

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. Sem. - II Remedial Examination, September 2009

Subject code: 110006

Subject Name: Elements of Mechanical Engineering

Date: 07/09/2009

Time: 11:00am-1:30pm

Total Marks: 70

Instructions:

1. Write seat no. and enrolment no. at given location on question paper.
2. Attempt all questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.
5. Use of steam table is permitted.

- Q. 1.**
- | | | |
|-----|--|-----------|
| (a) | Define prime movers. Classify the prime movers. | 03 |
| (b) | Define zeroth law of thermodynamics, and First law of thermodynamics. | 04 |
| (c) | In air compressor air enters at 1.013 bar and 27 degree centigrade having volume 5.0 m ³ /kg and it is compressed to 12 bar isothermally. Determine | 07 |
| | (i) Work done | |
| | (ii) Heat transfer and | |
| | (iii) Change in internal energy. | |
- Q. 2.**
- | | | |
|-----|--|-----------|
| (a) | Difference between Petrol (S.I.) engine and Diesel (C. I.) engine. | 03 |
| (b) | Determine condition of steam at a 12 bar if 2580 KJ/kg heat is required to produce it from water at 0 degree centigrade. | 04 |
| (c) | The following information is available from test of a combined separating and throttling calorimeter. | 07 |
| | (i) Pressure of steam in a steam main = 9.0 bar. | |
| | (ii) Pressure after throttling = 1.0 bar. | |
| | (iii) Temperature after throttling = 115 degree centigrade. | |
| | (iv) Mass of steam condensed after throttling = 1.8 Kg | |
| | (v) Mass of water collected in the separator = 0.2 Kg. | |
| | Calculate the dryness fraction of the steam in the main. | |
- OR**
- | | | |
|-----|---|-----------|
| (c) | Following readings were taken during test of single cylinder four stroke oil engine. | 07 |
| | (i) Cylinder diameter = 250 mm | |
| | (ii) Stroke length = 400 mm | |
| | (iii) Main effective pressure = 6.5 bar | |
| | (iv) Engine speed = 250 r. p .m. | |
| | (v) Net load on brake = 1080 Newton | |
| | (vi) Effective diameter of brake = 1.5 meter | |
| | (vii) Fuel used per hour = 10 Kg | |
| | (viii) Calorific value of fuel = 44300 KJ/Kg | |
| | Calculate (1) Indicated power, (2) Brake power, (3) Mechanical efficiency and (4) Indicated thermal efficiency. | |
- Q. 3.**
- | | | |
|-----|---|-----------|
| (a) | Derive an expression for efficiency of Otto cycle. | 03 |
| (b) | A hot air engine works on Carnot cycle with thermal efficiency of 70%. If final temperature of air is 20 degree centigrade, determine initial temp. | 04 |

- (c) In an ideal diesel cycle the temperature at beginning and at the end of Compression are 57.0 degree centigrade and 603 degree centigrade respectively. The temperatures at beginning and end of expansion are 1950 degree centigrade and 870 degree centigrade respectively. Determine the ideal efficiency of the cycle if pressure at beginning is 1.0 bar. Calculate: maximum pressure in the cycle. **07**
- OR**
- Q. 3.** (a) Differentiate between Fire tube and Water tube boiler. **03**
 (b) Enlist different mountings. Explain any one with figure **04**
 (c) A boiler generates 7.5 Kg of steam per Kg of coal burnt at a pressure of 11 bar. **07**
 The feed water temperature is 70 degree centigrade; boiler efficiency is 75 %, factor of evaporation 1.15. Take $C_p = 2.1 \text{ KJ/Kg K}$.
 Calculate (i) Degree of super heat and temp of steam generated.
 (ii) Calorific value of coal KJ/Kg
 (iii) Equivalent evaporation in Kg of steam per Kg of coal.
- Q. 4** (a) Explain working of Hartnell Governor with neat sketch. **04**
 (b) Explain construction and working of centrifugal pump with sketch. **04**
 (c) Derive an expression for compressor without clearance **06**
 $W = P * V * \log_e(P_2/P_1)$ for isothermal compression.
- OR**
- Q. 4** (a) Explain window air conditioner along with its advantages. **04**
 (b) Make comparison between vapour compressions and vapour absorption system. **04**
 (c) Explain Green's economizer with neat sketch. **06**
- Q. 5** (a) Differentiate between Clutch and Brake. **04**
 (b) Compare individual drive and group drive, **04**
 (c) What are the materials used for belts. Compare flat and V – belt drive. **06**
- OR**
- Q. 5** (a) Define ductility, plasticity, force and mass. **04**
 (b) Discuss construction and working of Cochran boiler with sketch. **04**
 (c) List various gaseous fuels. State its advantages and disadvantages. **06**
