Allowed Tables and Charts	------------

Answer all the following Questions: (50 Marks)

(Question Number-1): (10 Marks)

(a) Define the first law of thermodynamics for each part of an open gas turbine cycle and show its thermal efficiency can be obtained improved.

(2 Marks)

(b) Two kg of air at 1 bar and 123 $^{\circ}$C is compressed to a pressure of 6 bar. Determine the work-done, the heat exchange and the change in entropy, if the process is considered: 1- Isothermal 2- Adiabatically. Take cp = 1005 kJ/kgK and Cv = 0.718 kJ/kgK.

(6 Marks)

(c) Air flows through a convergent nozzle at 150 kPa and 600 K and very low velocity. It flows out of the nozzle at 80 kPa. If the nozzle is isolated, determine the air exit velocity. Take cp for air = 1.005 kJ/kgK and Cv = 0.718 kJ/kgK.

(2Marks)

(Question Number-2): (10 Marks)

(a) Show a comparison for Otto and Diesel air standard cycles and their thermal efficiency, if the maximum pressure and heat rejected are the same.

(2 Marks)

(b) In a Otto Air Standard Cycle, the pressure and temperature at the beginning of compression are 1 bar and 27 $^{\circ}$C. The cycle produces 450 kJ/kg of work. If the cycle has a expansion ratio of 10. Determine the cycle efficiency and the mean effective pressure, if Cp = 1.005 and Cv = 0.718 kJ/Kg. $^{\circ}$ C.

(8 Marks)

(Question Number-3): (9 Marks)

(a) Describe an experiment to measure the mechanical efficiency for internal combustion engine which has a single cylinder. (3 Marks)

(b) A brick wall of thickness 50 Cm. Find its thermal conductivity and the wall surfaces temperatures, if the inside and outside air temperatures and the heat transfer coefficients are 50 °C, 25 °C, 10 w/m²°C and 5 w/m² °C, respectively. The rate of heat transfer is 50 w/m². (6 Marks)

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(Question Number-4): (11 Marks)

(a) Show a comparison between the four and two Stroke Internal Combustion Engines use illustrations. **(2 Marks)**

(b) Discuss with illustrations and the principle relations of the following:

  i- The different methods of power transmission.
  ii- The lubrication importance and the tests of the lubricating oil.
  (4 Marks)

(c) belt system the driver diameter is 200 mm and the driven diameter is 800 mm. The driver rotates at 600 r.p.m. If the contact angle $\theta = 170\,^\circ$ and the friction factor $\mu = 0.35$, the slip factors $S_1 = 0.013$ and $S_2 = 0.011$ respectively, determine:

  (i) The speed ratio i.
  (ii) The tension ratio T_2/T_1.
  (iii) The axial distance C.
  (iv) The driven speed in r.p.m. in both cases with and without slip.
  (v) The belt length L. **(5 Marks)**

(Question Number-5): (10 Marks)

(a) Describe the hydraulic crane and show its main idea. **(2 Marks)**

(b) Describe the main types of heavy equipments which are used for constructions. **(2 Marks)**

(c) A hydraulic lift uses 1000 liters of water under pressure of 40 bar in lifting a load of 50 kN. How many floors can be estimated if the floor height is 3.25 m. Take the η_{Lift} efficiency for both the cane and the water pump is 70 %. **(6 Marks)**

Best Wishes and Successful   **Dr.Essam Wahba**