

JK LAKSHMIPAT UNIVERSITY, JAIPUR
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), April-May 2014

B. Tech in Mechanical Engineering, Semester VI

Roll No.....

Design of machine elements-II, ME-604

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
(i)	The following subject(s) is (are) related to 'Ergonomics' (a) Anthropology (b) Physiology (c) Psychology (d) All of the above	
(ii)	The objective of considering ergonomics in machine design is to ____ 1. Decrease physical stresses 2. make user adapt to the machine, 3. Make machine fit for the user 4. improve appearance of the product (a) Only 2 (b) 3 and 4 (c) 1 and 3 (d) 1, 3 and 4	
(iii)	What is the Wahl's factor if spring index is 6? (a) 1.477 (b) 0.995 (c) 1.252 (d) None of the above	
(iv)	In which condition the axial distance between two adjacent coils is called as pitch? (a) Compressed condition (b) Uncompressed condition (c) Both a. and b. (d) None of the above	
(v)	Which material cannot be used to manufacture shafts? (a) Plain carbon steels (b) Cast iron (c) Both a. and b. (d) None of the above	

(vi)	For brittle materials having static load, factor of safety is given as the ratio of _____ (a) Endurance strength and design stress (b) Design stress and allowable stress (c) Working stress and allowable stress (d) Ultimate strength and design stress	
(vii)	The ratio of endurance strength and allowable stress is used to determine FOS for _____ (a) Fatigue loading (b) Static loading of brittle materials (c) Static loading of ductile materials (d) All of the above	
(viii)	Which of the following factors are not considered while selecting values for factor of safety? (a) Cost (b) Failure consequences (c) Degree of uncertainty about loading and material (d) None of the above	
(ix)	In S-N diagram, the graph plotted between fatigue strength and number of stress cycles becomes horizontal for which type of materials? (a) Ferrous materials (b) Non-ferrous materials (c) Both a. and b. (d) None of the above	
(x)	Calculate fatigue stress concentration factor, when theoretical stress concentration factor is 1.62 and notch sensitivity is equal to 0.9 (a) 1.558 (b) 3.358 (c) 1.162 (d) None of the above	

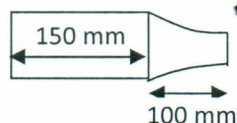
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
(i)	Define following terms- (1) Resilience, (3) Stiffness (3) Proof resilience	
(ii)	What are the major factors consider calculating actual endurance strength through theoretical endurance strength?	
(iii)	Briefly describe at least 3 major properties of engine oil.	
(iv)	Describe your answer for above question 1- (v) with neat and clean figure.	
(v)	Find the diameter of a shaft used to transmit 25 kW at 1500 rpm. Take $S_{yt}=300\text{MPa}$, F.O.S.= 3.	
(vi)	Determine the length of a shaft having 60mm diameter subjected to shear stress of 40 MPa and has an angle of twist equal to .01 radian. Take $G=80\text{GPa}$	

Q.3A	Suggest suitable process to produce a component undergo heavy load, mention all design consideration for suggested process?	05
Q.3B	One company ad shows that use their engine oil of grade 10W40, you feel zippy and people no more call you pushpendra; justify the statement of company ad through proper description of that numbers and letters.	05

Q.4A	What do you mean by law of gearing, derive the expression for law of gearing with suitable figure and correct notations.	05
Q.4B	Why and where the hydrodynamic theory (also known as petroff's law) is used, derive the expression of the petroff's law with proper notation and assumptions.	05

Q.5A	How stress concentration factor affect the ductile material and brittle material component, describe separately, also mention some methods to reduce stress concentration.	05
Q.5B	To design a gear drive an expression named Lewis bending equation with proper notations and assumptions.	05

Q.6A	An electric motor drives a machine through a pair of spur gears. The pinion is mounted on motor and shaft and overhangs by 200 mm from the nearest bearing. The pinion has 20 teeth of 10 mm module and 20 degree involute profile. Design the motor shaft to transmit 15 kW at 1200 rpm. Use safe shear stress value of 400 MPa, $K_m = 1.2$ and $K_t = 1$.	05
Q.6B	Calculate the diameter of a cantilever beam of 40C8 steel with $S_{ut} = 600$ MPa is subjected to a load varying from -50N to 150N. $K_a = 0.76$, $K_b = 0.85$, $K_c = 0.87$, $q = 0.9$, $K_t = 1.35$ and factor of safety = 1.5.	05



OR

Q.6B	Find the factor of safety of a machine component subjected to biaxial stress condition with σ_1 varying from -50MPa to 150MPa and σ_2 varies from 25MPa to 175MPa. Using maximum energy of distortion theory and take $S_{ut} = 600$ MPa, $S_e = 250$ MPa, $K_t = 1.85$.	05
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Q.7A	Calculate the diameter of a uniform bar having a machined surface is subjected to an axial load varying from 400kN to 150 kN. $S_{ut} = 630$ MPa, $K_c = 0.7$, $K_t = 1.42$ and factor of safety = 1.5.	05
Q.7B	A railway wagon weighting 3000 kg moving with a velocity of 4 m/s. it is brought to rest by two buffer springs of 200 mm diameter (mean coil diameter) undergoing a compression of 160 mm. the allowable shear stress in the spring is 600 MPa , $G = 84$ GPa,	05

OR

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Q.7B	Design the cantilever leaf spring to absorb 600N-m energy without exceeding a deflection of 150 mm and permissible stress of 800 MPa. The effective length of the spring with square and ground ends is 500 mm. $E = 200 \text{ GPa}$	05
Q.8A	A semielliptical laminated leaf spring with two full length leaves and ten graduated leaves are to be designed to support a central load of 6 kN over two points 1000 mm apart. The central band width is 100 mm. the ratio of total depth of the spring to its width is 2.5 mm. the design normal stress of the material of the leaves is 400 MPa and the modulus of elasticity is 208 GPa. Determine (i) Width and thickness of the leaves (ii) the initial gap between full length and graduated leaves (iii) the central bolt load	10
Q.9A	Find the diameter of a shaft (using modified Goodman diagram) to transmit twisting moments varying from 800Nm to 1600Nm. Use distortion energy theory as a theory of failure and take $S_{ut} = 600 \text{ MPa}$, $K_a = 0.8$, $K_b = 0.85$, $K_c = 0.897$, $K_t = 1.2$ and factor of safety = 2, $S_{yt} = 450 \text{ MPa}$.	10
Q.9B	A hollow shaft of diameter ratio 3/8 is required to transmit 600 kW at 110 rpm, the maximum torque being 20% greater than mean. The torsional shearing stress is not to exceed 62 MN/mm^2 and twist in length of 3 meters is not to exceed 1.4 degrees. Determine the diameter of the shaft. Assume $G = 84 \text{ GPa}$.	10
OR		
Q.9B	A shaft carries a 1000N pulley in the center of the two ball bearings which are 2000 mm apart. The pulley is keyed to the shaft and receives 30 kW of the power at 150 rpm. The power is transmit from the shaft through a flexible coupling just outside the right bearing. The belt drive is horizontal and the sum of the belt tension is 8000 N. calculate the diameter of the shaft if permissible stress in bending is 80 MPa and in the shear it is 45 MPa.	10