

Hall Ticket Number :

**R-20**

**Code: 20AC45T**

II B.Tech. II Semester Supplementary Examinations December 2023

**Managerial Economics & Financial Analysis**

(Common to EEE & ME)

Max. Marks: 70

Time: 3 Hours

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- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
2. In Part-A, each question carries **Two marks**.  
3. Answer **ALL** the questions in **Part-A** and **Part-B**

**PART-A**

(Compulsory question)

- |   |     |    |
|---|-----|----|
| 1. Answer ALL the following short answer questions ( 5 X 2 = 10M )                      | CO  | BL |
| a) List the demand forecasting Techniques   | CO1 | L1 |
| b) Illustrate Iso-quants curve  | CO2 | L2 |
| c) Define Oligopoly market  | CO3 | L1 |
| d) Why capital budgeting decisions also known as investment decisions?                  | CO4 | L2 |
| e) The trial balance is a rationale in preparation of final accounts, how it would act? | CO5 | L3 |

**PART-B**

Answer **five** questions by choosing one question from each unit ( 5 x 12 = 60 Marks )

Marks CO BL

**UNIT-I**

2. Under different elasticity of demand, explain the relationship between demand and revenue. 12M CO1 L2

**OR**

3. a) Describe the role of managerial economics in business decision making. 6M CO1 L2  
b) Discuss the nature and scope of managerial economics 6M CO1 L2

**UNIT-II**

4. Explain the cost output relationship in both short run and long run period. 12M CO2 L3

**OR**

5. a) Define production function. Explain cobb-douglas function in detail. 6M CO2 L3  
b) From the following details, find out : (i) Contribution per unit (ii) BEP (iii) Margin of safety (iv) Profit and (v) Volume of sales to earn a profit of Rs.24,000. Fixed cost Rs. 18,000; Variable cost Rs. 30,000 ; Sales Rs. 60,000 ; and units sold 20000. 6M CO2 L3

**UNIT-III**

6. Examine the features of monopoly competition through appropriate examples. 12M CO3 L2

**OR**

7. a) Distinguish between the partnership firm and joint stock company. 6M CO3 L2  
b) A firm under perfect competition, the seller is the price taker not the price maker" explain. 6M CO3 L2

**UNIT-IV**

8. Classify the capital budgeting Techniques and explain each. 12M CO4 L4

**OR**

9. A proposal is expected to generate cash flows of Rs. 8,000, 6,000, 4,000, 2,000 and Rs. 2,000 over next 5 years. Find the payback period of initial outlay required is a. Rs. 20,000 and b. 18,500. 12M CO4 L4

<b>UNIT-V</b>
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10. Prepare final accounts from the following trial balance of Snigdha Enterprises as on 31-03-2020.

Particulars	Debit Amount	Credit Amount.
Stock (1-1-2010)	3,000	
Purchases	14,000	
Fuel and gas	1,000	
Wages	3,000	
Printing & stationery	2,900	
Commission Received		6,000
Factory Rent	300	
Sales		28,800
Debtors	5,000	
Rent and Taxes	2,000	
Capital		25,000
Salaries	4,800	
Machinery	8,000	
Cash	2,000	
Creditors		5,500
Insurance	1,800	
Buildings	19,000	
Bills Payable		2,000
Furniture	4,900	
Interest received		800
Bank Overdraft		3,600
<b>Total</b>	<b>71,700</b>	<b>71,700</b>

**Adjustments:**

- a) Closing Stock Rs. 25,000.
- b) Unpaid wages Rs. 500.
- c) Outstanding salaries Rs. 1900.
- d) Depreciate Machinery by 10%.

12M CO5 L5

**OR**

11. a) Write the importance of final accounts preparation of an organization.
- b) Find out the current assets of a company from the following information:  
Inventory turnover ratio is 4 times. Inventory at the end is Rs. 20,000 more than the inventory in the beginning. Revenue from Operations Rs. 3,00,000 and gross profit ratio is 20% of revenue from operations.

