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Question Paper Code: 52113

M.E. DEGREE EXAMINATION, NOV 2016

First Semester

CAD / CAM

15PCD103 – INTEGRATED MECHANICAL DESIGN

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

(5 x 20 = 100 Marks)

1. (a) A machine component is subjected to a flexural stress which fluctuates between $+300\text{MN/m}^2$ and -150MN/m^2 . Evaluate the value of minimum ultimate strength according to (i) Gerber relation (ii) Modified Goodman relation and Soderberg relation. Take yield strength = 0.55 Ultimate strength, Endurance strength = 0. Ultimate strength and factor of safety = 2. (20)

Or

1. (b) A hot rolled bar of steel is subjected to a torsion load varying from -150N-m to 450N-m . Determine the required diameter of the bar using a factor of safety of 1.7. Properties of the material may be assumed as follow. Ultimate tensile stress = 450MPa Yield stress = 300MPa . (20)
2. (a) A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000Nm and a torque T. If the yield point of the steel in tension is 200MPa , Calculate the maximum value of this torque without causing yielding of the shaft according to (i) maximum principal theory (ii) maximum shear stress theory (iii) maximum distortion energy theory. (20)

Or

- (b) A mild steel shaft transmits 20kW at 200rpm. It carries a central load of 900N and is simply supported between the bearings 2.5m apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not to exceed 56MPa. What size of the shaft will be required, if it is subjected to gradually applied loads. (20)
3. (a) A motor shaft rotating at 1500 rpm has to transmit 15kW to a low speed shaft with a speed reduction is 3:1. Both the gear and pinion are made of C45 steel. design a spur gear drive to suit the above conditions. (20)

Or

- (b) Design the layout of 12 speed gear box for a milling machine having an output of speeds ranging from 180 to 2000rpm. Power is supplied to the gear box by 6kW induction motor at 1440 rpm. Follow the Arrangement $2 \times 2 \times 3$. (20)
4. (a) Determine the capacity and the main dimensions of a double block brake for the following data: The brake sheave is mounted on the drum shaft. The hoist with its load weights 45 kN and moves downwards with a velocity of 1.15 m/s. The pitch diameter of the hoist drum is 1.25m. The hoist must be stopped with in a distance of 3.25 m. The kinetic energy of the drum may be neglected. (20)

Or

- (b) The differential band brake has a drum diameter of 600mm and the angle of contact is 240° . The brake band is 5mm thick and 100mm wide. The co-efficient of friction between the band and the drum is 0.3. If the band is subjected to a stress of 50MPa, evaluate (i) The least force required at the end of a 600mm lever and (ii) The torque applied to the brake drum shaft. (20)
5. (a) Demonstrate the steps in designing a 12 speed gear box for an all geared headstock of a lathe. Maximum and minimum speeds are 600 rpm and 25mm respectively. The drive is from an electrical motor giving 2.25kW at 1440 rpm. (20)

Or

- (b) The drive arrangement for tiller crane has spur gear in between belt drive and rope drum. The crane is to be used in open wells for removing rock and debris. The lifting is provide by 7kW two speed electrical motor running at 720 rpm. The power is to be transmitted to the rope drum through belt drive and a two stage spur gear reduction unit. The speed reduction in the belt drive is 2, while over all speed reduction is 16. Design the required components. (20)