

GANPAT UNIVERSITY
 B.Tech. Sem.-I (B) (ME/MC/Civil) Examination, Nov.-Dec. 2010
ME 101 Elements of Mechanical Engineering

Max. Time: 3 hours

Max. Marks: 70

Instructions:

- (1) Attempt all question.
- (2) Right figure indicates full marks.
- (3) Assume required data if necessary.

SECTION-I

- 1 (a)** What is prime mover? Explain various sources of energy with classification of prime movers. **4**
- (b)** One kg. Of air at 7 bar pressure and 90° C temperature undergoes a non-flow polytropic process. The law of expansion is $pv^{1.1} = \text{const}$. The pressure falls 1.4 bar during the process. Calculate (i) The final temperature (ii) Work done (iii) Change in internal energy (iv) Heat exchange. Take $R = 287 \text{ J/kg.k}$ and $\gamma = 1.4$ for air. **5**
- (c)** Prove that $C_p - C_v = R$ with usual notations. **3**
- 2 (a)** Write short note: Water level indicator. **5**
- (b)** Steam at 5 bar, and dryness fraction of 0.85 expands reversibly at constant pressure until the temperature is 220 °C. Determine the work input and heat supplied per kg of steam during the process. Take $C_{ps} = 2.1 \text{ kJ/kg K}$. **6**
- OR**
- 2 (a)** 0.9 Kg. of air at a pressure of 14 bar, a volume of 0.17 m³ and temperature of 627 °C is supplied with heat at constant pressure till it's volume is doubled. The air is then expanded adiabatically till the pressure drops to 1 bar. Calculate (1) Heat supplied (2) Work done (3) Change in internal energy during constant pressure heating and workdone during adiabatic change. Take $C_p = 0.996 \text{ kJ/kg K}$ and $C_v = 0.711 \text{ kJ/kg K}$. **6**
- (b)** An engine operating on Diesel cycle has maximum pressure and temperature of 45 bar and 1500 °C. Pressure and temperature at the beginning of compression are 1 bar and 27 °C. Determine the air standard efficiency of the cycle. Take $\gamma = 1.4$ for air. **5**
- 3 Attempt any three:** **12**
- (a)** Differentiate between Fire tube boiler and Water tube boiler.
 - (b)** Derive the expression for air standard efficiency of Otto cycle.
 - (c)** Prove that dryness fraction $x = x_1 \cdot x_2$ for combined calorimeter.
 - (d)** Write short note: LPG, CNG and Bio-fuel.
 - (e)** Discuss steam generation process of constant pressure with T-h diagram

Steam table:

Abs.Pre.(P bar)	T _s °C	V _s (m ³ /kg)	h _f (kJ/kg)	h _{fg} (kJ/kg)
5	151.8	0.375	640.1	2107.4

SECTION-II

- 4 (a) Explain the working of 4-stroke diesel engine with net sketch. How it differs from 4-stroke petrol engine ? 6
- (b) A gear train consist of four gears : 1,2,3 and 4 having no of tooth equal to 30,75,40 and 120 respectively. The driver gear 1 runs at 1200 rpm. Find the speed of gear 4. 5
If (i) The gear train is simple
(ii) Gear 1 mesh with gear 2. gear 2 and 3 are mounted on same shaft and gear 4 mesh with gear 3.
- OR**
- 4 (a) What do you mean by Positive displacement air compressors? Derive the equation of work done for reciprocating air compressor with considering clearance volume. 6
- (b) A four cylinder, four stroke, spark ignition engine has a bore of 80 mm and stroke of 80 mm. The compression ratio is 8. Calculate the cubic capacity of the engine and clearance volume of each cylinder. 5
- 5 (a) Classify governor and explain Pronell governor. 4
(b) Enlist different types of gear train and explain Epicyclic gear train. 4
(c) Write a shot note on: "Bucket Pump" 4
- OR**
- 5 (a) What do you mean by governing? Explain Hit and Miss Governing. 4
(b) Enlist and explain different types of belt derives. 4
(c) Write a short note on: "Vane Pump" 4
- 6 **Attempt any three:** 12
- (a) Write a short note on: "Vapour Compression Refrigeration Cycle"
(b) Differentiate 2-Stroke cycle and 4-Stroke cycle IC engine
(c) Differentiate Positive displacement and dynamic displacement air compressor and classify them
(d) What is drive ? Differentiate between individual drive and group drive.
Write the factor affecting the selection of drives

End of paper

Best of luck