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S.E. (Mech./Auto.) (Second Semester) EXAMINATION, 2019

APPLIED THERMODYNAMICS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve *four* questions. Question Nos. **1 or 2, 3 or 4, 5 or 6, 7 or 8.**

(ii) All the *four* questions should be solved in one answer-book and attach extra supplements if required.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right side indicate full marks.

(v) Use of scientific calculator is allowed.

(vi) Assume suitable data, if necessary.

1. (a) Define the following engine nomenclature : [6]

(i) Cylinder Bore

(ii) Stroke

(iii) Displacement volume

(iv) Clearance volume

(v) Compression ratio

(vi) Cubic capacity.

P.T.O.

- (b) Explain with figures any *three* types of combustion chambers used in SI engines. [6]
- Or
2. (a) Explain the following losses associated the actual cycle (any *three*) : [6]
- (i) Time loss
 - (ii) Rubbing friction loss
 - (iii) Exhaust blowdown loss
 - (iv) Pumping loss
 - (v) Direct heat loss.
- (b) Describe briefly : [6]
- (i) Factors affecting the process of carburation.
 - (ii) Rating of fuels in SI engines.
3. (a) Explain phenomenon of diesel knock. Compare it with the phenomenon of detonation in S.I. engines. [6]
- (b) The following details were noted in a test on a 4-cylinder, 4-stroke engine, diameter = 100 mm; stroke = 120 mm; speed of the engine = 1600 rpm; fuel consumption = 0.2 kg/min; calorific value of fuel is 44000 kJ/kg; difference in tension on either side of the brake pulley = 40 kg; brake circumference is 300 cm. If the mechanical efficiency is 80%, Calculate :
- (i) brake thermal efficiency
 - (ii) indicated thermal efficiency
 - (iii) indicated mean effective pressure
 - (iv) Brake specific fuel consumption. [6]

Or

4. (a) What is supercharging ? How is it achieved ? Explain it with P-V diagram [6]

(b) During the trial of a single-cylinder, four-stroke oil engine, the following results were obtained : [6]

Cylinder diameter = 20 cm

Stroke = 40 cm

Mean effective pressure = 6 bar

Torque = 407 Nm

Speed = 250 rpm

Oil consumption = 4 kg/hr

Calorific value of fuel = 43 MJ/kg

Cooling water flow rate = 4.5 kg/min

Air used per kg of fuel = 30 kg

Rise in cooling water temperature = 45°C

Temperature of exhaust gases = 420 °C

Room temperature = 20°C

Mean specific heat of exhaust gas = 1 kJ/kg K

Specific heat of water = 4.18 kJ/kg K

Find the IP, BP and draw up a heat balance sheet for the test in kJ/hr.

5. (a) With neat sketch, discuss the effect of A : F ratio on emission of : [6]

(i) Unburnt HC

(ii) CO

(iii) NO_x.

(b) Draw neat labelled sketch of battery ignition system showing various components and briefly explain its working. [7]

Or

6. (a) With neat sketch explain splash lubrication system. [6]

(b) Write a short note on Emissions from S.I and C.I engines and their harmful effects. [7]

7. (a) Describe with a neat sketch, the working of a vane compressor. [6]

(b) A single stage reciprocating air compressor takes in 7.5 m³/min of air at 1 bar and 30°C and delivers it at 5 bar. The clearance is 5% of the stroke. The expansion and compression are polytropic, $n = 1.3$. Calculate : [7]

(i) the temperature of delivered air

(ii) volumetric efficiency

(iii) Power of the compressor.

Or

8. (a) Explain the following terms related to compressor : [6]

(i) Free air delivery

(ii) Capacity of compressor

(iii) Volumetric efficiency.

- (b) A three stage compressor delivers air at 70 bar from an atmospheric pressure of 1 bar and 30°C. Assuming the intercooling complete, estimate the amount of minimum work required to deal with 1 kg of air. Also find the amount of heat rejected in each intercooler. The index of compression is 1.2 throughout. Take C_p for air = 1.005 kJ/kg K. [7]