6M CO5 L5

Current liabilities = Rs.40,000

Quick ratio = 0.75 : 1

6M CO5 L5

\*\*\* End \*\*\*

Hall Ticket Number :

R-20

Code: 20AC41T

II B.Tech. II Semester Supplementary Examinations December 2023

**Probability and Statistics**

(Common to CE, ME, CSE, AI&amp;DS and AI&amp;ML)

Max. Marks: 70

Time: 3 Hours

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- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. In Part-A, each question carries **Two marks**.  
 3. Answer **ALL** the questions in **Part-A** and **Part-B**

**PART-A**

(Compulsory question)

- 1. Answer ALL the following short answer questions** (5 X 2 = 10M) CO BL
- a) Define Correlation between two variables. Also write the formula for Karl Pearson's coefficient of correlation. CO1 L1
- b) Two dice are thrown. Let A be the event that the sum of the points on the faces is 9. Let B be the event that at least one number is 6. Find (i)  $P(A \cap B)$  (ii)  $P(A \cup B)$  CO2 L3
- c) What is Binomial distribution function? Write the formulae for mean and variance of Binomial distribution. CO3 L1
- d) A random sample of size 100 has a standard deviation of 5. what can you say about the maximum error of estimate with 95% confidence? CO4 L3
- e) For F -distribution, find  $F_{0.05}$  with  $v_1 = 7$  and  $v_2 = 15$  CO5 L3

**PART-B****Answer five questions by choosing one question from each unit (5 x 12 = 60 Marks)**

Marks CO BL

**UNIT-I**

2. Find mean, median and mode for the following data:

Class interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	5	8	7	12	28	20	10	10

12M CO1 L3

**OR**

3. From the following data calculate the rank correlation coefficient

X	48	33	40	9	16	16	65	24	16	57
Y	13	13	24	6	15	4	20	9	6	19

12M CO1 L3

**UNIT-II**

4. Suppose a continuous random variable X has the probability density function
- $f(x) = K(1-x^2)$
- for
- $0 < x < 1$
- , and
- $f(x) = 0$
- otherwise.

Find (i) K (ii) Mean (iii) Variance

12M CO2 L3

**OR**

5. A random variable X has the following probability function:

X	1	2	3	4	5	6	7	8
P(X)	K	2K	3K	4K	5K	6K	7K	8K

Find the value of (i) K (ii) Mean (iii) Variance

12M CO2 L3

<b>UNIT-III</b>
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6. Seven coins are tossed and the number of heads are noted. The experiment is repeated 128 times and the following distribution is obtained.

No .of heads	0	1	2	3	4	5	6	7
Frequency	7	6	19	35	30	23	7	1

Fit a binomial distribution assuming that coin is unbiased

12M CO3 L3

**OR**

7. The marks obtained in mathematics by 1000 students is normally distributed with mean 78% and standard deviation 11%. Determine
- How many students got marks above 90%
  - What was the highest mark obtained by lowest 10 % of the students
  - Within what limits did the middle of 90% of the students lie

12M CO3 L3

<b>UNIT-IV</b>
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8. a) A researcher wants to know the intelligence of students in a school. He selected two groups of students. In the first group there are 150 students having mean IQ of 75 with Standard deviation of 15. In the second group there are 250 students having mean IQ of 70 with Standard deviation of 20. test whether there is any significant difference in the two groups by considering 1% level of significance.
- b) In a big city 325 men out of 600 men were found to be smokers. Does this information support the conclusion that majority of men in this city are smokers? level of significance 5%

8M CO4 L4

4M CO4 L4

**OR**

9. Before an increase on excise duty on tea 500 people out of a sample of 900 found to have the habit of having tea. After an increase on excise duty 250 are found to have tea habit among 1100. Is there any decrease in the consumption of tea? Test at 5% level of significance.

12M CO4 L4

<b>UNIT-V</b>
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10. Scores obtained in a shooting competition by 10 soldiers before and after intensive training are given below:

Before	67	24	57	55	63	54	56	68	33	43
After	70	38	58	58	56	67	68	75	42	38

Test whether the intensive training is useful at 0.05 level of significance

12M CO5 L4

**OR**

11. Two researchers adopted different sampling techniques while investigating some group of students to find the number of students falling into different intelligence level. The results are as follows:

Researcher	Below Average	Average	Above Average	Genius
X	86	60	44	10
Y	40	33	25	2

Would you say that the sampling techniques adopted by two researchers are significantly different? Level of significance 5%

12M CO5 L4

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Hall Ticket Number :									
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<b>R-20</b>
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**Code: 20A341T**

