

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

EndTerm Examination (Regular/Backlog), April-May2015

B. Tech in Mechanical Engineering, Semester VI



Roll No.....

ME 604 : Design of Machine Elements - II

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	(10 questions @ 1 mark)	10
i.	When bevel gears connect two shafts whose axes intersect at an angle greater than a right angle and one of the bevel gears has a pitch angle of 90° , then they are known as: (i) angular bevel gears (ii) crown bevel gears (iii) internal bevel gears (iv) mitre gears	
ii.	Soderberg relation is based on..... of the material whereas all the other failure relations for dynamic loading are based upon.....	
iii.	In a hydrodynamic lubricated bearing (i) there is a thick film of lubricant between the journal and the bearing (ii) there is a thin film of lubricant between the journal and the bearing (iii) there is no lubricant between the journal and the bearing (iv) lubricant is forced between the journal and the bearing by external pressure	
iv.	The ball bearings are provided with a cage (i) to reduce friction (ii) to maintain the balls at a fixed distance apart (iii) to prevent the lubricant from flowing out (iv) to facilitate slipping of balls	
v.	Which of the following statement is incorrect for gears? (i) The addendum is less than dedendum (ii) Pitch circle diameter is equal to the product of module and number of teeth (iii) The pitch circle is always greater than or equal to the base circle (iv) none of the above	
vi.	What is reliability factor in general?	
vii.	stress concentration occurs at the contact between (i) teeth of meshing gears (ii) cam and follower (iii) ball and races in ball bearing (iv) all above	
viii.	When a body is suddenly loaded the strain energy stored in it is the strain energy stored when the load is applied gradually on the body. (i) equal to (ii) twice (iii) thrice (iv) four times	
ix.	Surface endurance limit of gear material is dependent upon its (i) elastic strength (ii) yield strength (iii) BHN (iv) toughness	
x.	In helical gears, the distance between similar faces of adjacent teeth along a helix on the pitch cylinders normal to teeth is called as (i) Diametral pitch (ii) Axial pitch (iii) Normal pitch (iv) none	



Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	Explain low cycle fatigue.	
ii.	Give any three advantages of needle roller bearing over ball bearing.	
iii.	Why is pinion weaker than the gear made of same material?	
iv.	State two important reasons for adopting <i>involute</i> curve for gear tooth profile.	
Q.3A	A pinion with 25 teeth rotating at 1200 rpm drives a gear which rotates at 200 rpm. The module is 4 mm. calculate centre distance between gears.	05
Q.3B	Differentiate between crown and miter gears. Under which category of gears they lay. Draw neat figures and give their characteristics.	05
Q.4A	What is stress concentration? What are its causes? How it can be reduced?	05
Q.4B	Explain the lubrication in sliding contact bearings in detail.	05
Q.5	Define dynamic load carrying capacity, static load carrying capacity, bearing life rating.	5
Q.6A	A taper roller bearing has a dynamics load capacity of 26 kN. The desired life for 90% of bearings is 8000 hrs and the speed is 300rpm. Calculate the equivalent radial load that the bearing can carry.	05
Q.6B	Write three elementary equations for the design of machine elements. Explain endurance limit. What is the difference between UTS and endurance strength?	05
Q.7	A railway wagon moving at a velocity of 1.5m/s is brought to rest by a bumper consisting of two helical springs arranged in parallel. The mass of the wagon is 1500 kg. The springs are compressed by 150mm in bringing the wagon to rest. The spring index can be taken as 6. The springs are made of oil hardened and tempered steel wire with UTS = 1250 N/mm ² and modulus of rigidity = 81370 N/mm ² . The permissible shear stress for the spring wire can be taken as 50% of UTS. Design the spring and calculate: (i) wire dia (ii) mean coil dia (iii) no. of active coils (iv) total no. of coils (v) solid length (vi) free length (vii) pitch of coil (viii) required spring rate (ix) actual spring rate	15
OR		
Q.7	The cylinder of a 4-S diesel engine has specifications: BP=7.5 kW, speed = 1400rpm, $P_{mep} = 0.35$ MPa, $\eta_m = 0.8$, max. gas pressure = 3.5 MPa. the cylinder liner and head are made of grey cast iron (UTS = 260 N/mm ² , $\mu = 0.25$). the studs are made of steel 40C8 ($S_{yt} = 380$ N/mm ²). FoS = 6. Calculate: (i) bore and length of cylinder liner (ii) thickness of cylinder liner (iii) thickness of cylinder head (iv) size, number and pitch of studs	15
Q.8A	On the basis of your knowledge of mechanical engineering, design a compressed air engine to produce BP = 1kW. The pressure of incoming air is 40 atm. Do necessary calculations for the parts you think are important for power generation only. Draw the design and explain the working of your unique engine.	10

