

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

Term-End Examination

December, 2014

00966

BIME-011 : MACHINE DESIGN – II

Time : 3 hours

Maximum Marks : 70

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

1. Select the most appropriate answer and write it in the answer book. $7 \times 2 = 14$
- (a) The form factor of a spur gear tooth depends upon
- (i) circular pitch only
 - (ii) pressure angle only
 - (iii) number of teeth and circular pitch
 - (iv) number of teeth and the system of teeth
- (b) The minimum number of teeth on the pinion in order to avoid interference for 20° stub-system is
- (i) 12
 - (ii) 14
 - (iii) 18
 - (iv) 32

- (c) The backlash for spur gears depends upon
- (i) module
 - (ii) pitch line velocity
 - (iii) tooth profile
 - (iv) both (i) and (ii)
- (d) The helix angle for single helical gears ranges from
- (i) 10° to 15°
 - (ii) 15° to 20°
 - (iii) 20° to 35°
 - (iv) 35° to 50°
- (e) The number of starts on the worm for a velocity ratio of 40 should be
- (i) one
 - (ii) two
 - (iii) three
 - (iv) four
- (f) The cylinders in I.C. Engines are usually made of
- (i) cast iron or cast steel
 - (ii) aluminium
 - (iii) stainless steel
 - (iv) copper
- (g) The tapered roller bearings can take
- (i) radial load only
 - (ii) axial load only
 - (iii) both radial and axial loads
 - (iv) None of these

2. A journal bearing is proposed for a centrifugal pump. The diameter of the journal is 0.15 m and the load on it is 40 kN and its speed is 950 rev/min. Complete the design calculation for the bearing.

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3. A pair of straight teeth spur gears is to transmit 22 kW when the pinion rotates at 320 rpm. The velocity ratio is 1 : 3. The allowable static stresses for the pinion and gear materials are 120 MPa and 100 MPa respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine : (a) module (b) pitch circle diameters of both the pinion and gear taking into consideration the effect of the dynamic loading. The tooth form factor y can be taken as

$$y = 0.154 - \frac{0.912}{\text{No. of teeth}}$$

and the velocity factor C_v as $C_v = \frac{3}{3 + V}$,

where V is expressed in m/s.

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4. A pair of helical gears are to transmit 16 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45° . The pinion runs at 10,000 rpm and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module, and face width from static strength considerations and check the gears for wear.

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5. A triple threaded worm has teeth of 7 mm module and pitch circle diameter of 50 mm. If the worm gear has 30 teeth of $14\frac{1}{2}^\circ$ and the coefficient of friction of the worm gearing is 0.05, find 14

- (a) the lead angle of the worm
- (b) velocity ratio
- (c) centre distance
- (d) efficiency of the worm gearing

6. A 4-stroke diesel engine has the following specifications :

Brake Power = 6 kW; speed = 1,200 rpm;

Indicated mean effective pressure = 0.35 N/mm^2 ;

Mechanical efficiency = 75%.

Determine :

- (a) bore and length of the cylinder;
 - (b) thickness of the cylinder head;
 - (c) size of studs for the cylinder head. 14
7. (a) Discuss the design considerations for a crank pin.
- (b) State the two most important reasons for adopting involute curves for a gear tooth profile. 7+7