

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Nov.-Dec. 2015

B. Tech in Mechanical Engineering, Semester V

Roll No.....

ME 504: Design of Machine Elements - I

Time: 3 hours

Max. Marks: 100

Instructions to students:

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

Q.1	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	For a circular shaft of dia. D subjected to torque T, the maximum value of the shear stress is ; (a) $64 T/\pi d^3$ (b) $32 T/\pi d^3$ (c) $16 T/\pi d^3$ (d) $8 T/\pi d^3$	
ii.	Factor of safety is defined as the ratio of (a) Ultimate stress to Working stress (b) Working stress to Ultimate stress (c) Breaking stress to Ultimate stress (d) Ultimate stress to breaking stress	
iii.	Failure of a material is called fatigue when it fails (a) At the elastic limit (b) Below the elastic limit (c) At the yield point (d) Below the yield point	
iv	The washer is generally specified by its (a) Outer diameter (b) Hole diameter (c) Thickness (d) Mean diameter	
v	The shearing area of a key of length 'L', breadth 'b' and depth 'h' is equal to (a) $b \times h$ (b) $L \times h$ (c) $L \times b$ (d) $L \times (h/2)$	
vi	In a fillet welded joint, the weakest area of the weld is (a) Toe (b) root (c) throat (d) face	
vii	Which one of the following is not a friction clutch? [IES-2003] (a) Disc or plate clutch (b) Cone clutch (c) Centrifugal clutch (d) Jaw clutch	
viii	Which one of the following belts should not be used above 40°C ? (a) Balata belt (b) Rubber belt (c) Fabric belt (d) Synthetic belt	
ix	Manufacturing aspects in design mean: (a) Economy of manufacture (b) Lightness in weight (c) Standardization (d) Manufacturing facility	
x	Self- locking is not possible in the case of (a) Simple band brake (b) Differential band brake (c) Simple block brake (d) Internal expanding shoe brake	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
(i)	A 60 mm long and 6 mm thick fillet weld carries a steady load of 15 kN along the weld. The shear strength of the weld material is equal to 200 MPa. The factor of safety is	
(ii)	Why key is made weakest in the assembly of pulley, key and shaft?	
(iii)	Why, In designing a plate clutch, assumption of uniform wear conditions is made?	
(iv)	Show by neat sketches the various modes of failure of riveted joints.	

Q.3A	List the factors required to be taken into account for the selection of materials.	05
Q.3B	What do you mean by engineering design? Explain with a suitable example.	05
Q.4A	(i) What are the different types of brakes? Explain (ii) What is meant by a self energizing brake? How does it tend to be self locking and how should this be avoided?	05
Q.4B	Two plates of 6 mm thickness are to be joined by a double riveted zig zag lap joint. Design the joint, if the allowable strength of mild steel are $f_t = 100 \text{ N/mm}^2$, $\tau = 70 \text{ N/mm}^2$, and $f_{cr} = 130 \text{ N/mm}^2$	05
Q.5A	The torque developed by an engine is given by the following equation: $T = 14250 + 2200 \sin 2\theta - 1800 \cos 2\theta$ Where T is the torque in N-m and θ is the crank angle from the inner dead centre position. The resisting torque of the machine is constant throughout the work cycle. The COS is 0.01. The engine speed is 150 rpm. A solid circular steel disk, 50 mm thick is used as flywheel. The mass density of steel is 7800 Kg/m^3 . Calculate the radius of the flywheel disk.	15
Q.5B	Design a cast iron protected type flange coupling to connect two shafts of 36 mm diameter transmitting 15 kW at 720 rpm. The overload capacity is 1.25 times the average torque. The bolts and keys are made of C20 steel and the flanges are made of FG 200.	15
OR		
Q.5B	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. Engine is transmitting 3 MW at 100 rpm. The allowable shear stress in bolts (8) and shaft may be taken as 60 MPa. Pitch circle diameter of bolts is 1.6 times dia of shaft. Find: 1. Dia of shaft; 2. Dia of bolts; 3. Thickness of flange; 4. Dia of flange	15
Q.6A	Design a belt drive to transmit 110 kW for a system consisting of two pulleys of diameters 0.9 m and 1.2 m, centre distance of 3.6 m, a belt speed 20 m/s, $\mu = 0.3$, a slip of 1.2% at each pulley and 5% friction loss at each shaft, 20 % overload.	15
Q.6B	A single plate friction clutch has 300 mm outside diameter and 130 mm outside diameter for the frictional contact surfaces. Find the torque considering uniform pressure as well as uniform wear theory. Take $\mu = 0.2$, maximum allowable pressure is 0.7 MPa.	15
OR		
Q.6B	A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 kW at 1250 rpm. The outer diameter of the contact surfaces is to be 300 mm. The coefficient of friction is 0.4. (a) Assuming a uniform pressure of 0.17 N/mm^2 , determine the inner diameter of the friction surfaces. (b) Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of pressure when uniform wear condition reached.	15