

**B.Tech. – VIEP – MECHANICAL ENGINEERING
(BTMEVI)****Term-End Examination****December, 2015****BIME-010 : THERMAL ENGINEERING***Time : 3 hours**Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted. Use of Steam Table and Mollier Chart is permitted.*

1. (a) Enumerate the applications of compressed air. Also state how the air compressors are classified. What is the role of filter and drier used in a compressor? 7
- (b) A single cylinder, compression ignition engine with a brake thermal efficiency of 30% uses high speed diesel oil having a calorific value of 42000 kJ/kg. Determine the BSFC in kg/kWh. If mechanical efficiency is 80%, calculate ISFC in kg/kWh. 7
2. (a) What is the effect of atmospheric conditions on the output of a compressor? Discuss the effect of Temperature, Pressure and Humidity in brief. 7

- (b) Air is to be compressed in a single-stage reciprocating compressor from 1.013 bar and 15°C to 7 bar. Calculate the indicated power required for a free air delivery of 0.3 m³/min, when the compression process is
- (i) Isentropic
 - (ii) Reversible isothermal
 - (iii) Polytropic with $n = 1.25$ 7
3. (a) What do you mean by 'Cetane number', and 'Octane number' of fuels ? How are they determined ? 4
- (b) A single cylinder, four-stroke diesel engine having a displacement volume of 790 cm³ is tested at 300 rpm. When a breaking torque of 49 Nm is applied, analysis of the indicator diagram gives a mean effective pressure of 980 kPa. Calculate the brake power and indicated power of the engine. Also determine the mechanical efficiency of the engine. 10
4. (a) The following readings were taken during the test of a single-cylinder four-stroke oil engine : 7
- | | |
|-------------------|------------|
| Cylinder diameter | = 250 mm; |
| Stroke length | = 400 mm; |
| Gross m.e.p. | = 7 bar; |
| Pumping m.e.p. | = 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 :

- (i) Indicated power
 - (ii) Brake power
 - (iii) Mechanical efficiency
 - (iv) Indicated thermal efficiency
- (b) A single-cylinder, single acting air compressor running at 300 rpm is driven by a 23 kW electric motor. The mechanical efficiency of the drive between motor and compressor is 87%. The air inlet conditions are 1.013 bar and 15°C, and the delivery pressure is 8 bar. Calculate the free-air delivery in m³/min, the volumetric efficiency and the bore and stroke of the compressor. Assume that the index of compression and expansion is $n = 1.3$, that the clearance volume is 7% of the swept volume, and that the bore is equal to the stroke.

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5. (a) Compare a four-stroke and a two-stroke cycle engine. Provide advantages and disadvantages of each.

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- (b) For a four-stroke SI engine, the measured fuel consumption is 160 kg of fuel in one hour and air consumption is 410 kg during one-sixth of an hour. The heating value of fuel is 42000 kJ/kg and indicated power is 519.5 kW. Determine the air-fuel ratio and indicated thermal efficiency. 7
6. (a) Explain the following terms as applied to I.C. engines : 7
- (i) Bore
 - (ii) Stroke
 - (iii) TDC
 - (iv) BDC
 - (v) Clearance volume
 - (vi) Swept volume
 - (vii) Compression ratio
- (b) The output of an I.C. engine is measured by a rope brake dynamometer. The diameter of the brake pulley is 750 mm and rope diameter is 50 mm. The dead load on the tight side of the rope is 400 N and the spring balance reading is 50 N. The engine consumes 4.2 kg/hr of fuel at rated speed of 1000 rpm. The calorific value of fuel is 43900 kJ/kg.
- Calculate : 7
- (i) Brake specific fuel consumption, and
 - (ii) Brake thermal efficiency.

7. (a) Following observations were recorded during a test on a single-cylinder oil engine :

Bore = 300 mm;

Stroke = 450 mm;

Speed = 300 rpm;

I.M.E.P. = 6 bar;

Net brake load = 1.5 kN;

Brake drum diameter = 1.8 m;

Brake rope diameter = 2 cm.

Calculate :

(i) Indicated power

(ii) Brake power

(iii) Mechanical efficiency 7

(b) A four-stroke petrol engine delivers a brake power of 36.8 kW with a mechanical efficiency of 80%. Determine its indicated power and frictional power. 7

8. (a) What is the difference between 'Ignition timing' and 'Firing order' ? Elaborate in detail. 7

(b) What do you understand by 'Scavenging' in two-stroke engine ? How is it carried out ? Describe in detail. 7