

**Sixth Semester B.E**  
**MODEL QUESTION PAPER**  
**Marine Thermal Engineering**

Time: 3 hours

Max Marks: 100

**Instructions to students**

1. Answer any FIVE FULL questions, Taking ONE question from EACH UNIT.
2. Missing Data, if any, may be suitably assumed.

Q No		<b><u>UNIT-1</u></b>	Marks	CO's	RBTL
1	a	Explain the kinds of boundary conditions.	10	CO1	L2
	b	A Composite wall consist of a 10cm layer of building Brick ( $k= 0.7\text{W/mK}$ ) and 3cm thick plaster ( $k= 0.5 \text{ W/mK}$ ). What thickness of rock wool insulation material ( $k= 0.08\text{W/mK}$ ) should be added to reduce the heat loss through the wall by 70% insulated.	10	CO1	L3
2	a	Define and find the equation for efficiency and effectiveness of Fin.	10	CO1	L3
	b	A rod of $K=200\text{W/mK}$ , 5mm in diameter and 5cm in long has its one end is maintained at $100^\circ\text{C}$ . The surface is exposed to ambient air at $25^\circ\text{C}$ with convection coefficient of $100\text{W/m}^2\text{K}$ . Assuming tip is insulated, Determine i) Heat dissipation ii) Effectiveness iii) Efficiency.	10	CO1	L4
		<b><u>UNIT-2</u></b>			
3	a	With a neat sketch explain velocity boundary layer for flat plate.	10	CO2	L2
	b	Atmospheric air is contained between two 0.5m square vertical plates separated by a gap of 15mm. The two plates are maintained at $100^\circ\text{C}$ and $40^\circ\text{C}$ respectively. Determine the rate of heat transfer across the air space.	10	CO2	L3
4	a	With a neat sketch explain thermally developed flows.	10	CO2	L3
	b	Engine oil at $60^\circ\text{C}$ flows over a 5 m long flat plate whose temperature is $20^\circ\text{C}$ with a velocity of 2 m/s. Determine the total drag force and the rate of heat transfer per unit width of the entire plate.	10	CO2	L4
		<b><u>UNIT-3</u></b>			
5	a	For a black body enclosed in a hemispherical space show that emissive power of the black body is $\pi$ times the intensity of radiation.	10	CO3	L2
	b	Consider two large parallel plates one at $727^\circ\text{C}$ with emissivity 0.8 and another at $227^\circ\text{C}$ with emissivity 0.4. An aluminum radiation shield with emissivity 0.05 on both the side is placed between the plates. Calculate the percentage reduction in heat transfer and temperature of radiation shield.	10	CO3	L3
6	a	Derive an expression for effectiveness of counter flow heat exchanger in terms of NTU.	10	CO3	L2

	b	A heat exchanger has an effectiveness of 0.5m when the flow is counter and the thermal capacity of one fluid is twice that of the other fluid. Calculate the effectiveness of the heat exchanger if the direction of flow of one of the fluids is reversed with the same mass flow rates at before.	10	CO3	L3
		<b><u>UNIT-4</u></b>			
7	a	With a neat sketch explain vapour compression refrigeration.	10	CO4	L2
	b	In an ideal vapour compression refrigerator of 20kw cooling capacity, the saturated refrigerant vapour leaves the evaporator with an enthalpy of 180 KJ/Kg. the enthalpies at the exits of compressor and condenser are respectively 220 KJ/Kg and 65 KJ/Kg. show the refrigeration cycle on T-S and P-h diagrams and calculate i) COP ii) refrigerant flow rate iii) power required to drive compressor	10	CO4	L3
8	a	Explain the desirable properties of good refrigerant.	10	CO4	L3
	b	Air is conditioned from 40 <sup>0</sup> C DBT and 50% RH to a final temperature of 20 <sup>0</sup> C DBT and 40% RH by a dehumidification process followed by reheat process. Assuming that the entire process is at constant pressure of 1.01325 bar. Determine i) amount of water removed from air ii) The temperature of air leaving the dehumidifier iii) Refrigeration in tons for an air flow rate of 0.47m <sup>3</sup> /s and iv) heating required in KW.	10	CO4	L4
		<b><u>UNIT-5</u></b>			
9	a	Define: i. DBT ii. WBT iii. DPT iv. Specific humidity v. Relative Humidity	10	CO5	L2
	b	Derive the expression for enthalpy of moist air and explain winter air conditioning.(08 marks) c) Atmospheric air at 101.325 kPa ha 30 <sup>0</sup> C DBT and 15 <sup>0</sup> C DPT. Without using the pschometric chart, using the property values from the table, Calculate i. Partial pressure of air and water vapour ii. Specific humidity iii. Relative humidity iv. Vapor density and Enthalpy of moist air	10	CO5	L3
10	a	Explain marine air conditioning system	10	CO5	L3
	b	Atmospheric air at 101.325 kpa has 30 <sup>0</sup> c DBT and 15 <sup>0</sup> c DPT, using the property values from the tables, calculate i) partial pressures of air and water vapour ii) specific humidity iii) Relative humidity iv) vapour density v) Enthalpy of moist air	10	CO5	L4