

COLLEGE OF ENGINEERING PUNE.  
**ENDSEM EXAM** 2012-13.  
 BASIC MECHANICAL ENGINEERING.

Programme :FY BTECH (Electrical group ) Duration: 3hrs

Max Marks: 60

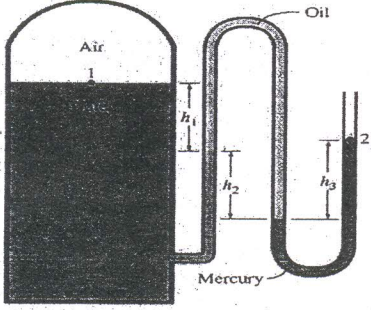
Instructions: **Answer all questions.**

Illustrate your answer with neat sketches.

Steam tables and nonprogrammable calculators are allowed

Q1		Attempt <b>any two</b> of following	
	a	Describe with neat sketch the construction and working of simple flat plate collector	04
	b	Explain construction and working of geothermal Thermal Power plant	04
	c	How is tidal energy harnessed? Explain.	04
Q2	a	A furnace wall consists of 200 mm layer of refractory bricks, 6 mm layer of steel plate and a 100 mm layer of insulation bricks. The maximum temperature of the wall is $1150^{\circ}\text{C}$ on the furnace side and the minimum temperature is $40^{\circ}\text{C}$ on the outermost side of the wall. An energy balance over the furnace shows that the heat loss from the wall is $400 \text{ W/m}^2$ . It is known that there is a thin layer of air between the layers of refractory bricks and steel plate. Thermal conductivities for the three layers are 1.52, 45 and $0.138 \text{ W/m}^{\circ}\text{C}$ respectively. Find: (a) To how many mm of insulation brick is the air layer equivalent? (b) What is the temperature of the outer surface of the steel plate?	05
	b	Define the term LMTD. State its purpose.	02
	c	Write the mechanism of heat transfer by radiation. Define the terms reflectivity, absorptivity and transmissivity	03
Q3	a	i) Determine and justify whether the heat and work transfer are positive ,negative or zero in following processes undergone by the system,  a) A pressure cooker containing hot water at $100^{\circ}\text{C}$ is let on the cooking range with gas switched off .Kitchen is at $25^{\circ}\text{C}$ temperature.  b) A mixture of ice and water contained in a vertical piston-cylinder arrangement with conducting walls .Some ice melts and the piston is allowed to move to keep the mixture pressure constant.	02
		ii) Is the process of free expansion, a reversible process? Justify your answer. Also write the values for work and heat transfer for this process.	03
	b	Air initially at 60 KPa pressure ,800K temperature and $0.1\text{m}^3$ volume is compressed isothermally until the volume of is halved and subsequently the air is cooled at constant pressure till the volume is halved again. Sketch the process and determine the total heat and work interaction. Assume Ideal gas behavior for air take $C_p=1.005 \text{ kJ/kg K}$ .	05
Q4	a	What are the various types of Mechanical type pressure measuring instruments? Explain Bourdon pressure gauge.	03
	b	Determine the viscosity of a liquid having Kinematic viscosity 6 stokes and specific gravity 1.9.	02



	c	<p>A conical tube is fixed vertically with its smaller end upwards and it forms a part of pipeline. The velocity at the smaller end is 4.5m/s and at the large end 1.5m/s. length of conical tube is 1.5m. The pressure at the upper end is equivalent to head of 10m of water.</p> <p>i) Neglecting the friction calculate the pressure, in bar, at lower end of tube.</p> <p>ii) If there are losses in the pipe are <math>= 0.3 (V_1 - V_2)^2 / 2g</math>, Where <math>V_1</math> and <math>V_2</math> are velocities at inlet and outlet respectively, calculate the pressure, in bar, at lower end.</p>	04
	d	 <p>Water in the tank is pressurized by air and pressure is measured by multi-fluid manometer as shown. Tank is located on a mountain at an altitude of 1400m and it has atmospheric pressure 85.6 kPa. Determine the pressure in tank if <math>h_1=0.1m</math>, <math>h_2=0.2</math>, <math>h_3=0.35m</math>. Specific gravity of oil and mercury is 0.85 and 13.6 respectively.</p>	02
	e	<p>Manometer shows reading of 35cm of water. Atmospheric pressure is 76.5cm of Hg</p> <p>Calculate pressure in terms of</p> <p>i) Meters of oil (specific gravity of 0.82) absolute.</p> <p>ii) <math>N/m^2</math> gauge.</p> <p>iii) In bar absolute.</p>	03
Q5	a	<p>With neat sketch explain working of household refrigerator. Give the function of each component in the system.</p>	05
	b	<p>What is critical point of steam? Steam at 15bar has specific volume of <math>0.12m^3/kg</math>. Determine the temperature, enthalpy of the steam. What will be the temperature if the enthalpy of steam is at 2850kJ/kg?</p>	05
Q6		<p>Attempt <b>any two</b> of following</p>	
	a	<p>Classify bearings. State advantages of rolling over sliding bearings</p>	04
	b	<p>What are keys? List the various types. Sketch and explain any two.</p>	04
	c	<p>Sketch at least two types of couplings. State their applications</p>	04