# B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

## Term-End Examination

## June, 2015

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## BIME-010 : THERMAL ENGINEERING

*Time : 3 hours*　　　　　　　　　*Maximum Marks : 70*

*Note :　Attempt any seven questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. Prove that the work done/kg of air in a compressor is given by

$$W = RT_1 \frac{n}{n-1}\left[\left(r_p\right)^{\frac{n-1}{n}} - 1\right],$$

where $r_p$ = pressure ratio.

Symbols carry usual meaning.　　　　　　　*10*

2. Explain the scavenging process in two-stroke SI engine. What do you understand by blow-down process ? Why is it necessary ? What is the difference between the blow-down used in 2-stroke and 4-stroke engines ?　　　　*10*

**3.** The following data relates to a performance test of a single-acting 14 cm × 10 cm reciprocating compressor.

  Suction pressure = 1 bar
  Suction temperature = 20°C
  Discharge pressure = 6 bar
  Discharge temperature = 180°C
  Speed of compressor = 1200 rpm
  Shaft power = 6·25 kW
  Mass of air delivered = 1·7 kg/min

Calculate the following :  *10*

  (a)  The actual volumetric efficiency

  (b)  The indicated power

  (c)  The isothermal efficiency

  (d)  The mechanical efficiency

  (e)  The overall isothermal efficiency

**4.** How are the fuels for SI engines rated ? Explain the effect of octane number on the performance of SI engine.  *10*

**5.** An 8-cylinder, 4-stroke SI engine develops 16·25 kW brake power when tested on 4000 rpm. The compression ratio of the engine is 7. The testing is carried out for 10 minutes and fuel consumption during testing period is 4·5 kg. Take C.V. of fuel used = 45000 kJ/kg. The air passing through the carburettor has 20°C temperature and 1·03 bar pressure. Air measured is 5·45 kg/min. The diameter and stroke both are equal to 8·5 cm.

Determine the following :                                    *10*

(a)   bmep

(b)   bsfc

(c)   The brake thermal and volumemetric efficiency

(d)   Air – fuel ratio

6.  Explain the construction and working of any one type of fuel injection pump. Illustrate your answer with suitable sketches.                    *10*

7.  What is the function of carburettor in an SI engine ? Briefly explain with a neat sketch the operation of a simple flat type carburettor.        *10*

8.  Explain the working of a battery ignition system with the help of a neat sketch. What are the main disadvantages of a battery ignition system ? How can these be overcome ?              *10*

9.  A 6-cylinder, 4-stroke petrol engine of cylinder bore 89 mm, stroke 101·6 mm has a volume compression ratio of 7 : 1. The relative efficiency is 55%, when the petrol consumption is 0·218 kg/hp hr.

Estimate :

(a)   the calorific value of petrol

(b)   corresponding petrol consumption in kg/hr

Given that the indicated mean effective pressure is 8·4 kg/cm$^2$, and speed is 2500 rpm.        *10*

**10.** The following readings were taken during the test of a single-cylinder four-stroke oil engine :

Cylinder diameter = 250 mm

Stroke length = 400 mm

Gross mep = 7 bar

Pumping mep = 0·5 bar

Engine speed = 250 rpm

Net load on the brake = 1080 N

Effective diameter of the brake = 1·5 m

Fuel used per hour = 10 kg

Calorific value of fuel = 44300 kJ/kg

Calculate the following :                                                    *10*

(a)    Indicated power

(b)    Brake power

(c)    Mechanical efficiency

(d)    Indicated thermal efficiency

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