



Machine Design - II (1090)

P. Pages : 4

Time : Four Hours

Max. Marks : 10

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory & attempt **any two** bits out of a, b, & c from each questions.
5. Use of non - programmable calculator is allowed.
6. Design data book is allowed.
7. Assume suitable data, if necessary.

UNIT - I

1. a) Explain 10
 - i) Pivoted block brake with long shoe.
 - ii) Factors while designing friction clutch.

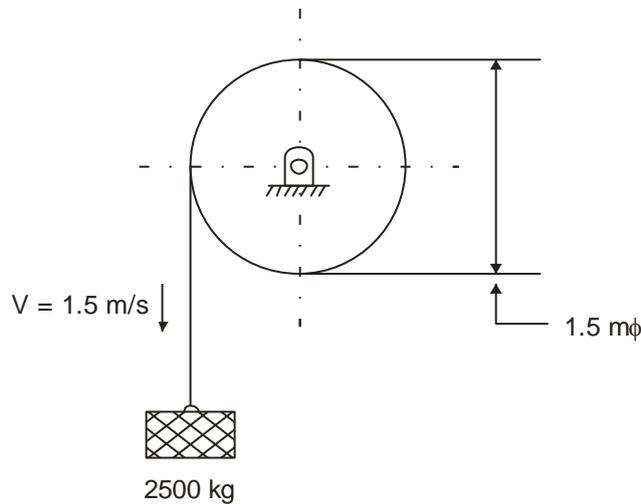
- b) A centrifugal clutch consists of four shoes, each having a mass of 1.5kg. 10

In the engaged position. The radius to the centre of gravity of each shoe is 110mm, while the inner radius of the drum is 140mm. The co-efficient of friction is 0.3. The pre- load in the spring is adjusted in such a way that the spring force at the beginning of engagement is 700N. The running speed is 1440 rpm. Calculate

 - i) The speed at which engagement begins: &
 - ii) The power transmitted by the clutch at 1440 rpm.

- c) A mass of 2500 kg is lowered at a velocity of 1.5 m/s from the drum as shown in following fig. The mass of the drum is 50 kg & its radius of gyration can be taken as 0.7m on applying the brake, the mass is brought to rest in a distance of 0.5m, calculate.
 - i) The energy absorbed by the brake. and
 - ii) The torque capacity of the brake.

10

**UNIT - II**

2. a) Explain 10
- i) Explain basic steps in chain drive designing.
 - ii) Explain ergonomics consideration in design of controls.
- b) It is required to select a flat belt drive for a compressor running at 720 rpm, which is driven by a 25 KW, 1440 rpm motor space is available for a centre, distance of 3m. The belt is - open type. 10
- c) 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 10
- i) The rated power for which the chain drive can be recommended,
 - ii) The tension in the chain for this rated power.
 - iii) The factor of safety for the chain based on the breaking load.

UNIT - III

3. a) A pair of spur gears consists of a 24 teeth pinion, rotating at 1000 rpm & 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 the velocity factor accounts for the dynamic load. Calculate 10
- i) beam strength
 - ii) wear strength
 - ii) rated power that the gears can transmit if service factor and the factor of safety are 1.5 & 2 respectively.
- b) Explain 10
- i) Gear tooth failure of spur gear
 - ii) Beam strength for helical gear

- c) The following data is given for a pair of parallel helical gears made of steel 10
- Power transmitted = 20 kw
 Speed of pinion = 720 rpm
 Number of teeth on pinion = 35
 Number of teeth on gear = 70
 centre distance = 285 mm
 Normal module = 5 mm
 Face width = 50 mm
 Normal pressure angle = 20°
 Ultimate tensile strength = 600 N/mm^2
 Surface hardness = 300 BHN
 Grade of machining = Gr, 6
 Service factor = 1.25
- calculate
- | | |
|---|---|
| i) Helix angle | ii) Beam strength |
| iii) Wear strength | iv) Static load |
| v) Effective load | vi) dynamic load by Buckingham's equation |
| vii) The effective factor of safety against bending failure. | |
| viii) The effective factor of safety against pitting failure. | |

UNIT - IV

4. a) A pair of straight bevel gears consists of a 24 teeth pinion meshing with a 48 teeth gear. The module at outside diameter is 6 mm, while the face width is 50 mm. The gears are made of grey cast is FG 220 ($S_{ut} = 220 \text{ N/mm}^2$). The pressure angle is 20° . The teeth are generated & assume that velocity factor accounts for the dynamics load. The pinion rotates at 300 rpm and the service factor is taken as 1.5 calculate. 10
- i) The beam strength of the tooth
 ii) The static load that the gears can transmit with a factor of safety of 2 for bending consideration.
 iii) The rated power that the gear can transmit.
- b) A pair of worm & worm wheel is designated as 1 / 30 / 10 / 10 10
 The input speed of the worm is 1200 rpm. The worm wheel is centrifugally cast, phosphorbronze and the worm is made of case hardened carbon steel 14C6. Determine the power transmitting capacity based on the beam strength.
- c) Explain force analysis of bevel & worm gear. 10

UNIT - V

5. a) A single - row deep groove ball bearing is subjected to a 30 second work cycle that consists of the following two parts. 10

	Part - I	Part - II
duration (s)	10	20
radial load (KN)	45	15
axial load (KN)	12.5	6.25
Speed (rpm)	720	1440

The static load & dynamic load capacities of the ball bearing are 50 & 68 KN respectively calculate the expected life of the bearings in hours.

- b) A high pressure cylinder consists of a steel tube with inner & outer diameters of 20 & 40 mm respectively. It is jacketed by an outer steel tube, having an outer diameter of 60 mm. The Tubes are assembled by a shrinkage process in such a way that maximum principal stress induced in any tube is limited to 100 N/mm^2 . Calculate the shrinkage pressure and original dimensions of the tubes ($E = 207 \text{ KN/mm}^2$). **10**
- c) Determine the principal stresses for thick cylinders with internal pressure. **10**