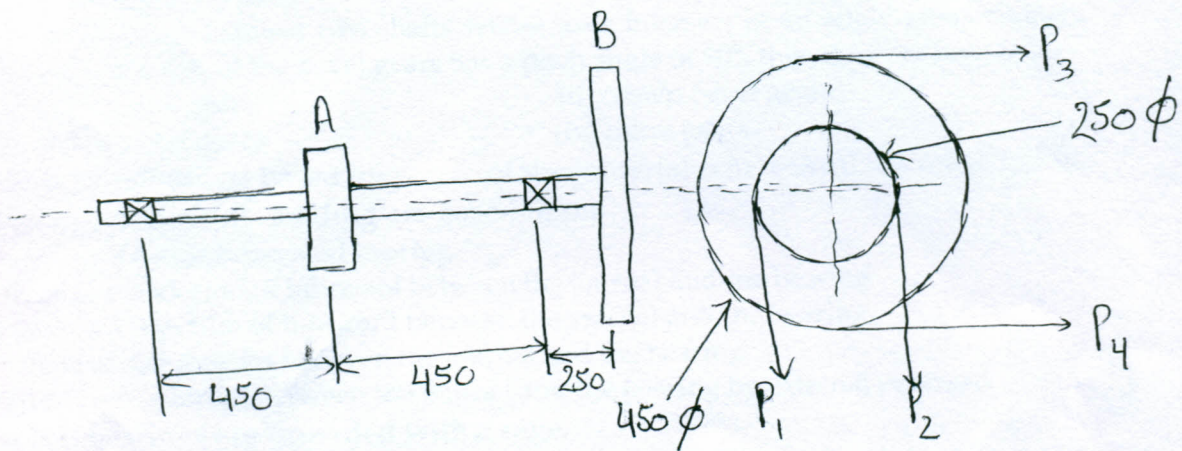
Q.9A A line shaft supporting two pulleys A & B as shown in fig. 1. Power is supplied to the shaft by means of a vertical belt on the pulley A, which is then transmitted to the pulley B carrying a horizontal belt. The ratio of belt tension on tight and loose sides is 3:1. The limiting value of tension in the belts is 2.7 kN. The shaft is made of plain carbon steel ($S_{ut} = 650 \text{ N/mm}^2$, $S_{yt} = 380 \text{ N/mm}^2$). The pulleys are keyed to the shaft. Determine the diameter of the shaft when factors for bending and torsion are 1.5 and 1.0 respectively. Draw the SFD and BMD also. 10

Q.9B Draw the gear tooth profile of an involute gear. Clearly mentioning the gear terminology through the profile. Draw neatly. 10

OR

Q.9B A footstep bearing supports a shaft of 150 mm diameter which is counter-bored at the end with a hole diameter of 50 mm. If the bearing pressure is limited to 0.8 N/mm² and the speed is 100 r.p.m.; find : 10

1. The load to be supported;
2. The power lost in friction; and
3. The heat generated at the bearing. (Assume coefficient of friction = 0.015)



all dimensions are in mm.

fig. 1

