KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

Marks scored:

Level : BE
Year : III

Course : MEEG 318
Semester : II

Exam. Roll No. :

Time: 30 mins.

F.M. : 20

Registration No.:

Date : SEP 06 2017

SECTION "A"

[20Q × 1=20 marks]

Use of Machine Design Data Book is **NOT** allowed for objective. Choose the most appropriate answer and **mark [X]**.

1. Is it possible to transmit power between shafts lying in different planes using gears?
[ ] yes [ ] may or may not [ ] no [ ] information not enough

2. Required velocity ratio is 60:1, which of the following are recommended?
[ ] spur [ ] helical [ ] worm [ ] bevel

3. A muff coupling is connecting two shafts. The torque involved is 650 N-m. The shaft diameter is 45mm with a key 7.5 mm x 15 mm x 80 mm respectively. Find the shear stress induced in the key.
[ ] 25.79 N/mm^2 [ ] 46.29 N/mm^2 [ ] 275.13 N/mm^2 [ ] not listed

4. Flexible shafts have _____ rigidity in torsion making them flexible.
[ ] low [ ] high [ ] very high [ ] infinitely small

5. The torque transmitting capacity of cone clutch increases as its semi vertical angle increase.
[ ] true [ ] decreases [ ] remains constant [ ] not listed

6. A pair of worm gear is written as 2/40/12/6. Calculate the center distance.
[ ] 40 mm [ ] 156 mm [ ] 80 mm [ ] 200 mm

7. Which of the following is not true for cast iron flywheels?
[ ] cheap [ ] complex shape [ ] sudden failure [ ] excellent damping

8. If a drum or radius 200 mm is rotating at 100 rpm, what would be the heat generated with frictional force of 1140 N.
[ ] 3345 W [ ] 4456 W [ ] 5969 W [ ] 11938 W

9. The common normal to the curves of the two teeth _____ the pitch point.
[ ] must pass through [ ] must not pass through
[ ] may or may not pass through [ ] passes depending upon gear type

10. The two gears are said to have conjugate motion if
[ ] they have constant angular velocity ratio
[ ] variable angular velocity ratio
[ ] infinitely small angular velocity ratio
[ ] none of the mentioned

11. Which of the following are not true for worm gears?
[ ] worm is in the shape of threaded screw [ ] threads on the worm have small lead
[ ] worm imposes high thrust loads [ ] characterized by low speed reduction ratio

12. A machine started malfunctioning due to some issues with the coupling. The coupling emplaced in the machine was Oldham. The only coupling available in the workshop is Hooke's coupling. So Oldham coupling can be replaced by Hooke's coupling.
[ ] can be done [ ] can be done for temporary use
[ ] can be done for small misalignment [ ] cannot be done

13. The shaft is always stepped with _____ diameter at the middle portion and _____ diameter at the shaft ends.
[ ] minimum, maximum [ ] maximum, minimum
[ ] minimum, minimum [ ] maximum, maximum

14. A hollow saddle key transmits power through _____
[ ] frictional resistance only [ ] interlocking only
[ ] friction and interlocking [ ] friction or interlocking

15. Is Lewis equation valid to obtain beam strength in bevel gears?
[ ] yes, it can be used [ ] yes, but cannot rely on the value
[ ] no, it can be used only for spur gears [ ] no, it can be used only for helical gears

16. The energy absorbed by brake is _____
[ ] kinetic energy [ ] potential energy
[ ] kinetic or potential energy [ ] strain energy

17. The multi disk clutches are _____
[ ] always dry clutches [ ] always wet clutches
[ ] dry or wet clutches [ ] depends on the lining materials

18. Identify the correct statement in relation to block brake.
[ ] the friction force and normal reaction are concentrated at midpoint of shoe
[ ] moment of frictional force about the pivot is not zero
[ ] shoe is constrained to move towards the drum to compensate the moment acting
[ ] pressure intensity on long shoe brake varies directly with sine of pressure angle of th lining

19. Identify the correct statement is
[ ] clutch and coupling perform same action
[ ] for a new friction lining, uniform wear theory is used
[ ] if a number of contact surface is 5, 6 number of disk required in multi disk clutch
[ ] the coefficient of friction is high in multi disk plate clutch

20. Which of the following is correct?
[ ] coupling is a mechanical device that temporarily joints to rotating shafts
[ ] Oldham coupling is used to connect two shafts having intersecting axes
[ ] spindle is used for a shaft that supports rotating elements like wheels
[ ] axle is frequently used in torque transmission

KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

SEP 0 6 2017

Level : B.E.
Year : III
Time : 2 hrs. 30 min.

Course : MEEG 318
Semester : II
F.M. : 55

SECTION "B"
[5Q × 11 = 55 marks]

Students are **ALLOWED** to bring their own Machine Design Data Book for this examination. Assume and/or select suitable data if not specified. **ANSWER ALL QUESTIONS.**

1. (a) A pair of spur gears with a pitch of 6 are in mesh. The pinion has 18 teeth and rotates at 1800 rpm transmitting 372.8 W. Both gears have 20-degree pressure angles. The number of teeth on the gear is 36. Determine the radial and tangential forces on the pinion. [3]
   (b) A pair of meshing helical gears has a normal pressure angle of 20, a diametral pitch of 5, and a normal circular pitch of 14 mm. The driver has 18 teeth and the follower has 36 teeth. Determine the pressure angle φ and center distance C. [3]
   (c) Explain in detail (with example) the criteria for selection of materials and basic steps involved for selection? [5]

