

KATHMANDU UNIVERSITY
End Semester Examination
August, 2018

Marks scored:

Level : BE
Year : III

Course : MEEG 318
Semester : II

Exam Roll No. :

Time: 30 mins.

F.M. : 20

Registration No.:

Date AUG 12 2018

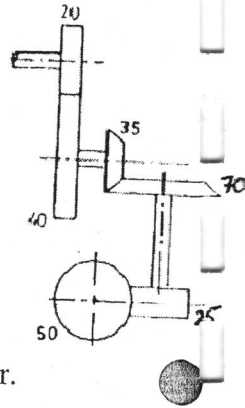
SECTION "A"

[20 Q × 1 = 20 marks]

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

1. The velocity ratio between pinion and gear drive is 2.3, the module of teeth is 2.0 mm and sum of number of teeth on pinion and gear is 99. What is the centre distance between pinion and gear?
 49.5 mm 99 mm 148.5 mm 198 mm
2. A 1.5 kW motor is running at 1440 rpm. It is to be connected to a stirrer running at 36 rpm. The gearing arrangement suitable for this application is
 spur gear helical gear bevel gear worm gear
3. For crown bevel gear, pitch angle is
 $< 90^\circ$ $= 90^\circ$ $> 90^\circ$ virtually any angle
4. Which type of key should be used for heavy consists of two square tapered keys placed 90° apart?
 Tangent Key Kennedy Key Saddle key Woodruff key
5. To make a worm drive reversible, it is necessary to increase
 center distance number of start reduction ratio worm diameter factor
6. What is the shortest distance between worm gear and axes of the worm for a worm gear pair designated as 2/40/10/8?
 50 mm 200 mm 320 mm 360 mm
7. Beam strength indicates the maximum value of the _____ force at the large end of the tooth that the tooth can transmit without bending.
 Tangential Radial Axial all of above
8. The hub is treated as a solid shaft while calculating torsional shear stress in the hub
 True False Occasionally Insufficient information
9. If number of contacting surfaces are 5, then number of disks required in multi disk clutch are?
 4 5 6 Insufficient information
10. A muff coupling is connecting two shafts. The torque involved is 650N-m. The shaft diameter is 45mm with length and height of the key being 14mm and 80mm respectively. Find the compressive stress induced in the key.
 70.1 N/mm² 51.6N/mm² 45.5N/mm² None of the listed
11. Is it possible to prevent back rotation of drum?
 Yes, by using back stop brake No, back rotation cannot be prevented
 Depends on the angular velocity Only in some specific cases decreases

12. Disk brakes largely suffer from the problem of self-locking.
 Yes, it is a major problem in disk brake No such problem is seen
 It depends on radius of the wheel rotating Material dependent
13. Ashby charts for material selection are mostly crucial during
 Conceptual Design Embodiment Design
 Detailed Design All of the above
14. In a block brake with short shoe, it is assumed that friction force and normal reaction are concentrated at the midpoint of the shoe.
 True, it is always the case False
 Sometimes Not enough information



15. A compound train consisting of spur, bevel and spiral gears are shown in the given figure along with the teeth numbers marked against the wheel. Over-all speed ratio of the train is
 8 2 1/2 1/8

16. When two gears are meshing, the clearance is given by the
 i. Difference between dedendum of one gear and addendum of the mating gear.
 ii. Difference between total and the working depth of gear tooth.
 iii. Distance between the bottom land of one gear and the top land of the mating gear.
 iv. Difference between the radii of the base circle and the dedendum circle.
 Which of these statements are correct?
 i, ii & iii ii, iii & iv i, iii & iv i, ii & iv

17. Consider the following specifications of gears A, B, C and D:

Gears	A	B	C	D
Number of teeth	20	60	20	60
Pressure angle	14.5°	14.5°	20°	14.5°
Material	Steel	Brass	Brass	Steel

Considering centre distance as 40 mm, which of these gears form the pair of spur gears to achieve a gear ratio of 3?

- A & B A & D B & C C & D
18. Which of the following statements are correct?
 i. For constant velocity ratio transmission between two gears, the common normal at the point of contact must always pass through a fixed point on the line joining the centre of rotation of the gears.
 ii. For involute gears the pressure angle changes with change in centre distance between gears.
 iii. The velocity ratio of compound gear train depends upon the number of teeth of the input and output gears only.
 iv. Epicyclic gear trains involve rotation of at least one gear axis about some other gear axis.
 i, ii & iii i, iii & iv i, ii & iv ii, iii & iv

19. Which of the statements is correct?
 Saddle key is more suitable than sunk key for heavy duty applications
 Hollow saddle key is superior to flat saddle key for power transmitting capability
 Woodruff key permits radial movement b/w shaft and the hub
 The main advantage of sunk key is that it is a neutral drive

20. Which of the following statements is/are true?
 Solid shafts are used in epicyclic gearboxes
 Flexible shafts have low rigidity in torsion making them flexible
 The stiffness of solid shaft is more than the stiffness of hollow shaft with same weight
 The strength of hollow shaft is more than the strength of solid shaft of same weight

AUG 12 2018

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

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) What are the advantages of Involute gear profile and cycloidal gear profile? [3]
- (b) A compacting machine shown in the figure 1 is used to create a desired thrust force by using rack and pinion arrangement. The input gear is mounted on tile motor shaft. The gears have involute teeth of 2 mm module. If the power transmission efficiency is 85%, find the torque required to deliver by motor. [3]

