I. DESIGN OF JOINTS AND FASTENERS

5mark and 15mark

1. General design procedure for machine design.
2. A hydraulic press exerts a total load of 3.5MN which is carried by two rods of 2.5m long supporting the upper head of the press. if the safe stress is 85mpa and E=210KN/MM^2,Calculate the dia of the rods and extension in each roads
3. Design a knuckle joint to transmit load of 60KN.take allowable stresses as 60mpa in tension, 75mpa in compression and 40mpa in shear.
4. name the type os steel with its composition designated as 40C 10S 18
5. Name at least five mechanical properties of materials
6. Design a sleeve and cotter joint to connect two mild steel rods for a pull of 80KN.the maximum permissible stresses are 62mpa in tension, 78mpa in shear, and 125mpa in crushing.
7. a pipe is to be used as a short compression member with the outside and inside diameters in the proportion of 4 to 3.the stress in the material is to be limited to 60 MN/mm^2 when the applied load is 35KN.determine the diameters of the pipe.
8. A steam engine cylinder has an effective diameter of 350mm and the maximum steam pressure acting on the cylinder cover is 1.25 N/MM^2 .calculate the no and size of studs required to fix the cylinder cover. Assume the allowable stress in the studs as 33mpa.
9. Design a sleeve and cotter joint to withstand a tensile load of60KN. All parts of the joint are made of the same materials and the permissible stresses are given below tensile stress=60N/MM^2,Crushing stress=125 N/MM^2 ,shear stress=70 N/MM^2
10. A plate 100mm wide and 10mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80KN.find the length of weld if allowable shear stress in the weld does not exceed 55 N/MM^2.

2. DESIGN OF SHAFTS AND COUPLINGS

5mark and 15mark

1. A solid circular shaft is subjected to a bending moment of 30X10^5 NMM and a torque of 10X10^5NMM the shaft material has an ultimate tensile stress of 700 N/mm^2 and ultimate shear stress is 500 N/mm^2 the FOS is 6.determine the dia of shaft.
2. The shaft and the flange of a marine engine are to be designed for flange coupling, in which the flange is forged on the end of the shaft. The following particulars are to be considered in the design. Power of the engine is 3MW, speed of the engine is 100rpm, permissible shear stress in bolts and shaft 60mpa.design the coupling.
3. A rigid flange coupling is to be designated to transmit 20KW at 1000rpm.allowable shear stress for shaft, key and bolt is 40 N/mm^2 ,allowable crushing stress for key and bolt is 80 N/mm^2 ,allowable shear stress for flange material is 15 N/mm^2 .design the coupling
4. Design a protective type flange coupling to connect two shafts to transmit 7.5KW at 720 rpm .The permissible shear stress for the shaft,bolt,key materials is 33N/mm^2.permissible crushing strength for bolt and key materials is 60 N/mm^2 and permissible shear stress fore cast iron is 15 N/mm^2.

3. DESIGN OF BELT DRIVES (FLAT BELT AND V BELT)

5mark and 10mark

1. Design a v belt drive and calculate the actual belt tensions and average stress from the following dia of driven pulley=500mm,dia of driving pulley=150mm,centre distance between pulleys=925mm,speed of driven pulley=300rpm,speed of driving pulley=1000rpm,power transmitted=7.5kw,service factor=1.3,coefficient of friction=0.3
2. Design a fabric belt to transmit 11kw at 420rpm of an engine to a line shaft at 20rps.engine pulley diameter is 550mm and the centre distance is 2m.assume coefficient of friction=0.2and number of plies=6
3. A power of 60kw at 750rpm is to be transmitted from an electric motor to a compressor shaft at 300rpm by v belt. The approximate larger pulley diameter is 1500mm. the approximate centre distance is 1650mm. cross sectional area is $350mm^2$. And density is $1000kg/m^3$, having an allowable stress of 2mpa is allowable for use. Overload factor is 1.5. $\alpha=34^0$, coefficient of friction =0.28
4. Select the crossed flat drive from the manufacturer's catalogue to transmit a power of 15KW at 1200 RPM the speed of the driven pulley is 450RPM .center distance between the shafts is 2m.apply steady load.
5. Design a V belt drive power to be transmitted 75KW, speed of driving wheel is 1440rpm, speed of driven wheel 400rpm, dia of driven wheel is 300mm, center distance is 2500mm, small pulley factor is 1.14, service factor is 1.3, correction factor for length 1.07.
6. Design a V belt drive and calculate the actual belt tensions from the following data's) diameter of driven pulley=600mm; ii) diameter of driving pulley=200mm; iii) centre distance between the pulleys=1000mm; IV) speed of driven pulley=400rpm; v) speed of driving pulley =1200rpm; VI) power transmitted=10KW; vii) service-heavy duty-16hrs/day.

