

Code No: RR220801

RR

Set No. 2

II B.Tech II Semester Examinations, December 2010
MECHANICAL ENGINEERING
Chemical Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the relative advantages and disadvantages of flat belt drive over V-belt drive.
- (b) An impregnated belt $10\text{mm} \times 250\text{mm}$ drives a pulley 100cm in diameter at 340 rpm . The angle contact on the smaller pulley is 120° . The stress in the tight side is 1000 kN/m^2 . Density of the belt is 0.98 g/cm^3 . The coefficient of friction between the belt and the pulley is 0.35 . Determine the power capacity of the belt in kW. [6+10]
2. (a) Define the following terms:
 - i. System
 - ii. Surroundings
 - iii. Boundary of a system
- (b) Differentiate between the flow work and non flow work with the help of neat drawing of PV diagram. [6+10]
3. (a) Show that the efficiency of a Carnot engine is the maximum possible efficiency.
- (b) Air is cooled reversibly at constant pressure of 100 kPa in a cylinder-piston arrangement from a temperature of 200°C to a temperature of 30°C . Calculate the work done, heat transfer and change in entropy per kg of air. For air $R = 0.287\text{ kJ/kgK}$ and $\gamma = 1.4$ [8+8]
4. (a) What do you understand by 'gear train'? Discuss the various types of gear trains.
- (b) Explain the principle, advantages and disadvantages of slipper bearings. [10+6]
5. (a) What are the effects of clearance volume and delivery pressure on the volumetric efficiency of a compressor? Illustrate the answers with sketches.
- (b) A two stage reciprocating compressor with an intercooler is to deliver 20 kg/min of air at 1600 kPa . It receives atmospheric air at 20°C . Determine the power required for the two stage adiabatic compressor. Assume 90 per cent efficiency for each stage. [8+8]
6. (a) Explain why isothermal process of wet steam is a constant pressure process, but it is not so for superheated steam.
- (b) Determine the quality and specific volume of steam for the following conditions:

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- i. Pressure of 450 kN/m² abs and total heat of 611 kcal/kg
ii. Pressure of 1000 kN/m² abs and total heat of 710 kcal/kg [6+10]
7. (a) Explain the merits and demerits of diesel engine with respect to petrol engine.
(b) Prove that the ideal thermal efficiency of an IC engine working on Otto cycle is given by $\eta_{th} = 1 - \frac{1}{(R_c)^{\gamma-1}}$ [6+10]
8. A dual cycle is used to model a piston engine. The engine intakes atmospheric air at 20°C, compresses it to 10MPa, and then combustion increases the pressure to 20MPa. For a cutoff ratio of 2, calculate the cycle efficiency and the power output for airflow of 0.1 kg/s. [16]

FIRSTRANKER

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Set No. 4

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