II B.Tech. II Semester Supplementary Examinations December 2023

**Theory of Machines**

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

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- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
2. In Part-A, each question carries **Two marks**.  
3. Answer **ALL** the questions in **Part-A** and **Part-B**

**PART-A**

(Compulsory question)

- |   |     |    |
|---|-----|----|
| 1. Answer ALL the following short answer questions ( 5 X 2 = 10M )        | CO  | BL |
| a) Define mechanism.  | CO1 | L2 |
| b) Define instantaneous centre.   | CO2 | L2 |
| c) Write the expression for gyroscopic couple during pitching of a ship.  | CO2 | L2 |
| d) Define swaying couple and give its expression.                         | CO4 | L2 |
| e) Distinguish between longitudinal, transverse and torsional vibrations. | CO5 | L2 |

**PART-B**

Answer **five** questions by choosing **one** question from each unit ( 5 x 12 = 60 Marks )

Marks CO BL

**UNIT-I**

- |  |    |     |    |
|--|----|-----|----|
| 2. a) What do you mean by constrained motion? What are the different types of constrained motions? Explain each type with examples and with neat sketches. | 6M | CO1 | L2 |
| b) Define the following terms<br>i) Link ii) Mechanism iii) Machine iv) Inversion  | 6M | CO1 | L2 |

**OR**

- |   |     |     |    |
|---|-----|-----|----|
| 3. Explain with sketches all inversions of double slider crank chain. | 12M | CO1 | L2 |
|---|-----|-----|----|

**UNIT-II**

- |   |     |     |    |
|---|-----|-----|----|
| 4. The crank of a slider crank mechanism rotates clock wise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine: 1. Linear velocity of midpoint of the connecting rod, and 2. Angular velocity of the connecting rod, at a crank angle of 45° from inner dead centre position. | 12M | CO2 | L4 |
|---|-----|-----|----|

**OR**

- |   |     |     |    |
|---|-----|-----|----|
| 5. A ship is propelled by a turbine rotor having a mass of 6 tonnes and speed of 2400 rpm. The direction of rotation of the rotor is clockwise when viewed from stern. The radius of gyration of the rotor is 450mm. Determine the gyroscopic effect when (i) The ship steers to the right in a curve of 60 m radius at a speed of 18 knots(1 knot = 1860 m/hr) (ii) The ship pitches 7.5 degrees above and 7.5 degrees below normal position and the bow is descending with its maximum velocity. The pitching motion is simple harmonic with a periodic time of 18 seconds (iii) The ship rolls and at the instant, its angular velocity is 0.035 rad/s counter-clockwise when viewed from the stern. Also find the maximum angular acceleration during pitching. | 12M | CO2 | L4 |
|---|-----|-----|----|

<b>UNIT-III</b>
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6. a) Derive an expression for length of path of contact between two mating gears. 5M CO3 L4
- b) Two mating gears have 50 and 13 involute teeth of module 10 mm and  $20^\circ$  pressure angle. The addendum is one module. Does the interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference? 7M CO3 L4

**OR**

7. The arm of an epicyclic gear train rotates at 100 r.p.m in the anti-clockwise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B, if the wheel A instead of being fixed, makes 200 r.p.m. clockwise? 12M CO3 L4

<b>UNIT-IV</b>
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8. A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. 12M CO4 L4

**OR**

9. The cranks of a two cylinder, uncoupled inside cylinder locomotive, are at right angles and are 300 mm long. The cylinders are 700 mm apart. The rotating mass per cylinder is 150 kg at the crank pin and the mass of the reciprocating parts per cylinder is 180 kg. The wheel centre lines are 1.5 m apart. The whole of the rotating and 60% of the reciprocating masses are to be balanced and the balance masses are to be placed in the planes of the rotation of the driving wheels at a radius of 600 mm. Find
- (i) the magnitude and direction of balancing masses
  - (ii) the magnitude of hammer blow
  - (iii) variation in tractive force
- Take crank speed = 150 rpm 12M CO4 L4

<b>UNIT-V</b>
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10. Derive natural frequency of spring mass system according to  
i) Energy method ii) Equilibrium Method 12M CO5 L4
- OR**
11. A shaft of 40 mm diameter and 2.5 m length has a mass of 15 kg per meter length. It is simply supported at the ends and carries three masses of 90 kg, 140 kg and 60 kg at 0.8 m, 1.5 m and 2 m respectively from the left support. Taking  $E = 200 \text{ GN/m}^2$ , find the frequency of the transverse vibrations. 12M CO5 L4

