

**Bihar Engineering University, Patna**  
**End Semester Examination - 2022**

T=14

**Course: B.Tech.**  
**Code: 102701**

**Semester: VII**  
**Subject: INTERNAL COMBUSTION ENGINES**

**Time: 03 Hours**  
**Full Marks: 70**

**Instructions:-**

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. **1** is compulsory

**Q.1 Choose the correct answer (any seven) of the following:**

**[2 x 7 = 14]**

- (a) The compression ratio of an internal combustion engine is defined as the ratio of
  - I. Displacement volume to clearance volume
  - II. Minimum to maximum cylinder volume
  - III. Maximum to minimum cylinder volume
  - IV. Clearance volume to displacement volume
- (b) Considering the same compression ratio and same conditions of air at the start of compression, the peak pressure generated in the cycle will be maximum for
  - (i) Otto cycle    (ii) Diesel cycle    (iii) Dual cycle    (iv) cannot be determined
- (c) Volumetric efficiency is the measure of
  - I. power of the engine
  - II. speed of the engine
  - III. breathing capacity of the engine
  - IV. pressure rise in the cylinder
- (d) A simple carburettor supplies rich mixture during
  - I. (i) starting    (ii) idling    (iii) cruising    (iv) accelerating
- (e) The method of determination of indicated power of multi-cylinder SI-engine is by the use of
  - (i) Morse test    (ii) Prony brake test    (iii) Motorint test    (iv) Heat balance test
- (f) An engine produces 10 kW brake power while working with a brake thermal efficiency of 30%. If the calorific value of the fuel used is 40000 kJ/kg, then what is the fuel consumption?
  - I. 1.5 kg/hour
  - II. 3.0 kg/hour
  - III. 0.3 kg/hour
  - IV. 1.0 kg/hour
- (g) Knocking tendency in a SI engine reduces with increases.
  - I. Compression ratio
  - II. Wall temperature
  - III. supercharging
  - IV. engine speed
- (h) Where does mixing of fuel and air take place in case of diesel engine?
  - I. Injection pump
  - II. injector
  - III. engine cylinder
  - IV. inlet manifold
- (i) A good CI engine fuel should have
  - I. high octane number
  - II. very high cetane number
  - III. a short ignition lag
  - IV. none of the above
- (j) The factors which must be considered before deciding the optimum firing order of an engine are
  - I. engine vibration
  - II. engine vibration and engine cooling

- III. engine vibration and development of back pressure
- IV. engine vibration, engine cooling and development of back pressure

- Q.2** (a) Derive an expression for air standard efficiency of otto cycle with P-V and T-S diagram. [7]  
 (b) What is abnormal combustion?
- Q.3** (a) Compare the Otto, diesel and diesel cycle for the [7]  
     i. same compression ratio and heat input.  
     ii. same maximum pressure and heat input.  
 (b) An air-standard dual cycle has pressure and temperature at the beginning of compression as 1 bar and 35°C, respectively. The compression ratio is 11, the pressure ratio during heat addition 1.6 and cut-off ratio 1.7. Calculate the [7]  
     i. percentage clearance;  
     ii. pressure and temperature at the salient points of the cycle;
- Q.4** An IC engine working on air standard Dual cycle has compression ratio 15, and the compression begins at 1 bar, 300 K. The maximum pressure is limited to 60 bar. The heat transferred to air at constant volume is twice that at constant pressure. Determine: [14]  
 (a) the pressure and temperature at the cardinal points of the cycle.  
 (b) the cycle efficiency, and  
 (c) the mean effective pressure of the cycle.
- Q.5** (a) Explain the effect of engine, speed and load on maximum brake torque (MBT) spark timing of SI engine. [7]  
 (b) A simple jet carburettor is required to supply 5 kg of air and 0.5 kg of fuel per minute. The fuel specific gravity is 0.75. [7]
- Q.6** (a) What are supercharging and turbo charging? Describe in brief the methods of turbo charging. [7]  
 (b) An eight-cylinder, four-stroke engine of 9 cm bore and 8 cm stroke with a compression ratio of 7 is tested at 4500 r.p.m. on a dynamometer which has 54 cm, arm. During a 10-minute test the dynamometer scale beam reading was 42 kg and the engine consumed 4.4 kg of gasoline having a Calorific value of 44000 kJ/kg. Air at 27°C and 1 bar was supplied to the carburettor at the rate of 6 kg/min. Find the – [7]  
     i. brake power delivered.  
     ii. brake mean effective pressure.  
     iii. brake specific fuel consumption.  
     iv. brake thermal efficiency.  
     v. volumetric efficiency.  
     vi. air-fuel ratio.
- Q.7** (a) Briefly discuss the air-fuel ratio requirements of a petrol engine from no load to full load condition. Describe the essential parts of a modern carburettor. [7]  
 (b) How are injection systems classified? Describe them briefly. Why is the air injection system not used nowadays? [7]
- Q.8** (a) Sketch the constructional layout of a battery ignition system and explain its working. [7]  
 (b) Explain and compare the wet sump and dry sump lubrication systems. [7]
- Q.9** Write short notes on any four of the following:- [14]  
     I. Adiabatic flame temperature  
     II. Multipoint port fuel injection system  
     III. Working principle of jet propulsion  
     IV. combustion chamber design of CI engine  
     V. Types of cooling system