

E-3450**B. E. VI Semester (Main & Re-Exam) Examination, 2014****DESIGN OF MACHINE ELEMENTS**

Branch : mech

Time : Three Hours]**[Maximum Marks : 75/50****[Minimum Marks : 30/20**

Note : Attempt *all* the questions of *Section - A*, *four* from *Section - B* and *three* questions from *Section - C*.

SECTION – A	$1 \times 10 = 10$ (50)
(Objective Type Questions)	$1.5 \times 10 = 15$ (75)

1. According to Indian standard specification a grey cast Iron designated by FG 200 means that the :
 - (a) carbon content is 2%
 - (b) max^m compressive strength is 200 N/mm²
 - (c) max^m tensile strength is 200 N/mm²
 - (d) max^m shear strength is 200 N/mm²

2. The metal suitable for bearing subjected to light load is :

(a) silicon bronze	(b) white metal
(c) monel metal	(d) phosphor bronze

3. According to Indian standard specifications 100 H6/g5 means that the.
 - (a) actual size is 100 mm
 - (b) basic size is 100 mm
 - (c) difference between the actual size and basic size is 100 mm
 - (d) none of the above

P.T.O.

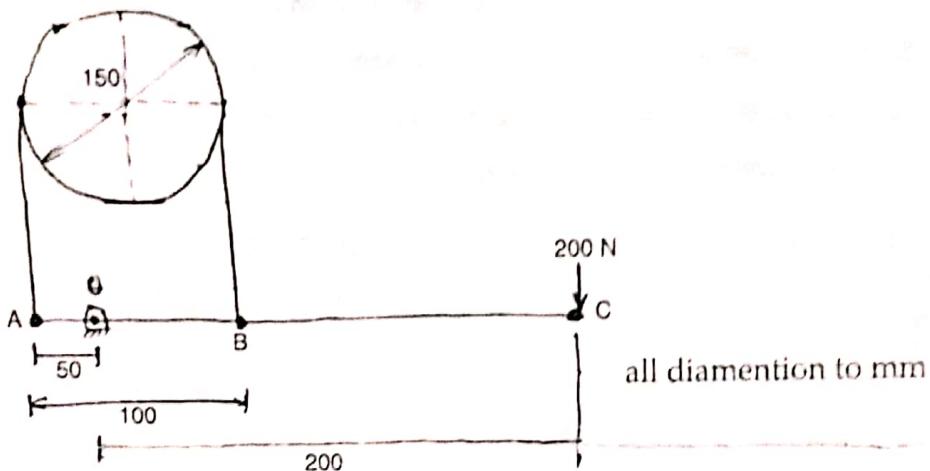
4. The modulus of elasticity for mild steel is approximately equal to :
 (a) 80 kN/mm^2 (b) 100 kN/mm^2 (c) 110 kN/mm^2 (d) 210 kN/mm^2
5. The poission ratio for steel varies from :
 (a) 0.21 to 0.25 (b) 0.25 to 0.33 (c) 0.33 to 0.38 (d) 0.38 to 0.45
6. If d = diameter of solid shaft and τ = permissible stress in shear for the shaft material, then torsional strength of shaft is written as.
 (a) $\frac{\pi}{32} d^4 \tau$ (b) $d \log_e \tau$ (c) ~~$\frac{\pi}{16} d^3 \tau$~~ (d) $\frac{\pi}{32} d^3 \tau$
7. Gust's theory is used by :
 (a) brittle materials (b) ~~ductile materials~~
 (c) elastic materials (d) plastic materials
8. The surface finish factors for a mirror polished material is :
 (a) 0.45 (b) 0.65 (c) 0.85 (d) 1.0
9. The Groove angle of the pulley for V-belt drive is usually.
 (a) ~~$20^\circ - 25^\circ$~~ (b) $25^\circ - 32^\circ$ (c) $32^\circ - 38^\circ$ (d) $38^\circ - 45^\circ$
10. The cone clutches have become absolute because of :
 (a) small cone angles (b) exposure to dirt and dust
 (c) difficulty in disengaging (d) All of these

SECTION – B $4 \times 4 = 16$ (50)**(Short Answer Type Questions)** $6 \times 4 = 24$ (75)

1. (a) Distinguish clearly between stress and bearing stress.
 (b) Define the :
 (i) Poisson's ratio
 (ii) bulk modulus
2. Determine the \max^m , \min^m and average pressure in a plate clutch when the axial force is 4 kN the inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear.
3. What are the common material used in mechanical Engg. Design ? How can the properties of steel be improved.