\*\*\* End \*\*\*

**Code: 20A343T**

II B.Tech. II Semester Supplementary Examinations December 2023

**Design of Machine Elements - I**  
(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

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- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. In Part-A, each question carries **Two marks**.  
 3. Answer **ALL** the questions in **Part-A** and **Part-B**

**PART-A**

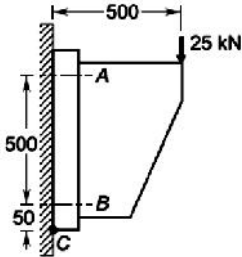
(Compulsory question)

- |   |     |    |
|---|-----|----|
| <b>1. Answer ALL the following short answer questions ( 5 X 2 = 10M )</b> | CO  | BL |
| a) Define factor of safety  | CO1 | L1 |
| b) Define notch sensitivity   | CO2 | L1 |
| c) What are the advantages of welded joints compared with riveted joints? | CO3 | L1 |
| d) What is the effect of keyway cut into the shaft                        | CO4 | L1 |
| e) What is the function of coupling                                       | CO5 | L1 |

**PART-B**

**Answer five questions by choosing one question from each unit ( 5 x 12 = 60 Marks )**

- |  | Marks | CO  | BL |
|--|-------|-----|----|
| <b>UNIT-I</b>  |       |     |    |
| 2. a) Define the terms: (i) Stiffness (ii) toughness (iii) Resilience (iv) malleability  | 6M    | CO1 | L1 |
| b) A steel plate of section 50 x 10 mm is bent into an arc of 1000 mm radius. Determine the bending stress induced and the bending moment required to bend the plate. Take $E = 2.1 \times 10^5$ MPa.  | 6M    | CO1 | L6 |
| <b>OR</b>  |       |     |    |
| 3. The stresses induced at a critical point in a machine component made of steel 45C8 ( $S_{yt}=380$ N/mm <sup>2</sup> ) are as follows.<br>$\uparrow_x = 100$ N/mm <sup>2</sup> $\uparrow_y = 40$ N/mm <sup>2</sup> $\downarrow_{xy} = 80$ N/mm <sup>2</sup>  | 12M   | CO1 | L6 |
| <b>UNIT-II</b>   |       |     |    |
| 4. a) What is stress concentration? Explain the methods of reducing stress concentration.  | 6M    | CO2 | L1 |
| b) Explain modified Goodman diagram for bending stresses   | 6M    | CO2 | L2 |
| <b>OR</b>  |       |     |    |
| 5. A rod of circular cross section is subjected to an alternating tensile force, varying from 20 kN to 70 kN. Determine the diameter of the rod, according to (i) Goodman method (ii) Soderberg method; using the following material properties: Ultimate tensile strength = 1000 Mpa, Yield strength = 550 Mpa. Take factor of safety as 2. Neglect stress concentration effect and other correction factors. | 12M   | CO2 | L6 |
| <b>UNIT-III</b>  |       |     |    |
| 6. A wall bracket is attached to the wall by means of four identical bolts, two at A and two at B as shown in <b>Fig.1</b> . Assuming the bracket is held against the wall and prevented from tipping about the point C by all four bolts and using an allowable tensile stress = 35 N/mm <sup>2</sup> , determine the size of the bolts on the basis of maximum principal stress theory.                      |       |     |    |



**Fig.1**

12M CO3 L6

OR

7. a) List the advantages and disadvantages of welded joints over riveted joints. 2M CO3 L2
- b) A rectangular cross-section bar is welded to a support by means of fillet welds as shown in Fig.2. Determine the size of the welds, if the permissible shear stress in the weld is limited to 75 MPa.

