Mech. Engg. Deptt.
INDIAN INSTITUTE OF TECHNOLOGY DELHI
Major Test - Ist Semester 2007-08
MEL 737: ADVANCED MECHANICAL ENGINEERING DESIGN
on 22.11.2007(Saturday) at 10:30-12:30 hrs in III 339
Course Coordinator/Faculty : Prof. T.K.Kundra

Max. Marks 120

Notes: ***"Machine Design" by R.L.Norton and other class data handouts are permitted for reference.***

1[a] How would you approach a mechanical engineering problem for getting feasible designs? For illustrating your strategy assume the problem of lifting a punctured wheel of a car.

b] Formulate constraints in case of the following requirements:

i) avoiding surface fatigue failure in case of wheel and rail
ii) avoiding buckling failure in case of a spring
iii) ensuring desired stiffness in case of a shaft
iv) ensuring sound dynamic design of a shaft
v) ensuring portability of a clinical weighing machine.

[c] A shaft 75mm diameter and supported on double row ball bearings, 700 mm apart, is carrying a central pulley weighing 200 Kg. Its critical speed is desired to be increased to three times of its present value; quantify possible structural modifications.

(10,10,20)

2 [a] Select the type of bearing with reasons/flow chart for the gear box of a four wheeler.

[b] How would you select the lubricant for the above application? Justify your choice.

[c] Select a deep-groove ball bearing for a radial load of 2000N and axial load of 750N. The shaft speed is 500rpm and its diameter is 40mm. The expected reliability is 95%, 5 years life and one shift/ day and 200 days/year of usage is expected for the application.

(10, 10, 20)

3. [a] Illustrate the principles of initial estimation of configuration, material & process with the example of spur gears.

[b] A component of a lathe is modelled like a simply supported shaft 600mm long is proposed to be made from C45 steel, having a diameter of 25mm. Maximum values of bending moment and torsion during the life time are estimated to be 250 Nm and 150 Nm respectively. Predict the safety of the component for static & fatigue strengths' and stiffness requirements.

(10,30)