CBCS SCHEME

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17AU53

# Fifth Semester B.E. Degree Examination, Aug./Sept. 2020
## Design of Marine Elements – I

Time: 3 hrs. Max. Marks: 100

**Note: 1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
**2.** ***If any missing data, assume suitably***



### Module-1

1 a. Explain important steps of design procedure. **(10 Marks)**

b. Find the maximum normal and shear stress for a machine member diameter 60mm subjected to a tensile load of 18kN and a twisting moment of 1.2kNm as shown in Fig Q1(b).

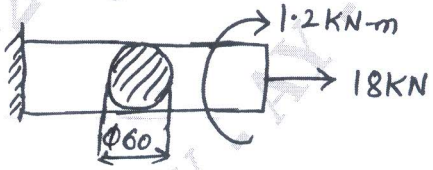


Fig Q1(b) **(10 Marks)**

**OR**

2 a. Explain theories of failure. **(10 Marks)**

b. A mild steel shaft having yield stress as 600MPa subjected to following stresses. Compute factor of safety by using MNST, MSST, DET.

i) $\sigma_1 = 420MPa \quad \sigma_2 = 410MPa \quad \sigma_3 = 0$

ii) $\sigma_1 = 420MPa \quad \sigma_2 = 180Mpa \quad \sigma_3 = 0.$ **(10 Marks)**

### Module-2

3 a. What do you mean by stress concentration? Explain the methods to reduce stress concentration. **(06 Marks)**

b. A circular shaft of 45mm diameter stepped down to 30mm diameter having fillet radius of 6mm subjected to twisting moment 150N-m. Find maximum stress? **(06 Marks)**

c. A bar of rectangular C/S with side ratio 2 is 300mm long it is subjected to an axial impact by a load of 1.5kN that falls on to it from a height of 10mm. Determine the sectional dimensions of the bar $\sigma_{au}$ = 120MPa, E = 210GPa? **(08 Marks)**

**OR**

4 a. A bar of rectangular section is subjected to an axial pull of 500kN. Calculate the thickness if the allowable tensile stress in the bar is 200MPa?

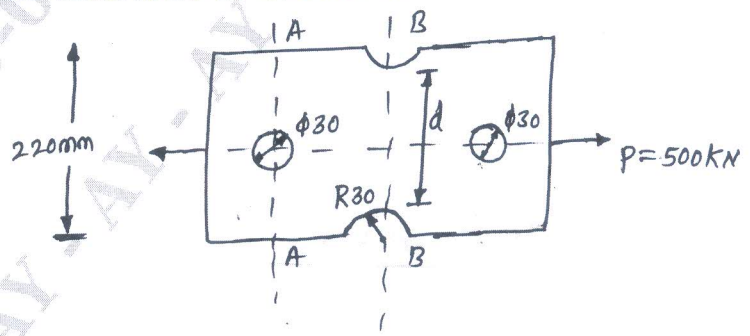


Fig Q4(a) **(10 Marks)**

b. A grooved shaft 'd' has a semicircular groove of radius 0.1D and is made of steel having torsional yield strength of 300MPa and a torsional endurance strength of 210MPa. The size and surface factors are 0.85 and 0.87 respectively. The notch sensitivity is 0.95. The shaft is sustain a twisting movement that fluctuates between 900N-m(cw) to −300 N-m (ccw). Find the diameter of the shaft. Take FOS = 3 consider the load factor 0.6.

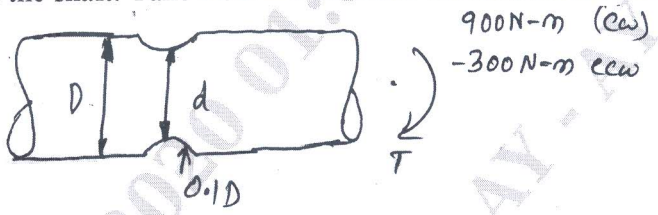


Fig Q4(b) **(10 Marks)**

## Module-3

5 a. Design a socket and spigot type cotter joint to sustain an axial load of 100kN. The material selected for the joint has the following design stresses $\sigma_t = 100N/mm^2$ $\sigma_c = 150N/mm^2$ and $\tau = 60N/mm^2$. **(10 Marks)**

b. Design a pin type flexible coupling to transmit 10kW at 500rpm. Assume C40 steel as shaft, bolt (pin) and key material ($\sigma_y$ = 328.6MPa) and C.I as flange and hub material ($\sigma_{ut}$ =124.5MPa). **(10 Marks)**

**OR**

6 A shaft supported by two bearings placed 1m apart. A 500mm pulley is mounted at a distance of 200mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 3000N. The pulley weighs 1000N. Another pulley 300mm diameter is placed 300mm to the left of right hard bearing is driven with the help of electric motor and the belt which is placed horizontally to the right when viewed from the left bearing. This pulley weighs 500N. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine suitable diameter of the shaft, assuming torque on one pulley is equal to torque on another pulley choose C15 steel ($\sigma_y$ = 235.4MPa, $\sigma_u$ = 425MPa) as shaft material and use ASME code for the design of shaft. Assume minor shock condition? **(20 Marks)**

## Module-4

7 a. A double riveted lap joint is to be made between 9mm plates, if the safe working stresses in tension crushing and shear are $80N/mm^2$ $120N/mm^2$ and $60N/mm^2$ respectively. Design the riveted joint. **(10 Marks)**

b. Design double riveted butt joint with two cover plates for the longitudinal seam of a boil shell 1.5m in diameter subjected to a steam pressure of $0.95N/mm^2$. Assume an efficiency of 75%, allowable tensile stress in the plate $90N/mm^2$ allowable crushing stress of $140N/mm^2$ and an allowable sheer stress in the rivet of $56N/mm^2$. **(10 Marks)**

**OR**

8 a. A plate of 80mm wide and 10mm thick is to be welded to another by means of two parallel fillet welds. The plates are subjected to a load of 50kN. Find the length of weld so that maximum stress does not exceed $50N/mm^2$. Consider the joint under static loading and then under dynamic loading? **(10 Marks)**

b. A 16mm thick plate is welded to a vertical support by two fillet welds as shown in Fig Q8(b). Determine the size of weld if the permissible shear stress for the weld material is 75MPa.

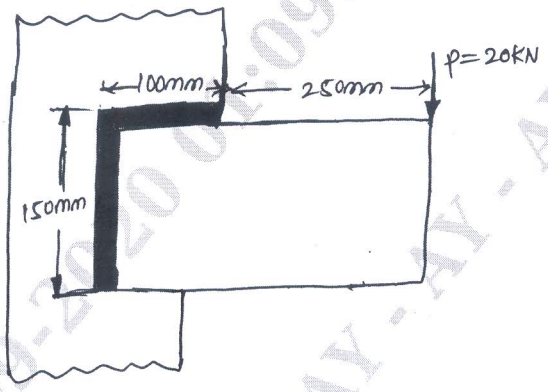


Fig Q8(b) **(10 Marks)**

## Module-5

9 a. Explain types of threads and its terminologies. **(10 Marks)**

b. Derive an expression for efficiency of self locking screw, and also show that efficiency of self locking screw is less than 50%. **(10 Marks)**

**OR**

10 Design a screw jack with a lift of 300mm to lift a load of load 50kN select C-40 steel ($\sigma_y$ = 328.6MPa) for the screw and soft phosphor bronze ($\sigma_{ut}$ = 345MPa and $\sigma_y$ = 138MPa) for nut. **(20 Marks)**

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