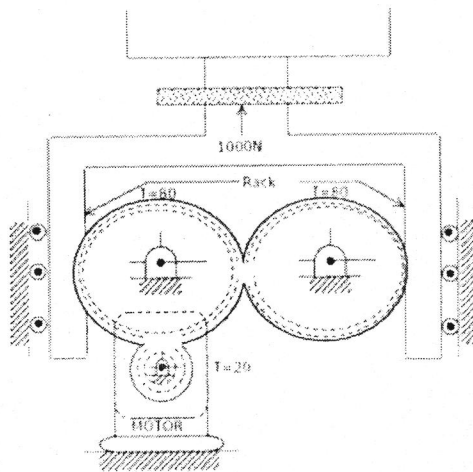


Figure 1

- (c) A 15 kW and 1200 rpm motor drives a compressor at 300 rpm through a pair of spur gears having 20° stub teeth. The centre to centre distance between the shafts is 400 mm. The motor pinion is made of forged steel having an allowable static stress as 210 MPa, while the gear is made of cast steel having allowable static stress as 140 MPa. Assuming that the drive operates 8 to 10 hours per day under light shock conditions, find from the standpoint of strength, (i) Module; (ii) Face width and (iii) Number of teeth and pitch circle diameter of each gear. Check the gears thus designed from the consideration of wear. The surface endurance limit may be taken as 700 MPa. [5]
2. (a) Taper roller bearings must be used in heavy duty worm gear speed reducers. Explain. [3]
 - (b) Explain the process of material selection in sequence with the design process. [3]
 - (c) Design a pair of helical gears to transmit 30 kW power at a speed reduction ratio of 4:1. The input shaft rotates at 2000 rpm. Take helix and normal pressure angle equal to 25° and 20°, respectively. Both pinion and gear are made of steel. [5]

Name of the part	Permissible stress	BHN
Pinion	55 Mpa	340
Gear	40 Mpa	300

Take number of teeth on pinion as 30.

3. (a) Explain the need of differential band brake over simple band brake. [2]
- (b) A machine started malfunctioning due to some issues with coupling. The coupling emplaced in the machine was Oldham. The only coupling available in the workshop is Hooke's coupling. So can the Oldham coupling be replaced by Hooke's coupling? Give your reason. [4]

- (c) Design a muff coupling for a shaft transmitting 25kW at 250 rpm. The safe shear stress for the plain carbon steel shaft is 50 N/mm^2 and for the cast iron muff it is 12 N/mm^2 . The allowable shear and crushing stress for the key's material are 40 N/mm^2 and 80 N/mm^2 respectively. Design torque may be taken as 1.15 times the average torque. [5]
4. (a) Explain the use of spring in friction disc clutch. [2]
- (b) The layout of a shaft supported on bearings at A & B is shown in figure 2. Power is supplied by means of a vertical belt on pulley B which is then transmitted to pulley C carrying a horizontal belt. The angle of wrap is 180° and coefficient of friction is 0.3. Maximum permissible tension in the rope is 3kN. The radius of pulley at B & C is 300 mm and 150 mm. [3]
- Calculate the torque supplied to the shaft
 - Calculate the tension in the rope of pulley C
 - If allowable shear stress in the shaft is 70 N/mm^2 and torsional and bending moments are $M=1185\text{kN-mm}$ and $m=330\text{kN-mm}$, find the diameter of the shaft

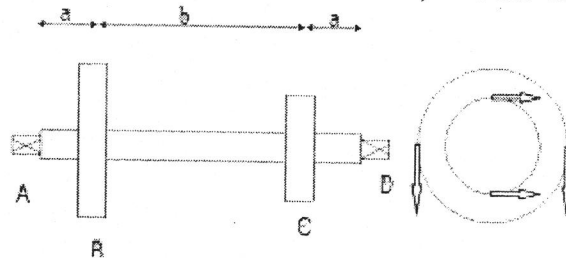


Figure 2

- (c) Design a cast iron flange coupling for following conditions:
 Diameter of shaft 60 mm, Factor of safety 2, Shear stress for shaft, bolt and key material = 40 MPa, Crushing stress for bolt and key = 80 MPa, Shear stress for cast iron = 8 MPa. [6]
5. (a) A differential band brake is used to control the speed of a drum as shown in figure 3. Determine the value of coefficient of friction for which the brake is self locking when the drum rotates counterclockwise. (1 in = 25.4 mm) [3]

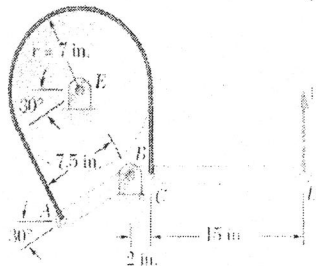


Figure 3

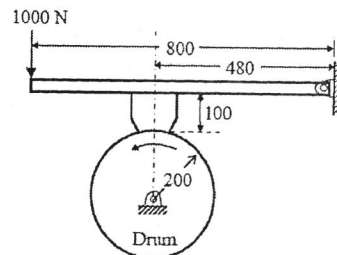


Figure 4

- (b) A multi-disc clutch has three discs on the driving shaft and two on the driven shaft. The inside diameter of the contact surface is 120 mm. The maximum pressure between the surfaces is limited to 0.1 N/mm^2 . Design the clutch for transmitting 25 kW at 1575 rpm. Assume uniform wear condition and coefficient of friction as 0.3. [4]
- (c) A drum brake is shown in the figure 4. The drum is rotating in anticlockwise direction. The coefficient of friction between drum and shoe is 0.2. The dimensions shown in the figure are in mm. [4]
- Find the braking torque (in N-m) for the brake shoe. If the available braking torque is only 25 N-m, then find
 - The new force (instead of 1000N) to be applied at the end of the lever for the clockwise and counter clockwise rotation of the brake drum; and
 - The location of the pivot or fulcrum to make the brake self locking for the clockwise rotation of the brake drum