Code: ME4T2

II B.Tech II Semester Regular/Supplementary Examinations
April 2019

APPLIED THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks: 70

PART – A

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

$11 \times 2 = 22$ M

1. a) Draw the Rankine cycle on T-S diagram.

   b) What is equivalence ratio?

   c) Define Boiler efficiency.

   d) Define Nozzle efficiency.

   e) What is the condition for maximum efficiency of an impulse turbine?

   (α is the angle made by absolute velocity at inlet)

   f) Draw the velocity diagram for Parson's reaction turbine.

   g) Define Condenser efficiency.

   h) Write any two advantages of steam condenser.

   i) Determine the length of the stroke of the piston, if velocity of the piston 152.5 meters /min and speed of the compressor is 100 r.p.m.

   j) What is the role of diffuser in centrifugal compressor?

   k) Write any two typical applications of axial flow compressor.

PART – B

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

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

2. a) Explain the Reheating technique in Rankine cycle with a
neat sketch and derive its efficiency.   8 M

b) Give the classifications of Fuels with its calorific values in
detail.   8 M

3. a) Differentiate between the boiler mountings and
accessories.   8 M

b) Derive the equation for the chimney Height in natural
draught.   8 M

4. a) Derive the required condition for maximum efficiency in
case of 50% reaction turbine.   8 M

b) In a stage of 50% Parson`s reaction turbine, the steam
consumption is 18000kg/hr and it runs at 300 rpm. The
discharge blade tip angles are 20^0 both for fixed and
moving blades. The axial velocity of flow is 0.7 times the
blade velocity. Determine the drum diameter and blade
height of a particular turbine pair where pressure of
steam is 2bar of dryness 0.95 the power developed amounts
to 3.75kW.   8 M

5. a) Explain the sources of air in the condenser and the effects of air leakages on condenser performance?   8 M

   b) The following observations were made during a test on surface condenser.   8 M
   Barometer reading = 760mm of Hg; Condenser vacuum = 705mm of Hg; Mean Temperature of condensate = 35^0C; Condensate collected = 2000kg/hr; Quantity of cooling water circulated=60000kg/hr; Rise in temperature of cooling water = 16^0C; Hot well temperature = 28^0C Determine i) Vacuum efficiency ii) Condenser efficiency iii) Quantity of steam entering the condenser and iv) Mass of air present per m^3 of condenser volume. Assume, inlet temperature of water as 20^0C.

6. a) Derive the expression for work done in case of Reciprocating compressor with clearance?   8 M

   b) A double– acting, single stage reciprocating air compressor takes air at 0.981 bar(abs) and 32 ^0C and delivers at 6.32bar(abs). The clearance is 5% of the stroke volume. The compression and expansion occurs as per the law $PV^{1.3} = C$. The Compressor handles $17m^3$/min of air, when measured at 1 bar and 15 ^0C. Determine the temperature of air delivered, stroke volume and indicated power of the compressor in Kw if it runs at 500 rpm.   8 M