



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH(AUE)/SEM-4/AUE-403/2010

2010

AUTOMOTIVE PETROL ENGINES

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10

i) Firing order of a 6-cylinder In-line Engine is

a) 1 – 3 – 5 – 6 – 4 – 2

b) 1 – 5 – 3 – 2 – 4 – 6

c) 1 – 4 – 6 – 2 – 5 – 3

d) 1 – 5 – 3 – 6 – 2 – 4. 1

ii) Specific heat C_p and C_v both increases with temperature. As temperature increases, what is the fate of ratio of specific heat γ ?

a) Increase b) Remains constant

c) Decreases d) None of these. 1



iii) The structure of most suitable SI engine fuel is

- a) straight chain hydrocarbon
- b) branched chain hydrocarbon
- c) closed chain hydrocarbon
- d) none of these.

1

iv) With increase in compression ratio, flame speed

- a) decreases
- b) increases
- c) remains the same
- d) none of these.

1

v) Knock in SI engines is a phenomenon

- a) post - TDC
- b) pre - TDC
- c) TDC
- d) none of these.

1

vi) Specific fuel consumption in MPFI engines is

- a) better than carburetted engine
- b) equal to that of carburetted engine
- c) worse than carburetted engine
- d) cannot be compared.

1



vii) Mechanical efficiency may be defined as

- a) Indicated Horse Power (IHP) to Brake Horse Power (BHP)
- b) Brake Horse Power (BHP) to Indicated Horse Power (IHP)
- c) Indicated Horse Power (IHP) – Brake Horse Power (BHP)
- d) Indicated Horse Power (IHP) \times Brake Horse Power (BHP).

1

viii) Petrol engine operates on

- a) constant volume cycle
- b) constant pressure cycle
- c) dual combustion cycle
- d) none of these.

1

ix) Advancing the spark timing in petrol engine with respect to TDC the tendency towards knocking while decreasing the speed of the engine the tendency.

- a) increases, decreases
- b) increases, does not change
- c) decreases, increases
- d) does not change, decreases
- e) increases, increases
- f) decreases, decreases.

2



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

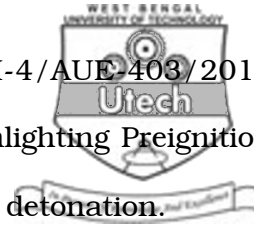
2. Briefly explain the classification of two stroke engines based on scavenging process.
3. With a neat sketch explain how a thermostatic controlled water cooling system works.

Write down the limitations of thermo-siphon system.

4. An eight cylinder four stroke oil engine of 8 cm bore and 9 cm stroke having compression ratio 7.5 is tested at 4600 rpm on a dynamometer with 55 cm arm. During a fifteen minute test, the dynamometer scale beam reading was 40 kg and the engine consumed 7 kg of gasoline having calorific value 44 MJ/kg. Air at 1.0 bar and 27°C was supplied to the carburetter at 5.8 kg/min.

Obtain the following :

- i) Brake power
- ii) BMEP
- iii) BSFC
- iv) Brake thermal efficiency
- v) Volumetric efficiency and
- vi) Air-fuel ratio.



5. Write a note on abnormal combustion highlighting Preignition and Autoignition. Explain the phenomenon detonation.
6. Describe D-MPFI and L-MPFI Gasoline Injection systems and also MPFI-Electronic Control system.

GROUP – C

(Long Answer Type Questions)

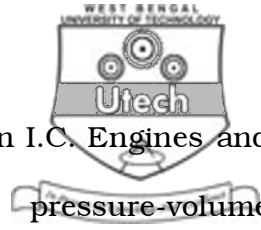
Answer any *three* of the following. $3 \times 15 = 45$

7. a) Describe, with a suitable diagram, the different stages of combustion in a spark-ignition engine. Explain each stage of combustion in a greater detail. 10
- b) Discuss the role of different parameters responsible for detonation. 5
8. a) Derive the following expression of Air-fuel ratio in a simple downdraft carburetter considering compressibility of air into account

$$A/F = 0.1562 \frac{C_{da}}{C_{df}} \cdot \frac{A_2}{A_f} \cdot \frac{p_1 \sqrt{\left(\frac{p_2}{p_1}\right)^{1.43} - \left(\frac{p_2}{p_1}\right)^{1.71}}}{\sqrt{2T_1 \rho_f (p_1 - p_2 - gz\rho_f)}}$$

where the symbols have their usual meanings. 8

- b) Describe how a simple downdraft carburetter functions. 7



9. a) Describe the various types of losses in I.C. Engines and explain how they influence the pressure-volume diagram. 13

- b) Define Octane number and Performance number. 2

10. During a trial on single cylinder 4 stroke oil engine, the following data were recorded. Diameter 250 mm; Stroke 600 mm; Area of indicator diagram 4.3 cm^2 ; Length of indicator diagram 7 cm; Spring constant $8.3 \text{ bar/cm}^2/\text{cm}$; Engine speed 360 rpm; Load on hydraulic dynamometer 990 N; Dynamometer constant 12,000. Fuel used 11 kg/hr, C-V of fuel 43,000 kJ/kg. 18.2 kg of cooling water circulated/minute with temperature rise of 24°C . Mass analysis of oil C 85%, H_2 13.5%; Incombustible 1.5%. The volume analysis of exhaust gas is CO_2 8%; O_2 11%; N_2 81%.

Exhaust gas temperature 400°C ; Specific heat of exhaust gases and that of superheated steam is 1.05 kJ/kg.K and 2.1 kJ/kg.K respectively; Ambient temperature 25°C ; Partial pressure of steam in exhaust gases is 0.035 bar.

- Draw a heat balance sheet on minute basis. 15



3 × 5

11. Write notes on the following :

- a) Morse Test and its application.
- b) Valve timing diagram and port timing diagram with proper reasoning.
- c) ASTM distillation curve and important qualities of SI engine fuels.

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