**Code: 9D15106b**

M.Tech I Semester Supplementary Examinations February/March 2018

**GEAR ENGINEERING**

(Machine Design)

(For students admitted in 2012, 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) State and explain the "Gear shaving" finishing process for spur gears.
(b) Explain the inspection of bevel gear blanks.

2 Using a standard gear system, design a pair of spur gears to connect a 72.5 kW, 3600 rpm motor to a 900 rpm load shaft. Shock loading from the motor and driven machine is negligible. The centre distance is to be as small as reasonably possible. A life of 5 years of 2000 hours per year operation is desired, but full power will be transmitted only about 10 percent of the time, with half power the other 90 percent. Likelihood of failure during the 5 years should not exceed 10 percent.

3 (a) Sketch and explain various forces acting between helical gears.
(b) For a helix gear derive an expression for the virtual number of teeth in terms of helix angle and the actual number of teeth.

4 A pair of straight-tooth bevel gears mounted on perpendicular shafts transmitting 25 kW power at 1000 rpm of the 36-tooth pinion. The gear speed is 400 rpm. Face width is 50 mm, module is 4 mm, and pressure angle is $20^0$ full depth system. Make a sketch showing:
(i) The direction and magnitude of the torque applied to the pinion by its shaft,
(ii) The direction and magnitude of the three components of force applied to a pinion tooth by a gear tooth.

5 Design a cylindrical worm-gear mesh to connect a squirrel-cage induction motor a liquid agitator. The motor speed is 1125 rpm and the velocity ration is to be 10:1. The output power requirement is 20 kW. The shaft axes are $90^0$ to each other. An overload factor of 1.25 is appropriate for this service. Design factor is 1.1 and use AGMA method.

6 Explain the following gear tooth surface failures:
(a) Pitting.
(b) Plastic flow.
(c) Scoring.

7 Draw the structural diagrams (Ray diagrams) of a machine tool speed box for minimum speed $(\eta_{min}) = 20$ rpm, maximum speed $\eta_{max}) = 2000$ rpm and Progression ratio $(\varphi)$ = 1.26. Which lay-out is best and why?

8 Formulate the problem and solve to optimize the centre distance for the compact design of the Helical gears for single stage speed reducer unit, assuming that minimum number of teeth on any gear should not be less than 21. The power to be transmitted is 7.5 kW. Speed reduction is 6. Both gears are made of cast iron material having static strength 55 MN/m$^2$. Face width should be more than 12 times of module and less than 20 times of the module. Both gears tooth is of involute form having $20^0$ pressure angle in normal plane. Helix angle is between $-5^0$ and $20^0$.

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