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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING  
MID TERM EXAMINATION - APR 2023**

**Semester :** Semester VI - 2020

**Course Code :** MEC4007

**Course Name :** Sem VI - MEC4007 - Design of Machine Elements-II

**Program :** MEC

**Date :** 15-APR-2023

**Time :** 9:30AM - 11:00AM

**Max Marks :** 60

**Weightage :** 30%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

**PART A**

**ANSWER ALL THE FIVE QUESTIONS**

**5 X 2=10M**

1. Explain creep phenomenon in belt drives with a suitable diagram  
(CO1) [Knowledge]
2. Identify any 2 advantages of belt drives over flat drives  
(CO1) [Knowledge]
3. Identify any 2 types of springs with diagram.  
(CO2) [Knowledge]
4. Define NIP in a leaf spring design.  
(CO2) [Knowledge]
5. Define helix angle in helical gear.  
(CO3) [Knowledge]

**PART B**

**ANSWER ALL THE THREE QUESTIONS**

**3 X 10 = 30M**

6. Brijesh is a senior design Engineer at Mercedes Benz and is struck with a problem of length of open belt in one of the cross belt design. As a colleague help him to obtain correct relation of belt length and also derive the same.  
(CO1) [Comprehension]

7. A semi-elliptic leaf spring used for automobile suspension consists of three extra full-length leaves and 12 graduated-length leaves, including the master leaf. The center-to-center distance between two eyes of the spring is 1.5 m. The maximum force that can act on the spring is 100 kN. For each leaf, the ratio of width to thickness is 11:1. The modulus of elasticity of the leaf material is 207 000 N/mm<sup>2</sup>. The leaves are pre-stressed in such a way that when the force is maximum, the stresses induced in all leaves are same and equal to 600 MPa. Identify and calculate any 2 parameters from above data, (CO2) [Comprehension]
8. Ram is designing the leaf spring to sustain a total load of P kN and is struck with the calculation of the deflection and bending stress of the spring. Enlist and derive the parameters. (CO2) [Comprehension]

### PART C

#### ANSWER THE ONE QUESTION

1 X 20 = 20M

- 9.a) An electric motor has to drive an exhaust fan. A flat leather belt is used in the drive. The thickness of the belt is 6.25 mm and maximum permissible stress in the belt is 2.1 MPa. The belt weighs 9708 N/m<sup>3</sup>. Identify which pulley governs the design and width of the belt from the above data. (CO3)

Particulars	Motor pulley	Fan pulley
Diameter	300 mm	1200 mm
Contact Angle	2.5 radian	3.78 radian
Coefficient of friction	0.3	0.25
Speed	900 rpm	
Power transmitted	22 kW	

- 9.b) It is required to design a pair of spur gears with 20° full-depth involute teeth based on the Lewis equation. The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 10 kW, 1440 rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4 : 1. The pinion as well as the gear is made of plain carbon steel 40C8 (S<sub>ut</sub> = 600 MPa). The factor of safety can be taken as 1.5. Design the gears (CO3)