

YEOVIL COLLEGE
DEPARTMENT OF ENGINEERING
BTEC HNC/D AEROSPACE ENGINEERING
UNIT 92 GAS TURBINE SCIENCE QCF

Learning Outcome 2, Classwork 2

To enable you to fully address Outcome 2 Investigate Thermodynamic Properties and Laws, you will either need to complete the following classwork or supply RPL evidence

Second Law of Thermodynamics

Q1 A petrol engine working on the Otto cycle has a compression ratio of 9:1, and at the beginning of compression the temperature is 32° C. After heat energy supply at constant volume, the temperature is 1700° C. The index of compression and expansion is 1.4. Calculate:

- (a) temperature at the end of compression;
- (b) temperature at the end of expansion;
- (c) air standard efficiency of the cycle.

Q2 In a diesel cycle the pressure and temperature of the air at the start of compression are 1 bar and 57° C respectively. The volume compression ratio is 16 and the energy added at constant pressure is 1250 kJ/kg. Calculate:

- (a) theoretical cycle efficiency;
- (b) mean effective pressure.

Q3 An indicator diagram taken from one cylinder of a 6 cylinder 2- stroke engine has an area of 2850 mm² and the length 75 mm when running at 2 rev/s. The indicator spring rate is 1 mm = 0.2 bar. Given that the cylinder bore is 550 mm and the stroke is 850 mm, calculate the indicated power of the engine, assuming each cylinder develops the same power.

Q4 A 6-cylinder, 4-stroke diesel engine has a bore of 150 mm and a stroke of 120 mm. The indicated mean effective pressure is 9 bar, the engine runs at 300 rpm, and the mechanical efficiency is 0.85. Calculate the indicated and the brake power.

Q5 A single 4-stroke engine is attached to a dynamometer which provides a braking load of 362 N. The radius at which the brake acts is 800 mm. If at this load the engine has a speed of 318 rpm, find the brake power.

Q6 A single 4-stroke oil engine has a cylinder diameter of 180 mm and a stroke 300 mm. During a test the following results were recorded,

Area of indicator = 500 mm²
Length of indicator card = 70 mm
Card scale (spring rate)
1 mm = 0.8 bar
Brake load = 354 N

Brake load radius = 780 mm
Engine speed = 5 rev/s
Fuel consumption = 3.2 kg/h
Calorific value of fuel = 43.5 MJ/kg

Calculate:

- (a) the indicated power;
- (b) the brake power;
- (c) the brake thermal efficiency.