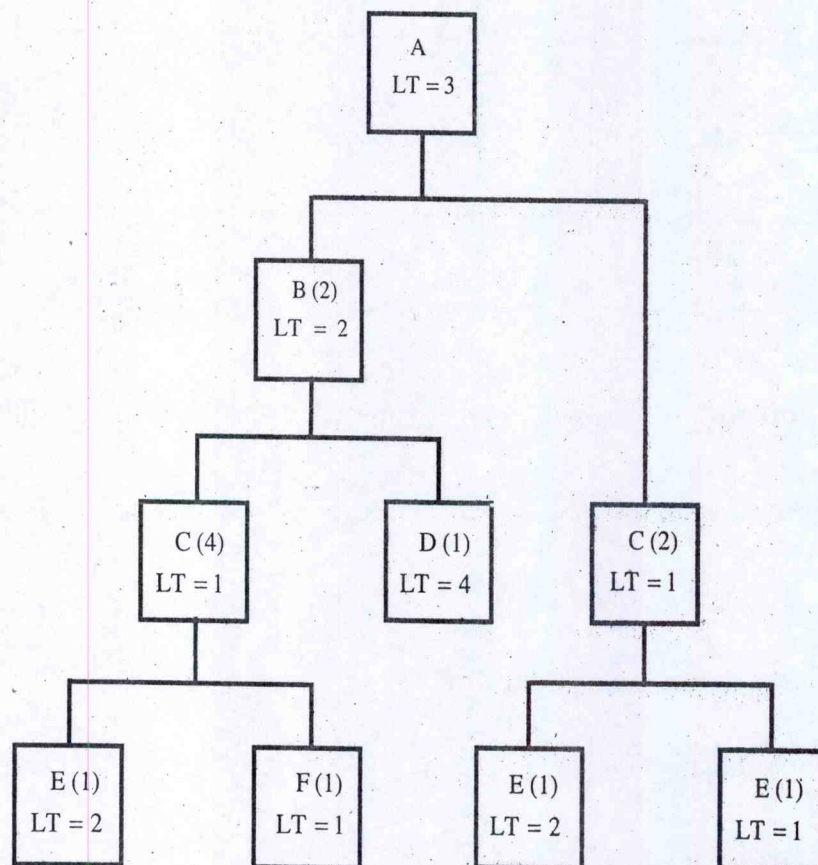
- (i) For a 40 seconds cycle time, balance the line assuming the least number of predecessor's rule. How many stations are required and what operations are assigned to each?
- (ii) What is the minimum number of stations for a 40 seconds cycle time. What is the efficiency of the balanced line obtained in part (i) and how long will take to produce 300 sandwiches a day.



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OR

- Q.3 (a) What is Master Scheduling and how it is different from aggregate planning? [4]
- (b) How does master scheduling differ under manufacturing strategies of [4]
- (i) make-to-stock
  - (ii) assemble-to-order
  - (iii) make-to-order
- (c) A master scheduler would like to determine whether an order for 200 items can be supplied in period 8. No stock of any components is on hand or on order and all order sizes are lot – for – lot. Determine the amount and date of planned order release for all components. [8]



## UNIT- IV

Q.4 (a) What is a Gantt Charts?

[4]

(b) Discuss the key functions of the operations scheduling and control.

[4]

(c) A machine shop has five jobs that are to be completed, given the following information -

[8]

Job Sequence	Processing Time	Due Date
A	110	610
B	290	450
C	310	310
D	10	330
E	20	320

Using SPT (by the smallest processing time) and the information in Table above, sequence the jobs A, B, C, D and E.

- What is the order of jobs?
- What is the average flow time?
- What is the average tardiness?
- How many jobs are tardy?



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**OR**

- Q.4 (a) What are some of the major obstacles that must be overcome in converting from a traditional system to JIT? [4]
- (b) What is the Kanban aspect of a JIT system? [4]
- (c) Contrast push and pull methods of moving goods and materials through production system. [8]

**UNIT- V**

- Q.5 (a) What is Bull whip effect and why does it occur? How it can be overcome? [6]
- (b) What impact has e-business had on supply chain management? [4]
- (c) What are some of the trade-offs that might be factors in designing a supply chain? [6]

**OR**

- Q.5 Draw the network for the data given in the table below and find the optimum duration and associated total project cost by crashing. Assume the indirect cost to be Rupees 185 per day. [16]

Activity	Predecessors	Normal Time (days)	Normal Cost (₹)	Crash Time (days)	Crash Cost (₹)
A	-	3	300	1	400
B	-	4	600	2	750
C	A	6	800	3	1300
D	B	7	1300	4	1540
E	C, D	8	1600	6	1920
F	C, D	9	1700	6	2210
G	E, A	5	800	3	1080
H	F, B	6	900	4	1190

7E7017

Roll No. \_\_\_\_\_

Total No. of Pages: 2

**7E7017**

**B. Tech. VII - Sem. (Main / Back) Exam., March - 2022**  
**Mechanical Engineering**  
**7ME6.2A Robotics**  
**ME, PI**

**Time: 3 Hours**

**Maximum Marks: 80**  
**Min. Passing Marks: 24**

*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 examination.  
(Mentioned in form No. 205)*

1. NIL \_\_\_\_\_

2. NIL \_\_\_\_\_

**UNIT - I**

Q.1 What do you mean by robotics? Explain progressive advancement in robotics. [16]

