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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – MAY 2025** |
| **Date:** 22-05-2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** B. Tech | |
| **Course Code:** MEC3086 | **Course Name:** Design of Machine Elements-II | |
| **Semester**: VI | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **26** | **24** | **26** | **24** | **--** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2 marks. 10Q x 2M=20M** | | | | |
| **1.** | How does the **arc of contact** influence the power transmission in a belt drive? | **2 Marks** | **L1** | **CO1** |
| **2.** | What is the function of a **chain drive**, and where is it commonly used? | **2 Marks** | **L1** | **CO1** |
| **3.** | How do you determine the **power transmission capacity** of a belt drive? | **2 Marks** | **L1** | **CO1** |
| **4.** | What is the significance of the **spring index** in helical springs? | **2 Marks** | **L1** | **CO2** |
| **5.** | What is the function of leaf springs in vehicles? | **2 Marks** | **L1** | **CO2** |
| **6.** | What is the Lewis equation used for in spur gear design? | **2 Marks** | **L1** | **CO3** |
| **7.** | What are the key features of helical gears? | **2 Marks** | **L1** | **CO3** |
| **8.** | Explain importance of Buckingham’s equation in designing a bevel gear? | **2 Marks** | **L2** | **CO3** |
| **9.** | Mention the types of clutches commonly used. | **2 Marks** | **L1** | **CO4** |
| **10.** | Define the term "self-locking" in brakes. | **2 Marks** | **L1** | **CO4** |

**Part B**

**Answer the Questions. Total Marks 80M**

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| 11. | An open belt running over the two pulleys, 240 mm and 600 mm in diameter, connects two parallel shafts 3m apart. The power to be transmitted is 4 KN from the smaller pulley that rotates at 300 rpm. Co coefficient of friction between the belt and pulley is 0.3, and the safe working tension is 10 N per width. Determine a) minimum width of belt b) initial belt tension c) length of belt required | 20 Marks | L5 | CO1 |
| Or | | | | |
| 12. | A chain drive connects two shafts 700 mm apart. The system reduces speed from 300 rpm to 150 rpm. The driving sprocket has 26 teeth and a PCD of 65 mm. The chain operates at a velocity of 4.5 m/s and transmits 7.5 kW power. Determine: The number of teeth on the driven sprocket, the pitch of the chain, the length of the chain, the efficiency of the system if the input power is 8.5 kW | **20 Marks** | **L5** | **CO1** |

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| 13. | A semi-elliptical laminated spring made of 9 leaves is 1.1 m long between the centers of the eyes. Two of the leaves extend to the full length of the spring. The leaves are held together by a band 80 mm wide. If the spring is to carry a load of 5.4 KN and the permissible stress is 400 MPa, determine the width and thickness of the leaves when a) leaves are not stressed initially, and b) leaves are stressed initially. Use 210 GPa. | 20 Marks | L5 | CO2 |
| Or | | | | |
| 14. | A railway wagon weighing 50 KN moving with a speed of 8 km/hour has to be stopped by four buffer springs, in which the maximum compression allowed is 220mm. Find the number of active turns in each spring of a mean diameter of 150mm. The diameter of the spring wire is 25 mm. Also, determine the maximum shear stress in each spring. Take G = 84 GPa. | **20 Marks** | **L5** | **CO2** |

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| 15. | A gear drive is required to transmit a maximum power of 22.5 KW. The velocity ratio is 1:2, and the rpm of the pinion is 200. The approximate center distance between the shafts may be taken as 600 mm. The teeth have 20-degree stub involute profiles. The static stress for the gear material may be taken as 60 MPa, and the face width is 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The dynamic factor may be taken as 80, and the material combination factor for the wear is 1:4 and the endurance limit is 84 MPa. | 20 Marks | L6 | CO3 |
| Or | | | | |
| 16. | A pair of helical gears is to transmit 16 KW power. The tooth is a 20° stub in a diameter plane. Helix angle is 45°. Pinion runs at 10000 rpm and gear runs at 2500 rpm. The center distance between the shafts is 200 mm. The gears are made up of cast steel. Design a pair of helical gears and recommend the hardness of the gears. | **20 Marks** | **L6** | **CO3** |

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| 17. | Design procedure for selecting a bevel gear train, including static, dynamic and wear conditions and also represent all the gear terms with a suitable figure? | 20 Marks | L6 | CO4 |
| Or | | | | |
| 18. | Design a worm gear drive to transmit 18 KW from a worm rotating at 1440 rpm to a worm wheel to rotate at 40 rpm. Check the heating capacity of the gears and determine whether the design is safe or not. The worm is made up of hardened steel, and the gear is made up of phosphor bronze (assume a number of shafts is 1) | **20 Marks** | **L6** | **CO4** |