B. Tech Degree III Semester Examination in Marine Engineering December 2010

MRE 303 THERMODYNAMICS AND HEAT TRANSFER

Time : 3 Hours Maximum Marks : 100

(All questions carry ***EQUAL*** marks)

I. (a) Explain the second law of thermodynamics.

(b) Heat is transferred directly from a heat reservoir at 280°C to another heat reservoir at 5°C. If the amount of heat transferred is 100 KJ what is the total entropy change as a result of this process.

OR

II. (a) Explain the concept of availability.

(b) A cyclic heat engine operates between a source temperature of 800°C and a sink temperature of 30°C. What is the least rate of heat rejection per KW net output of the engine?

III. A steam power plant operates on rankine cycle. The condition of steam at the boiler outlet is 20 bar and 360°C. It is then expanded to 0.08 bar. Assuming 80% efficiency for both turbine and pump, calculate the cycle efficiency.

OR

IV. A steam engine operating on ideal carnot cycle is supplied with dry-saturated steam at 15 bar. The isentropic expansion of steam continues till it is exhausted at 0.10 bar. Assuming the liqud to be saturated at entry to the boiler, calculate

(i) Work ratio

(ii) Thermal efficiency

V. Dry and saturated steam is expanded in a steam nozzle from 10 bar to 0.1 bar. Calculate

(i) Dryness fraction of steam at exit.

(ii) Heat drop

(iii) Velocity of steam at exit from the nozzle when initial velocity is 135 m/sec.

OR

VI. In a De lawal turbine, the steam issues from the nozzles with a velocity 850 m/sec. Following data are also available :

Nozzle angle	:	20°
Mean blade velocity	:	350 m/sec
Mass flow rate	:	1000 Kg/min
Friction factor	:	0.8

Assuming that the blades are symmetrical, determine

(i) Blade angles

(ii) Blade efficiency

(iii) Power developed

VII. A black surface , 0.25m^2 in area is having a temperature of 650°C. Calculate

(i) Total rate of energy emission

(ii) Intensity of normal radiation

OR

VIII. (a) Explain Fourier's law of heat conduction.

(b) The inner surface of a 235 mm brick wall of a furnace is kept at 800^0C, and it is found that the outer surface is 170^0C. Calculate the heat loss per square metre of wall area given that the conductivity is 0.865 w/m K.

In a liquid to liquid heat exchanger fluid A enters at 400^0C and leaves at 200^0C. Fluid B enters at 100^0 C and leaves at 150^0C. Assuming the overall co-efficient of heat transfer-constant, determine the logarithmic temperature difference for parallel and counter flow.

OR

Explain in detail the significance of following Non-dimensional numbers :

(i) Reynolds number
(ii) Prandtl number
(iii) Nusselt number
(iv) Grashoff number

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