(2)

4. What is clutch? Discuss the various types of clutches giving at least one Practical Application for each.
5. Diff. type of brakes? Explain single block or shoe brake?
6. A differentials band brake has a force of 220 N applied at the end of a lever as show in fig. the coefficient of friction between the band and the drum is 0.4 the angle of lap is 180° . Find the max^m and min^m force in the band when a clock wise torque of 450 N-m is applied to drum.



SECTION – C
(Long Answer Type Question)

$4 \times 4 = 16$ (50)
 $12 \times 3 = 36$ (75)

1. Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N operating at a speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load.
2. A concentric spring for an aircraft engine value is to exert a max^m force 5000 N. under an axial deflection of 40 mm both the springs have same free length same solid length and are subjected to equal max^m – shear stress of 850 MP. If the spring index for both the spring is 6. find
- (a) the load shored by each spring. 4
 - (b) the main dimensions of both the spring and 4
 - (c) the number of active coils in each spring. 4
3. (a) How the bevel gears are classified? Explain with neat sketches. 4
- (b) Explain the terms used in bevel gears and determinations of pitch angle for bevel gears. 8

4. A belt drive consists of two V-belts in parallel, on grooved pulleys of the same size, the angle of the groove is 30° , the cross-sectional area of each belt is 750 mm^2 and $\mu = 0.12$ the density of the belt material is 1.2 Mg/m^3 and the max^m safe stress in the material is 7 MPa . Calculate the power that can be transmitted between pulley of 300 mm. diameter rotating at 1500 rpm find also the shaft speed in rpm at which the power transmitted would be a maximum. 12
5. a worm drive transmits 15 kw at 2000 rpm. to a machine carriage at 75 r.p.m. the worm is triple threaded and has 65 mm. pitch diameter the worm gear has 90 teeth of 6 mm. module the tooth form is to be 20° full depth invaluable the coefficient of friction between the mating teeth may be taken as 0.10. calculate.
- (i) tangential force acting on the worm. 4
 - (ii) axial thrust and separating force on worm. 4
 - (iii) efficiency of the worm drive. 4

E-78

B.E. VI Semester (Mech.) Examination, May 2015

Design of Machine Elements

Time : Three Hours

Maximum Marks : 75

Note : (i) Assume missing data suitably.

(ii) Design data hand book allowed in examination hall.

Section-A

Note : Attempt all questions.

$$10 \times 1.5 = 15$$

P.T.O.

5. A Jaw clutch is essentially a -
- (a) Positive action clutch (b) Cone clutch
(c) Friction clutch (d) Disc clutch
6. A brake commonly used in Motor Car is -
- (a) Band Brake (b) Shoe brake
(c) Band and block break (d) Internal expanding brake
7. In a full bearing the angle of contact of the bearing with the journal is -
- (a) 360° (b) 270°
(c) 180° (d) 120°
8. The speed of ~~sprockets~~ reduces as the Chain pitch _____ for a given number of teeth.
- (a) increase (d) decrease
9. In helical gears, the right hand helices on one gear will mesh _____ helices on the other gear -
- (a) Right hand (b) Left hand
10. The helix angle for double helical gear may be made up to -
- (a) 45° (b) 60°
(c) 75° (d) 90°

Section-B

Note : Attempt any four questions :

1. What are the factors to be considered for the selection of materials for the design of machine elements. Discuss. $6 \times 4 = 24$
2. What are the rolling contact bearing? Discuss their advantages over sliding contact bearings.
3. Discuss the different type of belts and their material used for power transmission.
4. What is a clutch? Discuss the various types of clutches giving at least one practical application for each.
5. Write Soderberg's equation and state its application to different type of loadings.
6. Write the expression for static, Limiting wear load and dynamic load for spur gears and explain the various terms used in.

