Roll No. ..... Total Pages : 4

BT-6/M-20 **36044**

MACHINE DESIGN–II

Paper–ME 310 E

Opt. : (I)

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *five* question in all, selecting at least *one* question from each unit. Alt questions carry equal marks. Assume suitable missing data from the recommended design data book.

Topperworld.in

UNIT–I

1. A pair of spur gears consists of a 24 teeth pinion, rotating at 1000 rpm and transmitting power to a 48 teeth gear. The module is 6 mm, while the face width is 60 mm. Both gears are made of steel with an ultimate tensile strength of 450 N/mm^2. They are heat treated to a surface hardness of 250 BHN. Assume that velocity factor accounts for the dynamic load. Calculate

(a) beam strength;

(b) wear strength; and

(c) the rated power that the gears can transmit, if service factor and the factor of safety are 1.5 and 2, respectively. 20

2. A pair of straight bevel gears consists of a 30 teeth pinion meshing with a 45 teeth gear. The module and the face width

are 6 mm and 50 mm respectively. The pinion as well as the gear is made of steel (S_{ut} = 600 N/mm^2). Calculate the beam strength of the tooth. 20

UNIT–II

3. A simple chain No. 10B is used to transmit power from a 1400 rpm electric motor to a line shaft running at 350 rpm. The number of teeth on the driving sprocket wheel is 19. The operation is smooth without any shocks. Calculate (i) the rated power for which the chain drive can be recommended; (ii) the tension in the chain for this rated power; and (iii) the factor of safety for the chain based on the breaking load. 20

4. A cone clutch is to be designed to transmit 7.5 kW at 900 r.p.m. The cone has a face angle of 12°. The width of the face is half of the mean radius and the normal pressure between the contact faces is not to exceed 0.09 N/mm^2. Assuming uniform wear and the coefficient of friction between the contact faces as 0.2, find the main dimensions of the clutch and the axial force required to engage the clutch. 20

UNIT–III

5. A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm^2, find the axial load which the spring can carry and the deflection per active turn. 20

Topperworld.in

6. A 80 mm long journal bearing supports a load of 2800 N on a 50 mm diameter shaft. The bearing has a radial clearance of 0.05 mm and the viscosity of the oil is 0.021 kg/m-s at the operating temperature. If the bearing is capable of dissipating 80 J/s, determine the maximum safe speed. 20

UNIT–IV

7. The bore of a cylinder of the four stroke diesel engine is 150 mm. The maximum gas pressure inside the cylinder is limited to 3.5 MPa. The cylinder head is made of grey cast iron FG 200 (S_{ut} = 200 N/mm^2) and the factor of safety is 5. Determine the thickness of the cylinder head. Studs are used to fix the cylinder head to the cylinder and obtain a leak proof joint. They are made of steel FeE 250 (S_{yt} = 250 N/mm^2) and the factor of safety is 5. Calculate

(a) number of studs;

(b) nominal diameter of studs; and

(c) pitch of studs. 20

8. The turning moment diagram of a multi-cylinder engine is drawn with a scale of (1 mm = 2°) on abscissa and (1 mm = 1250 N-m) on ordinate. The intercepted areas between the torque developed by the engine and the mean resisting torque of the machine taken in order from one end are –30, +400, –270, +330, –310, +230, –380, +270, and –240 mm^2. The engine is running at a mean speed of 240 rpm and the coefficient of speed fluctuations is limited to 0.02. A rimmed

Topperworld.in

flywheel made of grey cast iron FG 200 (mass density = 7100 kg/m^3) is provided. The rim contributes 90% of the required moment of inertia. The rim has rectangular cross-section with width to thickness ratio of 1.5. Determine the dimensions of the rim. 20

Topperworld.in