B. Tech Degree I & II Semester Examination in Marine Engineering June 2012

MRE 107 FUNDAMENTALS OF ENGINEERING
(A) MECHANICAL ENGINEERING

Time : 1 ½ Hours   Maximum Marks : 50

I.   (a) State and explain the second law of thermodynamics.   (8)

      (b) A cylinder contains $1m^3$ of gas at 100 kPa and 100°C. The gas is compressed to a volume of $0.25m^3$, the final pressure being 600 kPa. Determine: (i) the mass of the gas (ii) heat transfer by the gas during compression.   (9)

OR

II. (a) Explain the concept of temperature and temperature scales.   (8)

      (b) A Carnot cycle operates between two reservoirs at temperatures T_1 and T_2 K. The work output of the engine is 0.6 times the heat rejected. The difference between the source temperature and sink temperature is 200°C. Calculate: (i) source temperature (ii) sink temperature (iii) cycle efficiency.   (9)

III. (a) Derive an expression for the air standard efficiency of the Otto cycle.   (8)

      (b) The efficiency of an Otto cycle is 50% and ratio of specific heats is 1.5. Find its compression ratio.   (9)

OR

IV. (a) Sketch and explain a Brayton cycle.   (8)

      (b) A four-stroke, single cylinder oil engine operating on diesel cycle has a piston diameter of 25cm, a stroke of 40cm and a clearance volume of 1560 CC. Fuel oil is injected during the first $\frac{1}{12}^{th}$ of the expansion stroke. Find the air standard efficiency of the engine.   (9)

V. (a) Explain scaling boilers in detail.   (8)

      (b) Using steam tables find the enthalpy and entropy of 1kg of steam at 10 bars when the condition of the steam is (i) dry saturated and (ii) dryness fraction is 0.9.   (8)

OR

VI. Write notes on:

      (i)   Triple point

      (ii)   T-S diagrams

      (iii)   Methods to prevent scaling in boilers   (4 x 4 = 16)

      (iv)   Two phase systems

***