

**Code: 9D15106b**

M.Tech I Semester Regular & Supplementary Examinations January/February 2017

GEAR ENGINEERING

(Machine Design)

Time: 3 hours

Max. Marks: 60

Answer any FIVE questions
All questions carry equal marks

- 1 (a) Derive an equation for sliding velocity between two teeth, when two gears are in mesh to transmit uniform motion.
(b) Write notes on gear tooth failure modes.
- 2 A bronze spur gear is to drive a mild steel pinion. The angular velocity ratio is 3.5:1. The teeth are to have standard 20° involute profiles. Determine the smallest diameter gears that can be used and the necessary face width to transmit 5 kW at 1800 rpm of the pinion. Design the gears based on strength and check the design for dynamic and wear load.
- 3 (a) For a helix gear derive an expression for the virtual number of teeth in terms of helix angle and the actual number of teeth.
(b) A helical pinion with 20° stub teeth, helix angle 23° , pitch diameter 100 mm, and face width of 40 mm transmits 20 kW at 10,000 rpm. If the pressure angle is measured in the plane perpendicular to the tooth, determine the tangential force, the separating force component and the axial or thrust force.
- 4 (a) Sketch and explain various forces acting between straight bevel gears.
(b) Derive the beam strength (Lewis) equation for bevel gear tooth.
- 5 A pair of worm gears is designated as 2/52/10/4. Power of 10 kW at 720 rpm is supplied to the worm shaft. The coefficient of friction is 0.04 and the pressure angle is 20° . Calculate:
(a) The centre distance.
(b) The speed reduction.
(c) The dimensions of the worm and worm wheel.
(d) The tangential, axial and radial components of the resultant gear tooth force acting on the worm wheel.
(e) Efficiency of the drive.
Sketch the worm wheel diagram showing the forces acting on it.
- 6 Explain the following gear tooth failures.
(a) Due to breakage of teeth.
(b) Gear surface failure.
- 7 A speed box for a machine tool is to be designed, for minimum speed ($n_{\min}$) = 20 rpm, maximum speed ($n_{\max}$) = 2000 rpm and progression ratio (ϕ) = 1.26. Draw the best possible structural diagram and speed chart, if the speed box has a structure with overlapping steps.
- 8 Formulate the problem and solve to optimize the centre distance for the compact design of the spur gears for single stage speed reducer unit. Assuming that minimum number of teeth on any gear should not be less than 17. The power to be transmitted is 7.5 kW. Speed reduction is 5. Both gears are made of cast iron material having static strength 55 MN/m². Face width should be more than 6 times of module and less than 12 times of the module. Both gears tooth is of involute form having 20° pressure angle.

