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Question Paper Code: 52113

M.E. DEGREE EXAMINATION, DECEMBER 2015

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 steel beam rectangular in section extends $2m$ out from the wall by which it is supported. It supports an end load of $10kN$. The safe bending stress is $60N/mm^2$. The thickness of the beam is 3 times its width. Calculate width and thickness of the beam. (20)

Or

- (b) A piston of a reciprocating compressor has a diameter of $60mm$. The maximum pressure on the piston face is $1.25MN/mm^2$. Assuming the gudgeon pin passing through the small end of the connecting rod can be safely loaded in shear up to $10MN/mm^2$. Calculate the minimum diameter of the gudgeon pin. (20)
2. (a) Power is transmitted to a shaft supported on bearings $900mm$ apart by a belt drive running on a $450mm$ pulley which overhangs the right bearing by $200mm$. Power is transmitted from the shaft through a belt drive, running on a $250mm$ pulley, located midway between the bearings. The belt drives are at right angle to each other and the ratio of belt tensions is 3. With the minimum tensions both the belt being limited to $2kW$. Determine the diameter of the shaft assuming permissible tensile and shear stress are $100MPa$ and $60MPa$ respectively. (20)

Or

- (b) A hollow shaft transmits $15kW$ power at $250rpm$ with the allowable shear stress limited to $50MPa$. Find the outer and inner diameters of the shaft if the ratio of outer diameter to inner diameter is 2. (20)
3. (a) A compressor running at $360rpm$ is driven by a $140kW$, $1440rpm$ motor through a pair of 20° full depth helical gears having helix angle of 25° . The centre distance is approximately $400mm$. The motor pinion is to be forged steel and the driven gear is to be cast steel. Design the gear pair. (20)

Or

- (b) A nine speed gear box used as a head stock gear box of a turret lathe is to provide a speed range of $180rpm$ to $1800rpm$. Using standard step ratio draw the speed diagram and the kinematic layout. Also find and fix the number of teeth on all gears. (20)
4. (a) A simple band brake is operated by a lever of length $500mm$ long. The brake drum has a diameter of $500mm$ and the brake band embraces $5/8$ of the circumferences. One end of the band is attached to the fulcrum of the lever which the other is attached to a pin on the lever $100mm$ from the fulcrum. If the effort applied to the end of the lever is $2000N$ and the coefficient of friction is 0.25, then design the simple band brake. (20)

Or

- (b) 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, its load weighs $45kN$ and the moves downwards with a velocity of $1.15m/s$. The pitch diameter of the hoist drum is $1.25m$. The hoist must be stopped within a distance of $3.25m$. The kinetic energy of the drum may be neglected. (20)
5. (a) Power is transmitted between the two shaft by a V-belt whose mass is $0.9kg/m$ length. The maximum permissible tension in the belt is limited to $2.2kW$. The angle of lap is 170° and the groove angle 45° . If the coefficient of friction between the belt and the pulleys is 0.17, find 1) Velocity of the belt for maximum power. 2) Power transmitted at this velocity. (20)

Or

- (b) A single cylinder double acting steam engine delivers $187.5kW$ at $100rpm$. The maximum fluctuation of energy per revolution is 15% . The speed variation is limited to 1% either way from the mean. The mean diameter of the rim is $2.4m$. Design a cast iron flywheel for the engine. (20)