GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

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Name of Examination : **Winter 2020** - (Preview)

Course Code & Course Name : **ME301 - Machine Design -I**

Generated At : **18-04-2022 16:20:52**

Maximum Marks : **60**   Duration : **3 Hrs**

[Edit] [Print] [View Answer Key] [Close] **Answer Key Submission Type:** Marking scheme with model answers and solutions of numerical

Instructions:

1. *All questions are compulsory. Do not write anything on question paper.*
2. *Illustrate your answer with suitable figures/sketches wherever necessary.*
3. *Assume suitable additional data; if required.*
4. *Use of design data, drawing instruments and non programmable calculators is allowed.*
5. *Figures to the right indicate full marks.*
6. *Additional supplements will not be provided.*

1)   **Attempt any two sub-questions.**

a)   Explain the general procedure of design of machine component or machine element.   [6]

b)   What are the different types of shafts? Explain ASME code for design of shaft.   [6]

c)   A mild steel shaft of 50mm diameter is subjected to bending moment of 2000N-m 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,   [6]

     i) Maximum principal stress theory.

     ii) Maximum shear stress theory and

     iii) Maximum distortion strain energy theory of yielding.

2)   **Attempt any two sub-questions.**

a)   Define and explain the following terms related to flywheel: [6]

     1) Coefficient of fluctuation of speed   2) Maximum fluctuation of energy   3) Coefficient of fluctuation of energy.

b)   Explain the strength equations for single and double transverse and parallel fillet welded joints with neat sketches.   [6]

c) i. A plate 100mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 KN. Find the length of the weld so that the maximum stress does not exceed 56MPa. Consider the joint first under static loading and then under fatigue loading, if stress concentration factor for parallel fillet weld is 2.7.   [4]

   ii. Give the requirements of good shaft couplings.   [2]

3)   **Attempt any two sub-questions.**

a)   Explain the different types of springs with neat sketches.   [6]

b)   A mild steel shaft transmits 20 KW at 200 rpm. It carries a central load of 900N and is simply supported between the bearings 2.5 metres apart. Determine the size of the shaft, if allowable shear stress is 42 MPa and 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? Assume K_m=1.5, K_t =1, for gradually applied loads.   [6]

c)   Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5.The maximum permissible shear stress for spring wire is 420MPa and modulus of rigidity is 84KN/mm^2. For spring index C, take Wahl's factor, K=$\frac{4c-1}{4c-4} + \frac{0.615}{c}$ [6]

SWG	7/0	6/0	5/0	4/0	3/0	2/0	0	1	2	3	4	5	6
Diameter (mm)	12.70	11.785	10.973	10.160	9.490	8.839	8.229	7.620	7.010	6.401	5.893	5.385	4.877

4)   **Attempt following all sub-questions.**

a)   Explain:- i)'Bolts of Uniform Strength' with neat sketch.   [6]

       ii) Stress concentration and it's causes.

b)   Design a cast iron protective type flange coupling to transmit 15 KW at 900 rpm from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used:-   [6]

Shear stress for shaft, bolt and key material   = 40MPa

Crushing stress for bolt and key   = 80MPa

Shear stress for cast iron   = 8 MPa.

Shaft diameter (mm) up to and including		6	8	10	12	17	22	30	38	44	50	58	65	75	85	95	110
Key cross section	Width (mm)	2	3	4	5	6	8	10	12	14	16	18	20	22	25	28	32
	Thickness (mm)	2	3	4	5	6	7	8	8	9	10	11	12	14	14	16	18

5)   **Attempt following all sub-questions.**

a)   Explain the fatigue failure and Mechanical reliability in design.   [6]

b)   Design a knuckle joint to transmit 150KN force. The Design stresses may be taken as 75 MPa in Tension, 60MPa in shear and 150MPa in compression.   [6]

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