Indian Institute of Technology Kharagpur

Department of Mechanical Engineering

ATF-1 (Internal Combustion Engine) ME41001

Tutorial 1

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1. The engine of the Fiat car has four cylinders of 68 mm bore and 75 mm stroke. The compression ratio is 8. Calculate the cubic capacity of the engine and the clearance volume of each cylinder. [1089.48 cm^3, 38.9 cm^3]

2. Derive an expression for the dimensionless piston speed.

3. Derive an expression for the dimensionless cylinder volume $V(\theta)/V(0)=f(\theta, r_c, r/l)$.

4. Compute the mean piston speed, bmep, torque and power/area for three engines: Marine ($\dot{W}_b$ =1118 kW, B=0.136 m, N=2600 rpm, L=0.127 m, n_c = 12), Dragster ($\dot{W}_b$ =447 kW, B=0.108 m, N=6400 rpm, L=0.0.095 m, n_c = 8) and Formula One ($\dot{W}_b$ =522 kW, B=0.086 m, N=10500 rpm, L=0.057 m, n_c = 8).

5. A 3.8 L four-stroke fuel-injected automobile engine has a power output of 88 kW at 4000 rpm and volumetric efficiency of 0.85. The bsfc is 0.35 kg/kW-hr. If the fuel has a heat of combustion of 42 MJ/kg, what are the bmep, thermal efficiency, and air to fuel ratio? Assume atmospheric conditions of 298 K and 1 bar.