4. DESIGN OF JOURNAL BEARING

5mark and 15mark

1. A journal bearing is proposed for a centrifugal pump. The diameter of journal is 150mm and the load on it is 40KN and its speed is 900rpm.design and gives the complete calculations for the bearing.
2. A journal bearing 75mm long supports a load of 7500N on a 50mm dia journal bearing running at 750rpm. The diameter clearance is 0.0693mm. Determine the viscosity of oil if the operating temp of the bearing surface is limited to 77ºc. The ambient temp is 21ºc. Heat dissipating coefficient is 210W/M^2/ºC.
3. A journal bearing of 150mm diameter is designed to carry a radial load of 9KN at 1200rpm.the diametric clearance is 0.15mm and the power lost in friction is 6KW. The viscosity of oil at operating temperature is 0.018kg/m s. find the required length of the journal.
4. Designation of ball bearing?
5. A 150mm dia shaft supporting a load of 10KN has a speed of 1500rpm. The shaft runs in a bearing whose length is 1.5times the shaft dia. If the diametric clearance of the bearing is 0.15mm and absolute viscosity of the oil at the operating temp is 0.011kg/ms. find the power wasted in friction.
6. Explain how a ball bearing is designated with an example, and important physical characteristics of a good bearing material.

5. DESIGN OF LEVERS AND SPURGEARS

5mark and 15mark

1. Design a hand lever of rectangular section subjected to a maximum load of 250N at the end of the moment arms of 1.2m. The thick of the lever is constant and is equal to 0.375times the width of the lever near the boss. Permissible shear stress for the shaft is 40 N/mm^2 and the permissible bending stress for the lever is 80 N/mm^2.
2. A foot lever is 1m from the centre of the shaft of the point of applications of 800N load. the allowable tensile stress is 75 N/mm^2 and allowable shear stress is 70 N/mm^2.determine dia of shaft, dimensions of boss, dia of shaft at the centre of the bearing, dimensions of key and dimensions of rectangular arm of the foot lever at 60mm from the centre of the shaft, assuming the width of arm is 3times the thickness.
3. A gear drive is required to transmit a maximum power of 22KW, the velocity ratio is 1:2.the pinion rotates at 200rpm.the approximate centre distance between the shafts may be taken as 600mm.the teeth have 20º stub involutes profiles. The material used for gear is CI. Determine the module, face width, number of teeth on each gear. Check you design for dynamic and weak loads.
4. It is desired to transmit 10KW from a motor shaft running at 1440rpm to a low speed reduction of 3:1. The teeth are 14 1/2º in volute with 25 teeth on the pinion. The starting torque is 30% higher than the running torque. Both the pinion and gear are made of same steel heat treated. Design the suitable spur gear thr above condition y=0.124-0.684/TP for 14 1/2º involves gear. Assume module is 6. Static stress is 210mpa
5. a cranked lever has the following dimensions; length of the handle is 420rpm; length of the lever arm is 520mm; journal overhang is 200mm; if the lever is operated by a single individual exerting a maximum force of 500N at a distance of $1/4^{th}$ length of the handle from its free end, find i) diameter of handle, ii) cross section of lever arm which is rectangular b=2t iii) diameter of journal. The permissible bending stress for the lever material is 50mpa and the shear stress of the shaft material is 40mpa.
6. Design a spur gear drive to connect an electric motor to a reciprocating pump both being mounted on the same bed. Speed of the motor is 1440rpm.speed reduction desired is 10:1.motor power is 36.8KW. The gears are to have 20 pressure angles. The minimum number of teeth on the pinion is 24.
7. A pinion runs at 600rpm drives a gear at a speed ratio of 4:1.allowable static stress of pinion and gear material is $85N/mm^2$.pinion has 16teeth of module 8mm.teeth is 20 º F.D systems. face width 90mm. find the power transmitted
8. Design a hand lever of rectangular section subjected to a maximum load of 300N at the end of the moment arm of 1.2m. The thickness of the lever is constant and is equal to 0.375times the width of the lever .Permissible shear stress for the shaft material is 42 N/MM^2 the bending stress for lever material is 80 N/MM^2