Section-C

Note : Attempt any three questions.

1. (a) Different type of spring. Explain it with suitable example of application.
(b) What is nipping in a leaf spring? Discuss its role list the materials commonly used for the manufacture of the leaf spring. $12 \times 3 = 36$
2. A reciprocating compressor is to be connected to an electric motor with the help of spur gear. The distance between the shaft is to be 500mm. The speed of the electric motor is 900 rpm. and the speed of the compressor shaft is desired to be 200 rpm., the torque to be transmitted is 500 k.m. taking starting torque as 25% more than the normal torque. Determine.
 - (I) Modular and face width of the gears using 20 degrees stubteeth.
 - (II) No. of teeth and pitch circle diameter of each gear. Assume suitable values of velocity factor and Lewis factor.

3. A helical cast steel gear with 30° helix angle has to transmit 35 kw at 1500 rpm if the gear has 24 teeth, determine the necessary module pitch diameter and face width for 20° full depth teeth. The static stress for cast steel may be taken as 56 mpa the width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear? The tooth factor for 20° full depth involute gear may be taken as $= 0.154 \frac{0.912}{TE}$
4. A 80mm 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 805/s. Determine the maximum safe load.
5. Write short notes on any three :
- Design of bearing caps and bolts
 - Reliability of bearing
 - Design of rope belt
 - Internal expanding brake

E-239**B. E. VI Semester (Main & Re-Exam) Examination– May, 2016****DESIGN OF MACHINE ELEMENTS**

Branch : Mech. Engg.

Time : Three Hours]

[Maximum Marks : 75

[Minimum Marks : 30

Note : Attempt *all* questions from Section - A (Objective type questions), *four* questions from Section - B (Short answer type questions) and *three* questions from Section - C (Long/Essay type questions).

SECTION – A[Marks : $1.5 \times 10 = 15$

1. The crowning on a 300 mm width of pulley face should be :

(i) 9 mm (ii) 12 mm (iii) 15 mm (iv) 18 mm

2. The included angle for the V-belt is usually :

(i) $20^\circ - 30^\circ$ (ii) $30^\circ - 40^\circ$ (iii) $40^\circ - 60^\circ$ (iv) $60^\circ - 80^\circ$

3. A. V-belt designated by A-914.50 denotes :

(i) a standard belt (ii) an oversize belt
 (iii) an undersize belt (iv) none of these

4. The relation between the pitch of the chain (P) and pitch circle deam of sprocket (D) is given by :

$$(i) P = D \sin\left(\frac{90^\circ}{T}\right) \quad (ii) P = D \sin\left(\frac{120^\circ}{T}\right)$$

$$(iii) \checkmark P = D \sin\left(\frac{180^\circ}{T}\right) \quad (iv) P = D \sin\left(\frac{360^\circ}{T}\right)$$

P. T. O.

SECTION – B

[Marks : $6 \times 4 = 24$

1. Drive the Energy stored in Helical springs of circular wire.
 2. Design of multiple Disc Clutch.

(2)

3. Drive the Good man Method for combination of stresses.
4. Derivation of Ratio of driving Tensions for flat belt drive.

$$\frac{T_1}{T_2} = e^{\mu \theta}$$

5. What are the factors to be considered for the selection of materials for the design of machine elements ? Discuss.
6. Write the expression for static. Limiting wear load and dynamic load for spur gears and explain the various terms used in.

SECTION – C

[Marks : $12 \times 3 = 36$]

1. A speed reducer unit is to be designed for an input of 1.1 kW with a transmission ratio 27 the speed of the hardened steel worm is 1440 r.p.m. the worm wheel is to be made of phosphor bronze the tooth form is to be 20° involute.
2. A pair of 20° full depth involute teeth bevel gears connect two shafts at right angle having velocity ratio 3 : 1. The gear is made of cast steel having allowable static stress as 70 MPa and the Pinion is of steel with allowable static stress as 100 MPa. The Pinion transmits 37.5 kW at 750 r.p.m. Determine :
 - (i) Module and face width
 - (ii) Pitch diameters and
 - (iii) Pinion shaft diameter

Assume tooth form factor,

$$Y = 0.15 - \frac{0.912}{T_E}$$

Where : T_E is the formative number of teeth width = 1/3rd, the length of Pitch cone and Pinion shaft over changes by 150 mm.

3. Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N operating at a speed of 1600 r.p.m. for an average life of 5 years at 10 hours per day.

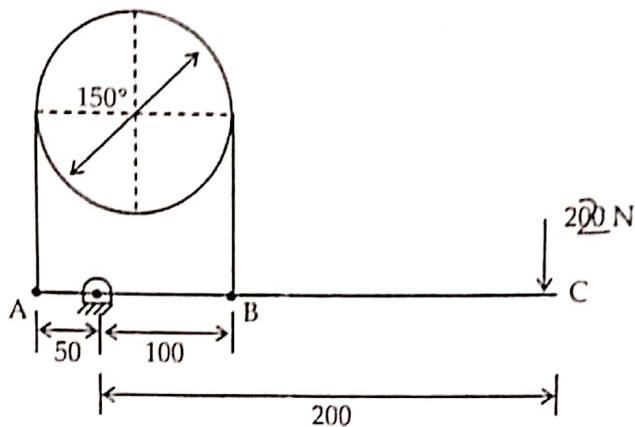
Assume uniform and steady load.

(3)

P. T. O.

- 4 A differential band brake has a force of 220 N. Applied at the end of a lever as show in fig. the coefficient of friction between the band and the drum is 0.4 the angle of lap is 180° , find.

- The maximum and minimum force in the band when a clockwise torque of 450 N-m is applied to the drum.
- The maximum torque that the brake may sustain for counter clockwise rotation of the drum.



All dimensions in mm

5. (i) Different type of spring ? Explain it with suitable example of applications.
 (ii) Drive the leaf spring ?

OR

A truck spring has 12 numbers of leaves, two of which are full length leaves. The Springs supports are 1.05 m a part and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 MPa. Determine the thickness and width of a steel spring leaves. The ratio of the total depth to be width of the spring is 3. Also determine the deflection of the spring.

E-450**B.E. VI Semester (Main & Re-Exam) Examination, May 2017****DESIGN OF MACHINE ELEMENTS****(M E)***Time : Three Hours /**/ Maximum Marks : 75**/ Minimum Marks : 30*

Note : Attempt all the questions of Section A, four from Section B and three questions from Section C.

Section-A**(Objective Type Questions)**

Note : This Section will contain ten objective type questions. They may be fill in the blanks, True/False or Multiple Choice Type. $1.5 \times 10 = 15$

1. The shear stress intensity in a I-Section beam subjected to transverse load is.
 - (a) Maximum at the neutral axis
 - (b) Maximum at the junction of web & flange.
 - (c) Uniform throughout
 - (d) Maximum at the outermost fiber.
2. Which material has better harden ability.
 - (a) Medium carbon steel
 - (b) Ni-Cr steel
 - (c) High carbon steel
3. The resistance to fatigue of material is measured by
 - (a) Elastic limit
 - (b) Young modulus of elasticity
 - (c) Ultimate strength
 - (d) Endurance limit

P.T.O.

4. Goodman's line and Sodesberg line relate to
 - (a) The fatigue strength for various combination of stress levels.
 - (b) The theory of maximum sheer stress
 - (c) The theory of maximum normal stress
 - (d) None of the above
5. Rearrange following processes of the increasing order of surface finish that can be obtained by :
 - (a) Grinding
 - (b) Broaching
 - (c) Turning
 - (d) Planning
 - (e) Flame cutting
6. Which type of thread would you used of the following :
 - (a) Lead screw for lethe
 - (b) Fastening of a braket to a well
 - (c) Screw jack
7. Which is the weakest section of a helical tension spring?
8. Suggest the method to increase the fatigue resistance to leaf spring?
9. In design of disc-clutch, it is usual practice to assume the frictional torque = $\beta \times$ normal torque where β is:
 - (a) Life factor
 - (b) Wear factor
 - (c) Engagement factor
 - (d) Reliability factor
10. A shaft is subjected to both radical and axial loads. The suitable bearing for the shaft is:
 - (a) A full sleeve Journal bearing
 - (b) A thrust bearing
 - (c) A toper roller bearing
 - (d) A roller bearing

