Enrolment No._____ Student sign:-_____

GUJARAT TECHNOLOGICAL UNIVERSITY

Mahatma Gandhi Institute of Tech. Education & Research Center, Navsari

B. E. F. Y. (SEM – II) MID SEMESTER EXAMINATION – MARCH 2009

Subject: Elements of Mechanical Engineering **(Code: 110006)**

Date: 26th March, 2009 **Time: 90 Minutes** **Max. Marks: 40**

Center Code:033

Instructions:

1. Attempt All Questions.
2. Make Suitable Assumptions Wherever Necessary.
3. Figures To The Right Indicate Full Marks.

Q.1 Attempt All Questions. **(12)**

a) Define Absolute Zero Temperature.

b) State Clausius Statement of Second Law of Thermodynamics.

c) Define Higher Calorific Value.

d) Write any two differences between primary fuel and secondary fuels.

e) Why high pressure boiler is necessary?

f) Draw a valve timing diagram of 4 stroke engine.

g) Write a function of Fuel Nozzle.

h) What is an air standard cycle?

i) What is Flywheel?

j) Why Clearance is required?

k) Define free air delivery.

l) Define Coefficient of Performance.

Q.2 a) Derive generalized equation of Steady Flow Energy Equation for process. **(04)**

b) Explain Benson Boiler with neat sketch. **(04)**

c) During testing of single cylinder two stroke oil engine, following data were obtained; **(06)**

Brake torque = 650 Nm Cylinder diameter = 24 cm

Speed = 400 rpm Stroke = 31 cm

Mean effective pressure = 5.12 bar Oil consumption rate = 9.12 kJ/hr

Calorific Value of the fuel = 43500 kJ/kg

Determine mechanical efficiency, indicated thermal efficiency, brake thermal efficiency & specific fuel consumption.

OR

Q.2 **a)** Draw P – T diagram for water and explain each process. **(04)**

b) Explain Babcock & Wilcox Boiler with neat sketch. **(05)**

c) Explain in brief water cooled system with neat sketch. Also write advantages and disadvantages of water cooled system over air cooled system. **(05)**

Q.3 **a)** Prove that with usual notations that Volumetric efficiency of the reciprocating Compressor is $\eta_{vol} = 1 - C\left[\left(\frac{p_2}{p_1}\right)^{\frac{1}{n}} - 1\right]$. **(03)**

b) Derive an expression for the efficiency of diesel cycle. **(04)**

c) Draw a neat sketch of Window Air Conditioner showing each part and refrigeration path on it. **(03)**

d) In an Otto cycle the compression ratio is 8.The temperature at the beginning of compression and at the end of heat supply are 310 K and 1600 K respectively. Assume $\gamma = 1.4$ and $C_V = 0.717$ kJ/kg K. Find: (1) heat supplied & (2) efficiency of the cycle. **(04)**

OR

Q.3 **a)** Draw Vapour compression system of refrigeration, Name the basic components & give their functions. **(03)**

b) Derive an expression of workdone of air compressor with usual notation with clearance volume. **(03)**

c) Air is compressed in a single stage reciprocating compressor. Pressure ratio is 10. Inlet pressure is 1 bar. Swept volume is 15 litres. The clearance volume is 6 % of swept volume. Value of n = 1.3. Calculate: (1) volume at all points & (2) power required if N = 233 rpm. Draw the P – V diagram to show the process. **(04)**

d) In an ideal constant volume cycle the pressure and the temperature at the beginning of compression are 97 kPa and 50^0 C respectively. The volume ratio is 5. The heat supplied during the cycle is 930 kJ/kg of working fluid. Take $C_V = 0.717$ kJ/kg K and $\gamma = 1.4$. Calculate: **(04)**

1. The maximum temperature attained in the cycle.
2. Thermal efficiency of the cycle.
3. Work done during the cycle/kg of the working fluid.

******** Best of Luck ********