

INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examinations - June/July 2019

M. Tech. (Marine Engineering and Management)

Semester-I

Applied Thermodynamics & Turbo-machinery (PG13T1101)

Date: 24-06-2019

Maximum Marks: 60

Time: 3hrs

Pass Marks: 30

Answer any **THREE** questions. All questions carry equal marks.
Use of steam tables and Mollier diagram is permitted.

(3 x 20 = 60 Marks)

1. (a) Explain the working of a closed cycle gas turbine power plant. 6
(b) In an oil-gas turbine power generation set up, air enters at pressure of 1 bar and 303K. The air is compressed to 4 bar pressure and then heated to a temperature of 500°C. If the air flows at the rate of 90 kg/min, find the power developed by the plant. Take γ for air as 1.4 and $C_p=1.05$ kJ/kg K. If 1.2 kg of oil with a calorific value of 30000 kJ/kg is burnt in the combustion chamber per minute, find the efficiency of the plant. 10
(c) What are the applications of gas turbines? 4
2. (a) Classify steam turbines. 6
(b) Draw the velocity triangle for an axial flow turbine. 6
(c) Steam at 20 bar, 360°C is expanded in a steam turbine to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, find the net work per kg of steam and the cycle efficiency. 8
3. (a) Differentiate between external and internal combustion engines. 6
(b) Explain the working of a 4-stroke petrol engine. 6
(c) A petrol engine uses 0.5 kg of fuel per b.p hour. The calorific value of fuel is 40000 kJ/kg. Mechanical efficiency of the engine is 0.8. Compressor ratio is 6. Find brake thermal, indicated thermal air standard and relative efficiencies

of the petrol engine. Take $\gamma = 1.4$ for air. 8

4. (a) Draw the neat sketch of a nuclear power plant and explain its working. 8

(b) Draw the T-s diagram of a binary vapour power cycle and explain. 6

(c) How do you improve the efficiency of steam power plant? 6

5. (a) Distinguish between reciprocating and rotating compressors. 6

(b) Write short notes on Availability and irreversibility. 6

(c) Explain the working of a simple air refrigeration system. 8
