ANNA UNIVERSITY – 2006

B.E/B.TECH V SEMESTER DEGREE EXAMINATION

DESIGN OF MACHINE ELEMENTS

(MECHANICAL ENGINEERING)

TIME-3HOUR
MARK-100

ANSWER ALL QUESTIONS

PART A (10 * 2 = 20)

1. Sketch the stress-strain diagram for a ductile specimen and indicate its salient features.

2. Indicate the type of fit used in the assembly of bush in the big-end of the connecting rod of an automobile.

3. Define 'endurance limit' in design

4. Indicate the type of fit specified by 120 H7 p6 in a drawing.

5. Mention any two desirable properties of the material used in an automobile piston.

6. Sketch and indicate the salient parts of a flange coupling.

7. Mention the stresses induced in a taper key used in a coupling.

8. What is a 'bearing characteristic number'.

9. Mention the names of any four theories of failure.

10. Define 'coefficient of fluctuation of speed' in a flywheel.

PART B (5 * 16 = 80)

11. i) A load of 5 KN is to be raised by means of a steel wire. Find the minimum diameter required, if the permissible stress in the wire is not to exceed 100 N /mm2

ii) A square bar of 20 mm x 20 mm in section is subjected to a bending moment of 1000 Nmm. Calculate the stress induced in the top and bottom fibres of the bar. What will be stress in the above fibres, if the bar is additionally acted upon by a tensile stress of 50 N/mm2 along the axis.

iii) A circular shaft is to transmit a torque of 500 Nmm at a speed of 1000 rpm. Find out the diameter of the shaft, if the permissible shear stress in the shaft material is 70 N/mm2.

12.a) A shaft is supported by two bearing arranged 1 m apart, A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of the left hand bearing and this drives a pulley directly below it with the help of a belt having maximum tension of 2.25 kN. Another pulley of 400mm diameter is placed 200 mm to the left of the right hand bearing and is driven with the help of an electric motor and a belt, horizontally to the right. The angle of contact for both the pulley is 1800 and the coefficient of friction is 0.24. Design the diameter of the solid shaft, allowing a working stress of 60 N/mm2 in tension and 40 N/mm2 in shear for the material of the shaft. Assume the torque input & torque output are equal.

OR

12.b) A bar of circular cross section is subjected to alternating tensile forces varying from a minimum of 200 kN to maximum of 500 kN. It is to be manufactured from a material with an ultimate tensile strength of 90 MPa and an endurance limit of 70 MPa. Determine the diameter of the bar using safety factors of 3.5 in ultimate tensile strength and 4 in endurance limit strength and stress concentration factor of 1.65 for fatigued load. Use Goodman relation for the basis of design.

13.a) A circular rod 45 mm diameter and 210 mm long is welded to a steel plate with axis of the rod perpendicular to the plate. The rod is subjected to a load of 10 kN at the free end, the direction of the load being perpendicular to the axis of the rod. The material of the plate & the rod are Mild Steel. Determine the size of the weld to withstand the loading.

OR

13.b) An electric motor weighting 5 kN is to be lifted by eye-bolt, which has been screwed into the body of the motor. Define the eye-bolt, assuming suitable proportions, if the permissible stresses for the bolt material are 60 MPa, 30 Mpa and 80 MPa in tension, shear and crushing respectively.

14.a) Select a deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load.

OR

14. b) Design a connecting rod for a petrol engine for the following data:

Diameter of the piston = 68 mm
Stroke length = 80 mm
Length of connecting rod = 160 mm
Maximum explosion pressure = 3.5 N/ mm2
Mass of reciprocating parts = 2.5 kg
Speed = 4000 rpm
Compression ratio = 8 :1

15.a) A helical compression spring of the exhaust valve mechanism is initially compressed with a pre-load of 375 N. When the spring is further compression and the valve is fully opened, the torsional shear stress in the spring wire should not exceed 750 N/mm2. Due to Space limitations, the outer diameter of the spring is not exceed 42 mm. The spring is to be designed for minimum weight. Calculate the wire diameter and the mean coil diameter of the spring.

OR

15.b) A semi-elliptic leaf spring consists of two extra full-length leaves and six graduated length leaves, including the master leaf. Each leaf is 7.5 mm thick and 50 mm wide. The center-to-centre distance between the two eyes is 1m. The leaves are pre-stressed in such a way that when the load is maximum, the stresses induced in all the leaves are equal to 350 N / mm2. Determine the maximum force that the spring can withstand.