



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



IV SEMESTER B.TECH (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: DESIGN OF MACHINE ELEMENTS [AAE 2252]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data if any may be suitable assumed and clearly mentioned.
- 1A. A pair of helical gears are used to transmit 15 kW power. The teeth are 20 full (04) depth in normal plane with a helix angle of 30. The pinion has 24 teeth and operates at 10,000 rpm. Design the gear pair and calculate all the gear parameters. (₀₁= 50 MPa (Cast steel), ₀₂= 40 MPa (Phosphor bronze), i=5, BHN₁=300, BHN₂=250)
- 1B. For the above designed gear pair, check for dynamic, static and wear safety. (06) Mention the remedial measures, in case of failure.
- 2A. With neat sketches, deduce a relation for ratio of tensions in a flat belt drive (05) pulley system. Mention the merits and demerits of V-Belts over flat belts, with suitable justifications.
- 2B. Design a journal bearing for a 10MW, 1000rpm steam turbine which is (05) supported by two bearings. The bearing diameter is 100mm. Consider the bearing to be an average industrial bearing.
- **3A.** Derive an equation for stresses in helical spring. (03)
- 3B. What is the normal range of value for stress correction factor (Wahl's factor) (02) in a helical spring? What is the effect of too small or a too large a Wahl's factor?

- 3C. Select a suitable ball bearing required to be mounted on a shaft of diameter (05) 45mm to withstand a radial load of 6kN and a thrust load of 3kN at a rated speed of 300rpm. The bearing works for 50 hrs. / Week for 3 years. Assume light shock conditions.
- 4A. Two shafts at right angles are connected with a pair of gears having 20° full (05) depth tooth form. The pinion is made of steel (=100 MN/m²) and the gear is to be of cast iron (= 85 MN/m²). The pinion having 16 teeth is to transmit 4 kW power at 900 rpm. The gear ratio, i=4.5. The gears are heat treated to 350 BHN. Mention which type of gear to be used and why, design the gear pair suitably. Calculate all the gear parameters.
- **4B.** For the above gear pair, check for safety based on strength and wear. **(05)**
- 5A. Design a leaf spring for the rear axle of a tractor trolley. The load on the rear (05) axle of the trolley is 10000N. The span is 1200mm and width of the clamp is 100mm. In all twelve leaves are used out of which two are main leaves and remaining graduated leaves.
- **5B.** Derive an equation for deflection of semi-elliptical leaf spring, **(03)** with usual notations.
- **5C.** Describe stable lubrication, with a neat plot. (02)