



B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Third Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

U18MET3007 MECHANICS AND THERMODYNAMICS

COURSE OUTCOMES

- CO1: Explain the concepts of thermodynamics and mechanisms of heat transfer.
 CO2: Discuss the working of turbines and boilers.
 CO3: Apply the fundamental concepts in determining the effect of forces on a particle.
 CO4: Apply the concept of Euler and Bernoulli's equation for solving fluid flow problems.
 CO5: Analyze the performance of various fluid machines.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions: -

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. Discuss on thermodynamic equilibrium. | CO1 | [K ₂] |
| 2. What are different modes of heat transfer? | CO1 | [K ₁] |
| 3. Define dryness fraction of steam. | CO2 | [K ₁] |
| 4. Differentiate between impulse and reaction steam turbines. | CO2 | [K ₂] |
| 5. State the necessary and sufficient condition for static equilibrium of a particle in two dimensions. | CO3 | [K ₂] |
| 6. State D Alembert's principle. | CO3 | [K ₁] |
| 7. State Newton's law of viscosity. | CO4 | [K ₁] |
| 8. List the types of flow lines and explain it. | CO4 | [K ₁] |
| 9. Compare hydraulic pumps and turbines. | CO5 | [K ₂] |
| 10. Classify pumps and turbines. | CO5 | [K ₁] |

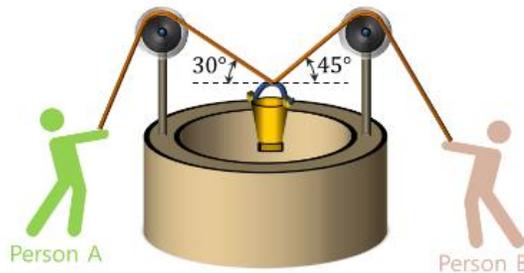
Answer any FIVE Questions: -

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

- | | | | |
|---|----|-----|-------------------|
| 11. a) In a gas turbine, the mass of gas enters at 10 kg/s with a velocity of 60 m/s and enthalpy of 1000 kJ/kg and exits from the turbine with a velocity of 150 m/s and enthalpy of 500 kJ/kg. The heat coming out from the turbine is 25 kJ/kg. Assume for gas $R = 0.285 \text{ kJ/kg K}$ and $C = 1.004 \text{ kJ/kg}$ and inlet conditions are 100 kPa and 27°C. Determine power output from the turbine (in kW). | 10 | CO1 | [K ₂] |
|---|----|-----|-------------------|

- b) During a cyclic process, a heat engine absorbs 500 J of heat from a hot reservoir, does work and ejects an amount of heat 300 J into the surroundings (cold reservoir). Calculate the efficiency of the heat engine? 6 CO1 [K₂]
12. a) Discuss the formation of steam from ice. 8 CO2 [K₁]
 b) Discuss simple Rankine cycle with a layout and p-v, T-S diagrams 8 CO2 [K₁]
13. a) Two persons A and B are drawing a bucket of water from a well using two ropes as shown in figure. In a given situation if person A is applying 30 N force. Find the Weight of the bucket. 8 CO3 [K₂]



- b) A ball of mass 2 kg moving with 2 m/s collides centrally with another ball of mass 4 kg moving with 3 m/s in the opposite direction. If the coefficient of restitution is 0.5. Find the velocities of both the balls after impact. 8 CO3 [K₂]
14. a) Derive Euler's equation 8 CO4 [K₁]
 b) Calculate capillary rise in a glass tube of 2.5 mm diameter when immersed vertically in a) water b) mercury. Take surface tension $\sigma = 0.0725$ N/m for water and 0.25 N/m for mercury in contact with air. The specific gravity for mercury is given as 13.6 and angle of contact 130° . 8 CO4 [K₂]
15. Discuss the working principle of reciprocating pump. Also draw and explain the performance curves of reciprocating pumps. 16 CO5 [K₂]
16. Explain the working principle of following turbine with neat sketch. 16 CO5 [K₂]
 I) Pelton turbine II) Kaplan turbine III) Francis turbine