Section-B

(Short Answer Type Questions)

Note : This section will contain **six** questions. Attempt any **four** questions out of **six** questions.

$$6 \times 4 = 24$$

1. Discuss the design consideration for Brakes?
2. Derive the different condition for power transmitted by conical pivot?
3. Classify the different types of bearing & also discuss the selection criteria for bearing material?
4. Explain the different modes of gear tooth failure & heat-removal analysis of gearing.
5. Discuss the different condition of steel compression springs subjected to alternatively load.
6. Classify the engineering material & also discuss the design parameter of castings?

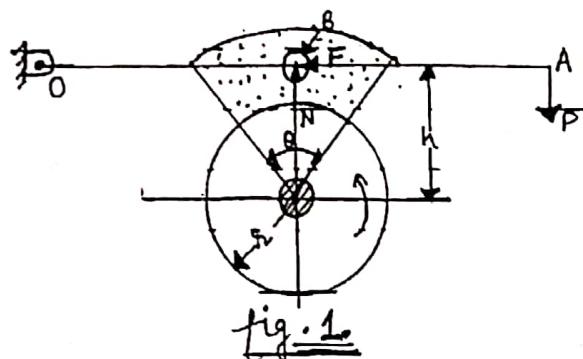
Section-C

(Long Answer Type Questions)

Note : This section will contain **five** questions. Attempt any **three** questions out of the **five** questions.

$$12 \times 3 = 36$$

1. The pivoted shoe brake shown in fig 1 is to be self-energizing. The angle of lap is 100° . The brakes must be able to apply a maximum torque of 300 N-M. If the coefficient of friction is 0.3, determine:
 - (i) The normal reaction on the brake clock.
 - (ii) The limiting value of 'e' for the brake to be self-energizing but not self-locking. The other dimensions are $b = 150$, $r = 200$ mm the drum rotates in counter clockwise direction.



2. Determine the main diamensions of a cone clutch faced with leather to transmit 40 HP (30 kW) at 750 rpm from an electric motor to an air compressor. As-E-450

(3)

P.T.O.

sume an overload factor of 1.75 Due to Possibility of contamination of lining a low value of 0.2 for friction factor is recommended?

- A 75 mm diameter shaft of a machine operates continuously for 8 hr. daily. Because of an overrunning clutch one of the shaft bearings will be subjected to a varying load and speed cycle as follows :

S.No.	Fraction of the cycle	Fr (N)	Fa (N)	RPM	Load Condition
1.	1/10	4000	2000	1000	Steady
2.	1/10	2000	2000	600	Light Shock
3.	1/2	5000	2000	400	Light Shock
4.	1/10	25000	2000	1500	Steady

Select a suitable ball or roller bearing that will satisfy the given conditions. The inner ring rotates.

- A pair of bevel gears is required to transmit 15 HP at 500 rpm from the driver shaft to the driven shaft. The speed reduction is to be 3:1. The shafts are inclined at 60° . Pinion is to be made of cast steel and gear of cast iron. The services factor may be taken as 1.15.

The pinion is mounted overhung on the driver shaft, which receives power through a pulley mounted on the shaft as shown in Fig. 2. The pulley weighs 1000 N, and ratio of the belt tension is two. Determine the bending and torsional movement acting on the shaft in a critical sections.

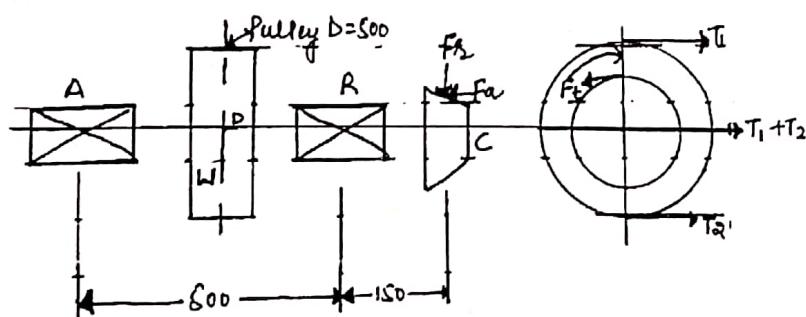


Fig. 2

- A laminated spring of an automobile is to carry a load of 5kN. The spring is to be made 1000 mm between the supports. Design the spring. Number of leaves may be taken as 8 with two of them of full length. Distance between U-bolts, may be taken as 60 mm.

