MANAV RACHNA
vidyanatariksha

MANAV RACHNA UNIVERSITY
FORMERLY MANAV RACHNA COLLEGE OF ENGINEERING
NAAC ACCREDITED 'A' GRADE INSTITUTION
Declared as State Private University under section 2f of the UGC act, 1956

DEPARTMENT OF ME

"T3-Examination, MAY-2018"

Semester: 4th **Date of Exam**: 21.05.2018
Subject: Thermal Engineering **Subject Code**: MEH212
Branch: ME **Session**: II
Course Type: Core **Course Nature: Hard**
Time: 3 Hours **Max.Marks**: 80
Program: B.Tech **Signature: HOD/Associate HOD:**

Note:- All Questions are compulsory from Part A (2*10=20 Marks). Attempt **any two questions from Part B** (15 Marks each) and **any two questions from Part C** (15 Marks each).

PART A

Q1. (a) Define Mach number. What is its significance?
(b) What is the relation between pressure and temperature of a compressible fluid for
(i) Adiabatic process (ii) Isothermal process
(c) What is critical pressure ratio for flow through a nozzle?
(d) What is the effect of friction in a flow through nozzle?
(e) Define velocity coefficient for flow through a nozzle.
(f) What are the applications of compressed air?
(g) Discuss the effects of clearance in a compressor.
(h) Define volumetric efficiency.
(i) What are the functions of a steam condenser?
(j) What are the disadvantages of a jet condenser?

PART B

Q2. (a) Define stagnation pressure. Obtain an expression for stagnation pressure in terms of approach Mach number and pressure. **8**
(b) Obtain an expression for velocity of sound wave in a compressible fluid. **7**

Q3 (a) Derive an expression for mass rate of flow of compressible fluid through a nozzle fitted to a large tank. What is the condition for maximum rate of flow? **8**
(b) Find the Mach number when an aeroplane is flying at 1100 km/hour through still air having a pressure of 7 N/cm^2 and temperature -5^{o}C. Wind velocity may be taken as zero. Take R=287.14 J/kgK and γ = 1.4. **7**

Q4 (a) What do you mean by a supersaturated flow? Explain with the help of h-s diagram. **5**
(b) Define different types of steam nozzles and sketch their shapes. **5**
(c) What is the effect of super saturation in nozzles. **5**

PART C

Q5 (a) Describe with a neat sketch the construction and working of a single-stage single-acting reciprocating air compressor. **8**

(b) Derive an expression for work done/kg of air in a reciprocating compressor. **7**

Q6. A single-stage single-acting compressor delivers 0.5 kg of air per minute at 5 bar. The temperature and pressure at the end of suction stroke are 20^{o}C and 1 bar. The bore and stroke of the compressor are 100mm and 150mm respectively. The clearance is 4% of the swept volume. Assuming the index of compression and expansion to be 1.3, find

(i) Volumetric efficiency of the compressor

(ii) Power required if the mechanical efficiency is 85%

(iii) Speed of the compressor (rpm). **15**

Q7. (a) Classify condensers. In what respect a jet condenser differs from a surface condenser? **5**

(b) Explain the effect of air leakage in a condenser. What are the sources of air leakage? **5**

(c) Explain the use of a cooling tower in a power plant. Describe any one type of cooling tower with a neat sketch. **5**
