



B.E DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Fifth Semester

AUTOMOBILE ENGINEERING

U18AUT5102: Design of Machine Elements

COURSE OUTCOMES

- CO1:** Familiarize and apply the design morphology in designing various machine element
CO2: Selecting suitable material for the machine elements
CO3: Calculate and analyze the forces acting on the Machine element
CO4: Choosing the appropriate machine element for the required function
CO5: Designing a machine element from the given data
CO6: Justify the design and present it in an effective manner

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. Distinguish between development design & new design. | CO1 | [K ₂] |
| 2. Discuss the advantage of using standard parts in machine design. | CO2 | [K ₂] |
| 3. Compare transmission shaft and machine shaft and how does it differ. | CO2 | [K ₂] |
| 4. List the types of stress acting on the shaft. | CO1 | [K ₂] |
| 5. Name different end connections for compression helical spring. | CO1 | [K ₂] |
| 6. Give us the assumptions of Hydrodynamic lubricated bearings. | CO1 | [K ₂] |
| 7. What is the advantage of split flywheel. | CO1 | [K ₂] |
| 8. Classify the gears based on its peripheral velocity. | CO1 | [K ₂] |
| 9. List down the gear consideration of Gear drive. | CO6 | [K ₂] |
| 10. List down the reason for Gear teeth failure. | CO6 | [K ₂] |

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

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|---|---|-----|-------------------|
| 11. a) Construct a flow diagram to infer general procedure in Machine design. | 8 | CO2 | [K ₂] |
| b) What are the factors to be considered for the selection of materials for the design of machine elements? | 8 | CO1 | [K ₂] |

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|-----|--|----|-----|-------------------|
| 12. | A shaft is supported on bearings A and B, 800 mm between centers. A 20° straight tooth spur gear having 600 mm pitch diameter, is located 200 mm to the right of the left-hand bearing A, and a 700 mm diameter pulley is mounted 250 mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3 : 1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa. | 16 | CO5 | [K ₃] |
| 13. | A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm ² , find the axial load which the spring can carry and the deflection per active turn. | 16 | CO5 | [K ₃] |
| 14. | A single cylinder, single acting, four stroke oil engine develops 20 kW at 300 r.p.m. The work done by the gases during the expansion stroke is 2.3 times the work done on the gases during the compression and the work done during the suction and exhaust strokes is negligible. The speed is to be maintained within ± 1%. Determine the mass moment of inertia of the flywheel. | 16 | CO5 | [K ₃] |
| 15. | A pair of cast iron bevel gears connect two shafts at right angles. The pitch diameters of the pinion and gear are 80 mm and 100 mm respectively. The tooth profiles of the gears are of 14 1/2° composite form. The allowable static stress for both the gears is 55 MPa. If the pinion transmits 2.75 kW at 1100 r.p.m., find the module and number of teeth on each gear from the standpoint of strength and check the design from the standpoint of wear. Take surface endurance limit as 630 MPa and modulus of elasticity for cast iron as 84 kN/mm ² | 16 | CO5 | [K ₃] |
| 16. | a) List down the Properties of Sliding contact Bearing. | 8 | CO2 | [K ₂] |
| | b) Discuss about the materials used for sliding contact bearing. | 8 | CO3 | [K ₁] |
