

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

**00112 Term-End Examination  
December, 2016**

**BIME-011 : MACHINE DESIGN – II**

*Time : 3 hours*

*Maximum Marks : 70*

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**Note :** *Attempt any five questions. Question no. 1 is compulsory. Use of machine design data book and scientific calculator is allowed. Assume missing data suitably, if any.*

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**1. Select the most suitable answer. 7×2=14**

- (a) The cylinders in I.C. engines are usually made of
- (i) cast iron or cast steel
  - (ii) aluminium
  - (iii) stainless steel
  - (iv) copper
- (b) The length of the piston in an I.C. engine varies between
- (i) 2.5 D and 3 D
  - (ii) 2 D and 2.5 D
  - (iii) 1.5 D and 2 D
  - (iv) D and 1.5 D

- (c) The helix angle for single helical gears ranges from
- (i)  $10^\circ$  to  $15^\circ$
  - (ii)  $15^\circ$  to  $20^\circ$
  - (iii)  $20^\circ$  to  $35^\circ$
  - (iv)  $35^\circ$  to  $50^\circ$
- (d) If  $Z$  = Absolute viscosity of the lubricant in kg/m-s,  $N$  = Speed of the journal in rpm, and  $p$  = Bearing pressure in  $\text{N/mm}^2$ , then the bearing characteristic number is
- (i)  $\frac{Zp}{N}$
  - (ii)  $\frac{ZN}{p}$
  - (iii)  $\frac{Z}{pN}$
  - (iv)  $\frac{pN}{Z}$
- (e) When the length of the journal is equal to the diameter of the journal, the bearing is said to be a
- (i) short bearing
  - (ii) long bearing
  - (iii) medium bearing
  - (iv) square bearing

- (f) The size of a gear is usually specified by
- (i) pressure angle
  - (ii) pitch circle diameter
  - (iii) circular pitch
  - (iv) diametral pitch
- (g) In worm gears, the angle between the tangent to the thread helix on the pitch cylinder and the plane normal to the axis of worm is called
- (i) lead angle
  - (ii) pressure angle
  - (iii) helix angle
  - (iv) friction angle

2. A full journal bearing of 50 mm diameter and 100 mm length has a bearing pressure of  $1.4 \text{ N/mm}^2$ . The speed of the journal is 900 rpm and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose viscosity at the operating temperature of  $75^\circ\text{C}$  may be taken as  $0.011 \text{ kg/m-s}$ . The room temperature is  $35^\circ\text{C}$ . Find

- (a) the amount of artificial cooling required, and
- (b) the mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is  $10^\circ\text{C}$ . Take specific heat of the oil as  $1850 \text{ J/kg}^\circ\text{C}$ .

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3. The following particulars of a single reduction spur gear are given :  
Gear ratio = 10 : 1  
Distance between centres = 660 mm approximately  
Pinion transmits 500 kW at 1800 rpm.  
Involute teeth of standard proportions (addendum = m) with pressure angle of  $22.5^\circ$   
Permissible normal pressure between teeth = 175 N per mm of width.  
Find

- (a) the nearest standard module if no interference is to occur,
- (b) the number of teeth on each wheel,
- (c) the necessary width of the pinion, and
- (d) the load on the bearings of the wheels due to power transmitted.

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4. Determine a suitable ball bearing to carry a radial load of 10000 N and an axial load of 4000 N. The shaft rotates at 1000 rpm. Average life is 5000 hours. Assume mild shock for the above purpose.

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5. Design a worm gearing to transmit 20 HP from an electric motor which is running at 1500 rpm and attached to another machine running at 75 rpm. Take the load as intermittent (< 3 hours of continuous service) and steady. (Use mechanical design data book)

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6. Design a connecting rod for a four-stroke petrol engine with the following data :

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Piston diameter = 0.10 m

Stroke = 0.14 m

Length of the connecting rod (centre to centre) = 0.315 m

Weight of reciprocating parts = 18.2 N

Speed = 1500 rev/min with possible overspeed of 2500

Compression ratio = 4.0

Probable maximum explosion pressure = 2.45 MPa

7. (a) Discuss the tapered shape factor of the skirt for pistons in an I.C. engine.

- (b) Explain the various types of stresses introduced in crank-web.

7+7