2. (b) A gearbox with gear ratio 2.5:1 reduction connects an 8 hp, 3500 rpm motor to a compressor as shown in Figure 1. A pair of 20^0 spur gear with face width of 50.8 mm with gear made of cast iron (allowable static stress is 60 N/mm^2) and pinion made of steel (allowable static stress 105 N/mm^2) are used in the gear box. Pinion has a diameter of 100 mm.
   i. Considering surface endurance strength of gears can be taken as 600 N/mm^2 design the gear set and check for bending and surface strength. [5]
   ii. Determine reasonable sizes for the input and output shafts of the gearbox and square keys. The shaft is made of plain carbon steel 40C8 ($\sigma_{yt} = \sigma_{yc} = 380$ N/mm^2, $\tau = 190$ N/mm^2).[4]
   iii. Explain the type of coupling you would select. [2]

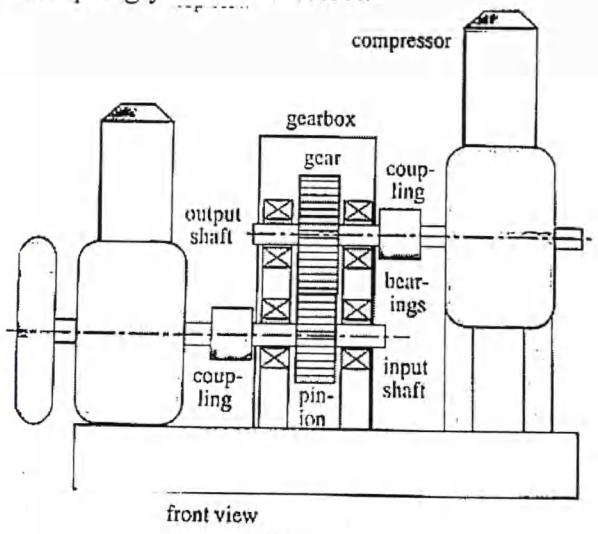


Figure 1

3. (a) Explain the working of cone clutch. Why is it not popular lately? [3]
   (b) How is normal pressure angle different from transverse pressure angle in case of a helical gear? [3]
   (c) A worm gear reducer is driven by a 1200 rpm motor. The worm has 3 threads and the gear has 45 teeth. The circular pitch of the gear is 12.7mm, the center distance is 114.3 mm, the normal pressure angle is 20 degrees, and face-width of the gear is 25.4 mm. Use a coefficient of sliding friction of 0.029. Determine: [5]
      i. Gear and worm diameters, and worm Lead.
      ii. The worm gear efficiency
      iii. Is the unit self-locking

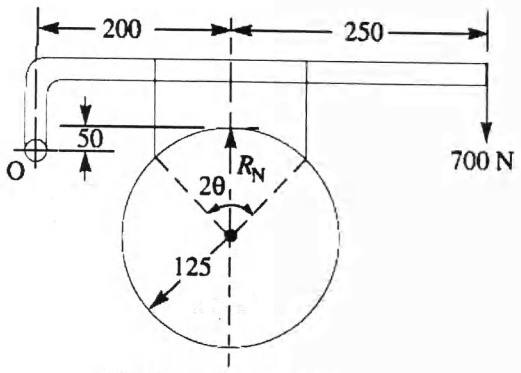
4. (a) Explain with neat Figure the type of coupling you would suggest for the system where both the shafts to be connected are not movable axially or laterally. [2]

(b) Design a sleeve coupling used to connect two steel shafts transmitting 15 kW power at 1500 rpm. The shafts and key are made of steel with an ultimate shearing stress of 140 N/mm^2. The sleeve is made of grey cast iron with ultimate strength of 400 N/mm^2. The factor of safety for the shafts and key is 3. [5]

(c) A multi-disc clutch has three discs on the driving shaft and two on the driven shaft. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform wear and coefficient of friction as 0.3, find the maximum axial intensity of pressure between the discs for transmitting 25 kW at 1575 rpm. [4]

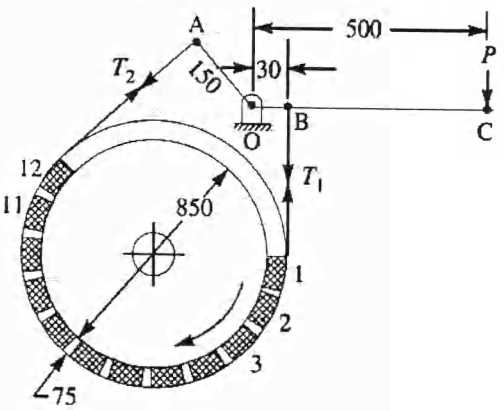
5. (a) Explain the need of multiple disk clutch over single disk clutch. [2]

(b) A single block brake is shown in Fig 2. The diameter of the drum is 250 mm and the angle of contact is 60 ^{0}. If the operating force of 700 N is applied at the end of a lever to stop the drum and the coefficient of friction between the drum and the lining is 0.35, determine the direction of rotation of drum and torque that may be transmitted by the block brake. [4]



All dimensions in mm.

Figure 2



All dimensions in mm.

Figure 3

(c) In the band and block brake shown in Fig. 3, the band is lined with 12 blocks each of which subtends an angle of 15 ^{0} at the center of the rotating drum. The thickness of the blocks is 7 mm and the diameter of the drum is 850 mm. If, when the brake is inaction, the greatest and least tensions in the brake strap are T1 and T2, show that

$$\frac{T_1}{T_2} = \left(\frac{1 + \mu \tan 7\,^1/_2{}^\circ}{1 - \mu \tan 7\,^1/_2{}^\circ} \right)^{12}$$

Where μ is the coefficient of friction for the blocks. With the lever arrangement as shown in Fig. 3, find the least force required at C for the blocks to absorb 225 kW at 240 rpm. The coefficient of friction between the band and blocks is 0.4. [5]