Code: ME4T2

II B.Tech - II Semester – Regular/Supplementary Examinations October-2020

APPLIED THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks:70

PART – A

Answer *all* the questions.   All questions carry equal marks

                                                    11 x 2 = 22M

1.

   a) Mention any two methods to improve the efficiency of Rankine cycle and which method enhances the work done by the turbines.

   b) How can you classify the fuels?

   c) What are the characteristics of a good boiler?

   d) Explain about the supersaturated flow in steam nozzles.

   e) Distinguish between the Impulse turbines and Reaction turbines.

   f) Define the stage efficiency and nozzle efficiency.

   g) What are the functions of steam condenser in thermal power plants?

   h) Write the sources of air in condenser.

   i) Differentiate between the static and stagnation pressure.

   j) Draw the velocity triangle for the axial flow compressors with nomenclature.

   k) Define the polytropic efficiency of axial flow compressors.

PART – B

Answer any **THREE** questions.   All questions carry equal marks.

$$3 \times 16 = 48 \text{ M}$$

2. a) Explain the working and analysis of the regenerative
Rankine cycle with one feed water heater with T-S diagram
and also find the mass of bleed steam..   8 M

   b) A steam power plant operates on ideal Rankine cycle,
receives the steam at 20 bar and 300^0 C at a rate of 3kg/s
and it is exhausted at 0.1 bar. Calculate the following
i) quality at the end of the turbine ii) net power output
iii) steam rate iv) heat rejected by the condenser in kW
v) Rankine cycle efficiency.   8 M

3. a) Derive the expression for Critical pressure ratio in
nozzles.   8 M

   b) Calculate the equivalent evaporation from and at 100^0C for
a boiler, which receives water at 60^0C and produces steam
at 1.5MPa and 300^0C. The steam generation rate is
16000kg/h. Coal is burnt at the rate of 1800 kg/h. The
calorific value of coal is 34750 kJ/kg. Also evaluate the
thermal efficiency of the boiler. If the efficiency of the boiler
is increased by 5% due to use of economiser, find the saving
in coal consumption per hour.   8 M

4. a) What is compounding, why compounding is required for steam turbines? Explain the pressure and velocity compounding with neat sketch. 8 M

   b) Define the degree of reaction in axial flow turbines and show that for 50% of degree of reaction the blades are symmetrical. 8 M

5. a) Explain the working of surface condenser with a neat diagram and also mention the advantages of surface condensers over the jet condensers. 8 M

   b) A vacuum of 710mm of Hg was recorded in a condenser when the barometer reads 755mm of Hg .The temperature of the condensate was 25^0C. Evaluate the pressure of steam and air in the condenser, mass of air per kg of steam and also calculate the vacuum efficiency. 8 M

6. a) Define the volumetric efficiency of Reciprocating air compressors and derive the expression for volumetric efficiency with clearance volume. 8 M

   b) Differentiate between the axial flow and centrifugal compressors. 8 M