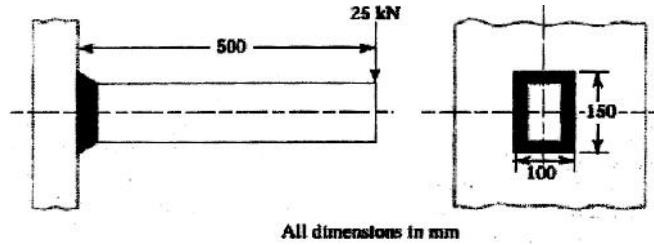


Fig.2

10M CO3 L6

## UNIT-IV

8. a) Prove that a square key is equally strong in shear and compression 6M CO4 L4
- b) A standard splined connection 8X36X40 is used for a gear and shaft assembly rotating at 700 rpm. The length of the gear hub is 50 mm the normal pressure on the spines is limited to 6.5 N/mm<sup>2</sup>. Calculate the power that can be transmitted from gear to shaft. 6M CO4 L6

OR

9. Design a cotter joint of socket and spigot type, which may be subjected to a pull or push of 30 kN. All the parts of the joint are made of the same material with the permissible stresses; 55 MPa in tension, 70 MPa in compression and 40 MPa in shear. 12M CO4 L6

## UNIT-V

10. Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 r.p.m. The angle of wrap of the belt is 180° and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa. 12M CO5 L6

OR

11. a) State the function of coupling 2M CO5 L1
- b) Design a clamp coupling of cast iron to connect two shafts transmitting 20kW at 1400 rpm and capable of resisting 20 % over load. The shaft and key materials are the same with 50 mpa as permissible shear stress .Take the permissible shear stress for the sleeve material as 15 mpa, assume the no.of bolts to be 4 and taking the permissible tensile stress for the bolt material as 70 mpa and coefficient of friction between the shaft and sleeve as 0.03 10M CO5 L6

\*\*\* End \*\*\*



Hall Ticket Number : 

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<b>R-20</b>
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**Code: 20A342T**

II B.Tech. II Semester Supplementary Examinations December 2023

**Fluid Mechanics and Hydraulic Machines**

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

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Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)2. In Part-A, each question carries **Two marks**.3. Answer **ALL** the questions in **Part-A** and **Part-B****PART-A****(Compulsory question)**

1. **Answer ALL the following short answer questions** (5 x 2 = 10 Marks)
- |  | CO | BL |
|--|----|----|
| a) A plate is 0.254 mm distant from a fixed plate and moves at 61 cm/s. The plate requires 20N/m <sup>2</sup> force to maintain this speed. Determine the dynamic viscosity of the fluid between the plates. | 1  | 3  |
| b) Give the physical significance of the friction factor and identify its dependency on the Reynold number.  | 2  | 2  |
| c) A 75 mm diameter water jet having a velocity of 25 m/s strikes a flat plate, which is inclined at 30° to the jet. Determine the force normal to the plate surface.  | 3  | 3  |
| d) What is a draft tube? Why is it used in a reaction turbine?   | 4  | 2  |
| e) What is priming? Why is it needed before starting a centrifugal pump?   | 5  | 2  |

**PART-B****Answer five questions by choosing one question from each unit (5 x 12 = 60 Marks)**

Marks CO BL

<b>UNIT-I</b>
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2. Highlight the importance of Viscosity in the engineering domain. A 20 mm wide gap between two vertical plane surfaces is filled with oil of specific gravity of 0.85 and dynamic viscosity of 2.5 Ns/m<sup>2</sup>. A metal plate of size 1.25 m x 1.25 m x 0.2 cm with a weight of 30 N is placed mid-way in the gap. Give the schematic diagram for the arrangement and determine the following.
- (i) The force required to lift the plate with a velocity of 0.12 m/s
- (ii) The shear stress developed in the plate
- |  |     |   |   |
|--|-----|---|---|
|  | 12M | 1 | 5 |
|--|-----|---|---|

**OR**

3. The velocity components in a 2D in-compressible flow are represented as  $u = y^3 + 6x - 3x^2y$ ;  $v = 3yx^2 - 6y - x^3$ . Check whether the flow is
- (i) Continuous and/or
- (ii) Ir-rotational. If the flow is Ir-rotational, determine the corresponding potential and stream function. Give a case with suitable justification for which the streamline, streakline, and pathline of a flow will coincide.
- |  |     |   |   |
|--|-----|---|---|
|  | 12M | 1 | 5 |
|--|-----|---|---|