**OR**

Q.1 What do you understand by human arm characteristics of robot? Explain the manipulation and control of robots with the neat sketch. [16]

**UNIT - II**

Q.2 What do you mean by transform? Explain the transformation of vectors. [16]

**OR**

Q.2 Describe the classification of end-effectors. Differentiate between the various grippers on the basis of design and drive system. [16]



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### UNIT - III

Q.3 What do you mean by manipulator transformation matrix? Describe the various inputs and outputs considered in the modeling. [16]

OR

Q.3 Derive inverse kinematic equation of manipulator for a particular position. Explain the cooperation and interaction between human and humanoid robots. [16]

### UNIT - IV

Q. 4 Explain different types of sensors used in robotics. Describe the criteria of selecting sensor for different application. [16]

OR

Q.4 Explain the term "Image processing". Define the application of vision controlled robotics system. [16]

### UNIT -V

Q.5 Write short notes on - [16]

- (a) VAL system and language
- (b) Non industrial application of robots

OR

Q.5 Explain the robot languages. Describe the importance of computer control and robot software. [16]

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7E7018

Roll No. \_\_\_\_\_

Total No. of Pages: **3**

**7E7018**

**B. Tech. VII - Sem. (Main / Back) Exam., January - 2022**

**Mechanical Engineering**

**7ME6.3A CNC Machines and Programming**

**ME, PI**

**Time: 3 Hours**

**Maximum Marks: 80**

**Min. Passing Marks: 24**

*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 examination. (Mentioned in form No. 205)*

1. NIL

2. NIL

### **UNIT- I**

- Q.1 (a) "Basic structure of CNC machine is different from that of a conventional machine." Discuss this fact and why it is so. [8]
- (b) Define automation. What are different types of automation? [8]

**OR**

- Q.1 (a) Explain the function of MCU in NC Machine. What is the roll of PLC in CNC system? [4+4=8]
- (b) What are the historical developments in automation? Write in detail. [8]

### **UNIT- II**

- Q.2 (a) Compare hydraulic and pneumatic drives for CNC machines. [8]
- (b) (i) Why do you need a interpolator on a NC machine? [4]
- (ii) Explain the use of a circular interpolator and its application. [4]



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**OR**

- Q.2 (a) Define sensors and their applications in Numerical Control Machines? Also write down the various types of sensors. [8]
- (b) Write short notes on the following -
- (i) Guide ways elements of NC- machine [4]
  - (ii) Coolant system of NC- machine [4]

**UNIT- III**

- Q.3 (a) What do you mean by APT language? Explain geometry statements and post processor statements with examples of APT language of CNC programming. [8]
- (b) How is cutter compensation specified in a machining centre? With the help of example show how is it operational? [8]

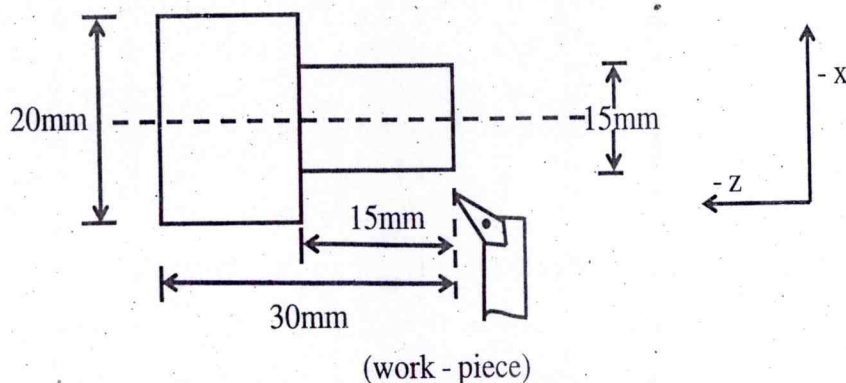
**OR**

- Q.3 (a) Explain the method of storing and implementing "Tool offset". [8]
- (b) Prepare the part programming for the turning and facing of given object as shown in figure. [8]

Raw material → Aluminium rod of 20 mm

Speed = 800 RPM, Feed = 200 mm/min,

Depth of cut = 2 mm



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## UNIT- IV

- Q.4 (a) Describe NC simulation & explain the application of volumetric NC simulation. [8]
- (b) Write Short Notes on –
- (i) 5 – Axis programming [4]
  - (ii) Kinematic – simulation [4]

### OR

- Q.4 (a) (i) What do you mean by robot – programming? [2]
- (ii) What are the various methods for robot – programming? [4]
- (iii) Explain the features of VAL & AML robot programming. [4]
- (b) Explain CAPP systems in detail. [6]

## UNIT- V

- Q.5 (a) What is canned cycle? What are the advantages of standardized fixed cycles over general part programming? What is Coordinate Measuring Machine (CMM)? [2+3+3=8]
- (b) Define FMS. What are the basic component of FMS? Explain the different application of CIM as seen in production industries. [8]

### OR

- Q.5 (a) Explain the adaptive control system with neat sketch. Write functions of adaptive control system. [8]
- (b) Write short notes on the following – [Any two] [2×4=8]
- (a) Die-sinking process
  - (b) Rapid product development
  - (c) Tooling and Instruments for NC-special considerations in High speed cutting
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