Code: 9D15106b

M.Tech I Semester Supplementary Examinations August/September 2018

GEAR ENGINEERING

(Machine Design)

(For students admitted in 2013, 2014, 2015 & 2016 only)

Time: 3 hours Max. Marks: 60

Answer any FIVE questions

All questions carry equal marks

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1 (a) Differentiate between cycloid and involute gear tooth profiles.
(b) Sketch and explain the 'gear hobbing' generation process for spur gear.

2 A spur gear is having a module of 3 mm, a 38 mm face width, 18 teeth and a pressure angle of 20^0 involute profile with full-depth system. The material is AISI steel 1020 steel. Using a design factor of 3, estimate the power output of the gear:
(i) Corresponding to the speed of 20 rev/sec and moderate applications.
(ii) Based on obtaining an infinite life in bending.

3 A pair of helical gears is to transmit 9 kW power. The teeth are 20^0 full depth involute system in the diametral plane and having a helix angle of 30^0. The pinion has an 60 mm pitch diameter and operates at 6000 rpm. The pitch diameter of the gear is 240 mm. The pinion is made of heart treated steel and the gear is made of cast iron. Determine the suitable module and face width. Check the design for dynamic and wear load conditions.

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 single-thread worm rotates at 1800 rpm is in mesh with a 24-tooth worm gear to transmit 2.25 kW power to the output shaft. The worm pitch diameter is 80 mm and the tangential diametral pitch of the gear is 0.157 teeth / mm. The normal pressure angle is 14.5^0. The ambient temperature is 25^0C. Assume an overload factor as 1.25 and the design factor as 1. Gear face width is 52 mm and the gear material is chilled-cast bronze. Find: (i) The gear geometry. (ii) The transmitted gear forces. (iii) The mesh efficiency.

6 Explain the following gear tooth failures:
(a) Gear lubrication failure.
(b) Due to breakage of teeth.

7 A three stage 18 step speed box with minimum speed $(\eta_{min}) = 32$ rpm and progression ratio $(\varphi) = 1.41$ is powered by a 10 kW motor running at 1440 rpm. Draw the structural diagram (Ray diagram) of the speed box. Determine the number of teeth on gears, assuming minimum number of teeth on gear is 21.

8 Formulate and solve the problem of minimum tooth deflection of gear set under the given conditions: Power to be transmitted = 7.5 kW, transmission ratio = 6. Motor speed = 1440 rpm. Assume the centre distance being 250 mm. Minimum number of teeth on any gear is not less than 18. Tooth profile in involute form with 20^0 pressure angle. 6 m ≤ face width (b) ≤ 14 m, where m, is the module of the gears. Both gears are made of cast iron material.

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