<b>UNIT-II</b>
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4. a) Water flows at 75 lit/s in a pipe having diameters at sections 1 and 2 as 300 mm and 150 mm, respectively, which are at heights 5 m and 3 m above the datum. If the pressure at section 1 is 450 kPa, determine the pressure at section 2. Neglect energy loss between the two sections.
- |  |    |   |   |
|--|----|---|---|
|  | 4M | 2 | 3 |
|--|----|---|---|
- b) A venturi meter is provided in a 200 mm diameter pipe for measuring the water discharge of 62.8 lit/s. For a gauge pressure of 100 kPa in the pipe, determine the throat diameter of the venturi meter if it has to produce cavitation pressure there. The throat is 2 m higher than the venture inlet. Take atmospheric pressure as 101.3 kPa and vapor pressure as 2.39 kPa absolute.
- |  |    |   |   |
|--|----|---|---|
|  | 8M | 2 | 5 |
|--|----|---|---|

**OR**

5. a) Obtain an expression for the Darcy-Weisbach friction factor for the laminar flow in a pipe.
- |  |    |   |   |
|--|----|---|---|
|  | 5M | 2 | 3 |
|--|----|---|---|

- b) Two pipes each 400 mm long are available for connecting to a reservoir from which a flow of  $0.10 \text{ m}^3/\text{s}$  is required. If the diameters of the two pipes are 0.30m and 0.15 m, respectively, determine the ratio of the head loss when the pipes are connected in series to the head loss when they are connected in parallel. Neglect minor losses. 7M 2 5

**UNIT-III**

6. A water jet having a velocity of 36 m/s strikes a series of radial curved vanes mounted on a wheel that is rotating at 240 rpm. The jet makes an angle of  $20^\circ$  with the tangent to the wheel at the inlet and leaves the wheel with a velocity of 6 m/s at an angle of  $130^\circ$  to the tangent to the wheel at the outlet. Water is flowing from outward in a radial direction. The outer and inner radii of the wheel are 500 mm and 250 mm, respectively. Determine the following. i) Vane angles at the inlet and outlet ii) Work done per second per 'N' of water iii) Efficiency of the wheel 12M 3 5

**OR**

7. What do you mean by Hydroelectric power plant? List out different elements of the plant. Emphasize the basis for the selection and classification of these plants. Give the detailed construction and working principle of the Hydroelectric plant. 12M 3 2

**UNIT-IV**

8. A Pelton wheel turbine working under a head of 359 m runs at 750 rpm and generates 9560 kW. The various parameters of the turbine are; Overall efficiency = 85%, Jet ratio = 6, Coefficient of velocity = 0.985, Speed ratio=0.45, No. of poles in generator = 36. Assuming suitable data, determine the following. i) Runner diameter ii) Jet diameter iii) No. of jets required iv) Synchronous speed of the generator v) Specific speed of the turbine 12M 4 5

**OR**

9. An inward flow reaction turbine is working under a head of 15 m with a speed of 300 rpm. The inner and outer diameter of its runner is 500 and 750 mm, respectively. The runner width at the inlet is 70 mm. The radial component of fluid velocity is constant from inlet to outlet and is equal to  $0.2\sqrt{2gh}$ , where h is the turbine head. Water leaves the wheel radially. The blade efficiency is 95% and the overall efficiency of the turbine is 85%. Assuming suitable data, calculate the following. i) Angle of guide vanes ii) Angle of moving vanes at inlet and outlet iii) Water flow rate iv) Width of the runner at the outlet 12M 4 5

**UNIT-V**

10. A single-acting reciprocating pump has a piston diameter of 0.15 m and a stroke length of 0.3 m. The center of the pump is 5 m above the water level in the sump and 33 m below the delivery water level. The lengths of the suction and delivery pipes are 6.5 m and 39 m, respectively and both the pipes have the same diameter of 75 mm. If the pump is working at 30 rpm, determine the pressure head on the piston at the beginning, middle, and end of both suction and delivery stroke. Also, determine the power required to drive the pump. Take atmospheric pressure as 10.3 m of water and Darcy's friction factor for both pipes as 0.04. 12M 5 5

**OR**

11. A four-stage centrifugal pump with identical impellers develops a total head of 80 m when running at 500 rpm. The outer diameter of the impeller is 65 cm and the width at the outlet is 55 mm. The discharge is 220 lit/s. The vane angle at the outlet is  $35^\circ$ . The flow at the inlet is radial. Determine the manometric efficiency of the pump. 12M 5 5

\*\*\* End \*\*\*