

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

Term-End Examination

00708

June, 2016

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 (if any) suitably.

1. Select the most appropriate alternative as an answer : $7 \times 2 = 14$

- (a) In thrust bearing, the load acts
- (i) along the axis of rotation
 - (ii) perpendicular to the axis of rotation
 - (iii) 30° to the axis of rotation
 - (iv) None of the above
- (b) In a full journal bearing, the angle of contact of the bearing with the journal is
- (i) 120°
 - (ii) 180°
 - (iii) 270°
 - (iv) 360°

- (c) The length of the cylinder in I.C. engines is usually taken as
- (i) equal to the length of piston
 - (ii) equal to the length of stroke
 - (iii) equal to the cylinder bore
 - (iv) 1.5 times the length of stroke
- (d) The number of starts on the worm for a velocity ratio of 40 should be
- (i) single
 - (ii) double
 - (iii) triple
 - (iv) quadruple
- (e) The helix angle for double helical gears may be made up to
- (i) 45°
 - (ii) 60°
 - (iii) 75°
 - (iv) 90°
- (f) The rolling contact bearings are known as
- (i) thick lubricated bearings
 - (ii) plastic bearings
 - (iii) thin lubricated bearings
 - (iv) anti-friction bearings
- (g) The backlash for spur gears depends upon
- (i) module
 - (ii) pitch line velocity
 - (iii) tooth profile
 - (iv) both (i) and (ii)

2. A motor shaft rotating at 1500 rpm has to transmit 15 kW to a low speed shaft with a speed reduction of 3 : 1. The teeth are $14\frac{1}{2}^\circ$ involute with 25 teeth on the pinion. Both the pinion and gear are made of steel with a maximum safe stress of 200 MPa. A safe stress of 40 MPa may be taken for the shaft on which the gear is mounted and for the key. Design a spur gear drive to suit the above conditions. Also sketch the spur gear drive. Assume starting torque to be 25% higher than the running torque. 14

3. Design a journal bearing for a centrifugal pump from the following data :
- Load on the journal = 20,000 N;
Speed of the journal = 900 rpm;
Type of oil is SAE 10, for which the absolute viscosity at $55^\circ\text{C} = 0.017 \text{ kg/m-s}$;
Ambient temperature of oil = 15.5°C ;
Maximum pressure for the pump = 1.5 N/mm^2 .
- Determine the mass of lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C .

Heat dissipation coefficient = $1232 \text{ W/m}^2/^\circ\text{C}$. 14

4. A pair of helical gears have to transmit 12 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45° . The number of teeth on pinion is 20, and runs at 10,000 rpm. The teeth on gear is 80. If the gears are made of cast steel having static strength of 100 MPa, determine the required face width. 14

5. Determine the dynamic load carrying capacity of a deep-groove ball bearing with the least bore size, and which is required to resist a radial load of 4 kN and an axial load of 3 kN. The shaft rotates at 14,000 rpm. The bearing is required to be in operation for 12,000 hours. 14

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

Brake power = 6 kW; Speed = 1200 rpm;
Indicated mean effective pressure = 0.35 N/mm²
Mechanical efficiency = 75%.

Determine : 6+4+4

- (a) Bore and length of the cylinder;
- (b) Thickness of the cylinder head; and
- (c) Size of studs for cylinder head.

7. (a) State the two most important reasons for adopting involute curves for a gear tooth profile. 7

(b) Discuss the design of connecting rod for a 4-stroke petrol engine. 7