E-728**B. E. VI Semester (Main & Re-Exam) Examination, May – 2018****DESIGN OF MACHINE ELEMENTS****Branch : ME****Time : Three Hours]****[Maximum Marks : 75
[Minimum Marks : 30**

 **Note :** Attempt *all* questions from Section-A (Objective Type Questions), *four* questions from Section-B (Short Answer Type Questions) and *three* questions from Section-C (Long/Essay Type Questions).

SECTION – A **$1.5 \times 10 = 15$** Attempt *all* questions.

1. An aluminium member is designed based on :

- | | | |
|-------------------------------------|------------------|--------------------------|
| <input checked="" type="checkbox"/> | (a) Yield stress | (b) Elastic limit stress |
| <input type="checkbox"/> | (c) Proof stress | (d) Ultimate stress |

2. Rankine's theory is used for :

- | | | |
|-------------------------------------|-----------------------|-----------------------|
| <input checked="" type="checkbox"/> | (a) Brittle materials | (b) Ductile materials |
| <input type="checkbox"/> | (c) Elastic materials | (d) Plastic materials |

3. The ratio of endurance limit in shear to endurance limit in flexure is :

- | | |
|-------------------------------------|----------|
| (a) 0.25 | (b) 0.35 |
| <input checked="" type="checkbox"/> | (c) 0.55 |
| (d) 0.70 | |

P. T. O.

4. The speed of the sprocket reduces as the chain pitch for a given number of teeth.
- (a) increases (b) decrease
(c) some (d) None of these
5. In leaf spring, the longest leaf is known as :
- (a) lower leaf (b) master leaf
(c) upper leaf (d) none of these
6. The cone clutch have become obsolete because of :
- (a) small cone angle (b) exposure of dirt
(c) difficulty in disengaging (d) all of these
7. For a band brake, the width of the band for a drum diameter greater than 1 m, should not exceed :
- (a) 150 mm (b) 200 mm
(c) 250 mm (d) 300 mm
8. In thrust bearing, the load acts :
- (a) along the axis of rotation
(b) parallel to the axis of rotation
(c) perpendicular to the axis of rotation
(d) in any direction
9. Which of the following is antifriction bearing ?
- (a) Journal bearing (b) Pedestal bearing
(c) Collar bearing (d) Needle bearing

10. Lewis equation in spur gear is applied :

- (a) only to the pinion
- (b) only to the gear
- (c) to stronger to the pinion or gear
- (d) to weaker of the pinion or gear

$6 \times 4 = 24$

SECTION - B

Attempt any *four* questions :

1. Describe with the help of a neat sketch the principle of operation of an internal expanding shoe brake. Derive the expression for the breaking torque.
2. Explain the phenomenon of interference in involute gears. what are the conditions to be satisfied in order to avoid interference ?
3. Describe with the help of a neat sketch, a centrifugal clutch and deduce an expression for the total frictional torque transmitted. How the shoes and springs are designed for such a clutch ?
4. Explain what you understand by A. M. Wahl's factor and state its importance in the design of helical springs ?
5. Write Soderberg's equation and state its application to different types of loadings. What information do you obtain from Soderberg diagram ?

SECTION - C

$12 \times 3 = 36$

Attempt any *three* questions :

1. (a) Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 rpm for an over-age life of 5 years at 10 hours per day. Assume uniform and steady load.

