



ANJUMAN-I-ISLAM'S  
**KALSEKAR TECHNICAL CAMPUS, NEW PANVEL**  
School of Engineering & Technology

**DEPARTMENT OF MECHANICAL ENGINEERING**

CLASS:- BE

SUBJECT:- Mechanical Utility System

DURATION:- 60 min.

SEM:- VII

DATE:-16 / 09 / 2016

MARKS:- 20 Marks

**CLASS TEST 01**

**Q.01 Attempt any two: ( 4 x 2 = 08 Marks)**

- a) A single stage reciprocating compressor takes  $1 \text{ m}^3$  of air per minute at 1.013 bar at  $15^\circ\text{C}$  and delivers it at 7 bar according to law  $PV^{1.35} = C$ . Calculate power require to drive the compressor neglecting clearance. (04)
- b) Centrifugal compressor delivers 16.5 kg/s of air with total head pressure ratio of 4:1. The speed of compressor is 15000 rpm. Inlet total head temperature is  $20^\circ\text{C}$ , slip factor is 0.9, power input factor is 1.04 and isentropic efficiency is 80%. Calculate i) overall diameter of the impeller. ii) Power Input. (04)
- c) Explain in detail the term static head and total head for centrifugal compressor. (04)

**Q.02 Attempt any two: (6 x 2 = 12 Marks)**

- a) A two stage double acting air compressor operating at 220 rpm takes in air at 1 bar and  $27^\circ\text{C}$ . The size of the low pressure cylinder is 360 mm x 400 mm. Stroke of high pressure cylinder is same as that of low pressure cylinder and the clearance in both the cylinder is 4%. The low pressure cylinder discharge the air at pressure of 4 bar. The air passes through intercooler and it enters the high pressure cylinder at  $27^\circ\text{C}$  and 3.8 bar. Finally air is discharge from the compressor at 15.2 bar. The compression index in both the cylinder is 1.3. Take  $C_p = 1.005 \text{ kJ/kg k}$ . Calculate i) Heat rejected in the intercooler. ii) Diameter of high pressure cylinder. iii) Power require to drive high pressure cylinder. (06)
- b) A two stage single Acting reciprocating compressor takes in air at the rate of  $0.2 \text{ m}^3/\text{s}$ . The intake temperature and pressure of air are 0.1 MPa and  $16^\circ\text{C}$ . The air is compressed to a final pressure of 0.7MPa. The intermediate pressure is ideal and intercooling is perfect. The compression index in both the stage is 1.25 and compressor run at 600 rpm. Neglecting clearance determine i) Total Volume of each cylinder. ii) Power require to drive the compressor. iii) Rate of heat rejection in the intercooler. (06)
- c) Single inlet type of centrifugal compressor handles 528 Kg/min of air. The ambient air condition are 1 bar and  $20^\circ\text{C}$ . The compressor run at 20000 rpm with isentropic efficiency of 80%. The air is compressed in the compressor from 1 bar static pressure to 4 bar total pressure. The air enters the impeller eye with a velocity of 145 m/s with no pre-whirl. Take slip factor as 0.9. Calculate  
i) Rise in total temperature during compression if the change in Kinetic Energy is negligible. ii) The tip diameter of the impeller. iii) eye diameter if hub diameter is 12 cm. (06)