FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION.
SCHOOL OF TECHNOLOGY EDUCATION
FIRST SEMESTER 2012/2013 EXAMINATION

COURSE TITLE: THERMODYNAMICS
COUSE CODE: AUT 512 (2 UNITS)
TIME ALLOWED: 2 HOURS
INSRUCTION: ATTEMPT ANY **FOUR (4)** QUESTIONS (Each Question carries 15 marks)

1. A spark ignition engine has a swept volume of 3,600,000 mm^3 and a clearance volume of 950,000 mm^3. At the commencement of the compression stroke, the pressure of air/fuel mixture is 101.3KN/m^2 and the temperature is 65^0C. If R is 295 J/kgk and γ = 1.4. Calculate: (a) The temperature at the end of the compression stroke when the pressure is 750KN/m^2. (b) The specific heats of the mixture. (c) The mass of the mixture.
2. (a) A hydraulic servo-assisted braking system has a cylinder of 20 mm vacuum servo unit with slave cylinder of 16 mm diameter. When the brakes are applied by a pedal force of 178N, the effective pedal leverage is 5 to 1 and the air pressure in the vacuum unit is 32.45KN/m^2 absolute. The efficiency of the system is 90%. Calculate the hydraulic pressure in the brake.
   (b) Define Velocity Ratio and Mechanical Advantage as applied to machine.
3. (a) The combustion chamber of an over-head valve engine is hemispherical, the radius being equal to that of the bore radius. The bore and stroke are 80mm and 140mm respectively. Assuming that the piston just reaches the hemisphere; Calculate the swept volume of the cylinder and the compression ratio.
   (b) Enumerate briefly: (i) Entropy (ii) Enthalpy.
4. (a) State and describe **four (4)** factors that cause a process to be irreversible.
   (b) A force of 310N is applied perpendicular to the foot-brake pedal of a car fitted with hydraulic brakes. The pedal leverage is 6 to 1 and the diameter of the master cylinder is 25mm. the wheel cylinder (4 double acting) are 32mm diameter, and each wheel cylinder plunger moves 0.8 mm when the brakes are applied. Allowing 25mm of free pedal movement. Calculate:
      (i) Distance moved by the pedal when the brakes are applied.
      (ii) Force exerted on each brake shoe.
5. A hydraulic garage press is operated by a force of 265N applied perpendicular to the end of a lever, the lever ratio is 15 to 1. The pumping plunger is 25mm diameter and its stroke is 50mm. the ram is 200mm diameter. Neglecting friction, Calculate:
   (i) The load on press
   (ii) The number of pumping strokes required to move the ram 50mm.
6. (a) Enumerate briefly on the following: (i) Isothermal Expansion
   (ii) Adiabatic Expansion
   (b) The pressure of the working substance just at the beginning of the working stroke in an engine cylinder is 2,000,000 N/m^2 gauge and the volume is o.02m^3. Calculate the volume at the end of the working stroke if the pressure is then 331,000 N/m^2 gauge. The polytrophic index for the expansion is 1.32. Normal atmospheric pressure is 101.3N/m^2.