(3)

P. T. O.

- (b) A journal bearing 60 mm is diameter and 90 mm long runs at 450 rpm. The oil used for hydro-dynamic lubrication has absolute viscosity of 0.06 kg/m-s. If the diametral clearance is 0.1 mm, find the safe load on the bearing.
2. A pair of helical gears are to transmit 15 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45° . The pinion runs at 10,000 rpm and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given $\sigma_{es} = 618$ MPa.
3. Design 20° involute worm and gear to transmit 10 kW with worm rotating at 1400 rpm and to obtain a speed reduction of 12 : 1. The distance between the shafts is 225 mm.
4. Define the following terms :
- Lead
 - Radial bearing
 - Backlash
 - Friction clutch
5. (a) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm^2 . Also calculate the maximum shear stress induced.
- (b) What is a self-energizing brake ? When a brake become self-locking.
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E-951**B. E. VIth Semester (Main & Re-Exam) Examination, May – 2019****DESIGN OF MACHINE ELEMENTS****Branch : ME****Time : Three Hours]****[Maximum Marks : 75****[Minimum Marks : 30**

Note : Attempt *all* questions in Section – A, *four* questions from Section – B and *three* questions from Section – C.

SECTION – A**[Marks : $1.5 \times 10 = 15$**

1. Failure of material is called fatigue when it fails :

(a) at the elastic limit	(b) below the elastic limit
(c) at the yield point	(d) below the yield point

2. In cyclic loading, stress concentration is more in :

(a) Brittle material	(b) Ductile material
(c) Brittle and ductile material	(d) Elastic material

3. The surface finish factor for a mirror polished material is :

(a) 0.45	(b) 0.65
(c) 0.85	(d) 1

4. The notch sensitivity q is expressed in terms of fatigue stress concentration factor K_f and theoretical stress concentration factor K_t , as :

(a) $\frac{K_f + 1}{K_t + 1}$	(b) $\frac{K_f - 1}{K_t - 1}$
(c) $\frac{K_t + 1}{K_f + 1}$	(d) $\frac{K_t - 1}{K_f - 1}$

5. For maximum power, the velocity of the belt will be :

(a) $\sqrt{\frac{T}{m}}$	(b) $\sqrt{\frac{T}{2m}}$	(c) $\sqrt{\frac{T}{3m}}$	(d) $\sqrt{\frac{T}{4m}}$
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P. T. O.

6. A leaf spring in automobiles is used :

(a) to apply force	(b) to measure force
(c) to absorb force	(d) to store strain energy

7. When helical spring is cut into halves, the stiffness of the resulting spring will be :

(a) Same	(b) Double
(c) One-half	(d) One forth

8. A cone clutches have become absolute because of :

(a) Small one angle	(b) Exposure to dirt
(c) Difficult in disengaging	(d) All of these

9. In thrust bearing, the load acts :

(a) Along the axis of rotation	(b) Parallel to the axis of rotation
(c) Perpendicular to the axis of rotation	(d) In any direction

10. The contact ratio for gears is :

(a) Zero	(b) Less than one
(c) Greater than one	(d) None of these

SECTION – B[Marks : $4 \times 6 = 24$]

1. Write Soderberg's equation and state its application to different type of loading.
2. How are ends of belt joined ? For horizontal belts which side (tight or slack) of the belt should run on the top and why ?
3. Explain what do you understand by A.M. Wahl's factor and state its importance in the design of helical springs ?
4. What is meant by hydrodynamic lubrications ? List the basic assumption used in the theory of hydrodynamic lubrication.
5. How do you express the life of a bearing ? What is an average or medium life ?
6. What is Tredgold's approximation about the formative number of teeth on bevel gear ?

SECTION - C[Marks : $3 \times 12 = 36$]

1. A bronze spur pinion rotating at 600 rpm drives a cast iron spur gear of a transmission ratio of 4 : 1. The allowable static stresses for bronze pinion and cast iron gear are 84MPa and 105MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8mm. The face width of both the gears is 90mm. Find the power that can be transmitted from the stand point of strength. Check the gear for wear.
2. Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load.
3. Design 20° involute worm and gear to transmit 10KW with worm rotating at 1400 rpm and to obtain a speed reduction of 12 : 1. The distance between the shafts is 225 mm.
4. Write short notes on the following :
 - (a) Interference in involute gear
 - (b) Rocklash
 - (c) Addendum cone diameter
 - (d) Hobbing