

Hall Ticket Number:

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Code No. : 15503

VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD
B.E. (Mech. Engg.: CBCS) V-Semester Main Examinations, December-2018

Machine Design

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

| Q.No. | Stem of the question | M | L | CO | PO |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|----|-------|
| Part-A (10 × 2 = 20 Marks) | | | | | |
| 1. | Classify various types of springs and mention applications of each. | 2 | 2 | 1 | 1,2,3 |
| 2. | Compression coil spring made of an alloy steel is having the following specifications : Mean diameter of coil = 50 mm ; Wire diameter = 5 mm ; Number of active coils = 20. If this spring is subjected to an axial load of 500 N ; solve the problem to find the maximum shear stress(neglect the curvature effect) to which the spring material is subjected. | 2 | 3 | 1 | 1,2,3 |
| 3. | Outline the wear considerations that have to be made while designing a gear | 2 | 2 | 2 | 1,2,3 |
| 4. | Name the various causes for the failure of a gear tooth. | 2 | 1 | 2 | 1,2,3 |
| 5. | Classify various types of bearings and mention their applications. | 2 | 2 | 3 | 1,2,3 |
| 6. | List the Assumptions made in the theory of Hydrodynamic Lubricated Bearings. | 2 | 1 | 3 | 1,2,3 |
| 7. | Name the various stresses that are considered in the design of a crank shaft. | 2 | 3 | 4 | 1,2,3 |
| 8. | What are the various forces that are acting on a connecting rod? | 2 | 2 | 4 | 1,2,3 |
| 9. | What stresses are considered for the design of a crane hook. | 2 | 2 | 5 | 1,2,3 |
| 10. | Compare trapezoidal cross sections and rectangular cross sections used in the design of crane hook and also specify the most preferable cross-sections. | 2 | 2 | 5 | 1,2,3 |
| Part-B (5 × 10 = 50 Marks) | | | | | |
| 11. a) | Define the terms solid length, spring index, free length and spring rate of helical springs. | 3 | 1 | 1 | 1,2,3 |
| b) | 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. | 7 | 3 | 1 | 1,2,3 |
| 12. a) | Classify various types of gears and mention their applications | 3 | 2 | 2 | 1,2,3 |
| b) | A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The distance between the shafts is to be 500 mm. The speed of the electric motor is 900 r.p.m. and the speed of the compressor shaft is desired to be 200 r.p.m. The torque, to be transmitted is 5000 N-m. Taking starting torque as 25% more than the normal torque, determine: 1). Module and face width of the gears using 20 degrees stub teeth, and 2). Number of teeth and pitch circle diameter of each gear. Assume suitable values of velocity factor and Lewis factor. Consider cast steel for gear whose allowable static stress is 140 MPa and cast iron for pinion whose allowable static stress is 60 MPa. | 7 | 5 | 2 | 1,2,3 |

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| 13. a) How do you express the life of a bearing? What is an average or median life? | 3 | 1 | 3 | 1,2,3 |
| b) The ball bearings are to be selected for an application in which the radial load is 2000 N during 90 per cent of the time and 8000 N during the remaining 10 per cent. The shaft is to rotate at 150 r.p.m. Determine the minimum value of the basic dynamic load rating for 5000 hours of operation with not more than 10 per cent failures. | 7 | 4 | 3 | 1,2,3 |
| 14. a) Summarize the design consideration for a piston of an IC engine | 3 | 2 | 4 | 1,2,3 |
| b) Design a cast iron piston for a single acting four stroke engine for the following data: Cylinder bore = 100 mm; Stroke = 125 mm ; Maximum gas pressure = 5 N/mm ² ; Indicated mean effective pressure = 0.75 N/mm ² ; Mechanical efficiency = 80% ; Fuel consumption = 0.15 kg per brake power per hour ; Higher calorific value of fuel = 42 × 10 ³ kJ/kg ; Speed = 2000 r.p.m. Any other data required for the design may be assumed. | 7 | 5 | 4 | 1,2,3 |
| 15. a) Explain about the considerations that has to be made while designing a Machine Frame. | 3 | 2 | 5 | 1,2,3 |
| b) The section of a crane hook is rectangular in shape whose width is 30mm and depth is 60mm. The centre of curvature of the section is at a distance of 125mm from the inside section and the load line is 100mm from the same point. Solve the problem to find the capacity of hook if the allowable stress in tension is 75N/mm ² . | 7 | 3 | 5 | 1,2,3 |
| 16. a) What is meant by nipping of leaf springs? Briefly explain. | 5 | 1 | 1 | 1,2,3 |
| b) Tell the different types of failure of gear tooth and mention the preventive measures that can be taken to avoid failures. | 5 | 1 | 2 | 1,2,3 |
| 17. Answer any <i>two</i> of the following: | | | | |
| a) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20 × 10 ⁶ revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing. | 5 | 3 | 3 | 1,2,3 |
| b) List out the design considerations of a crank shaft. | 5 | 1 | 4 | 1,2,3 |
| c) Distinguish between straight beam and curved beam. | 5 | 4 | 5 | 1,2,3 |

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

| S. No. | Criteria for questions | Percentage |
|--------|----------------------------------------------------------------------------------|------------|
| 1 | Fundamental knowledge (Level-1 & 2) | 50 |
| 2 | Knowledge on application and analysis (Level-3 & 4) | 40 |
| 3 | *Critical thinking and ability to design (Level-5 & 6) (*wherever applicable) | 10 |

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