Registration No : | | | | | | | | | | |

Total Number of Pages : 03 **B.Tech.**

PCME4306

6th Semester Back Examination 2017-18

DESIGN OF MACHINE COMPONENTS

BRANCH : MECH

Time : 3 Hours

Max Marks : 70

Q.CODE : C144

Answer Question No.1 which is compulsory and any FOUR from the rest. The figures in the right hand margin indicate marks. Use of Prescribed Design Data Book is permitted inside the examination hall. Draw neat sketches wherever necessary. Assume any missing data suitably.

Q1. **Answer the following questions(Compulsory) :** **(2 x 10)**

a) Draw S~N (fatigue) Curves for ferrous components and show the salient points of the curve.

b) State the maximum shear stress theory and maximum distortion energy theory?

c) What is the difference between Gerber curve and Soderberg lines?

d) Explain with neat sketch the working principle of centrifugal clutch.

e) Why in case of thin cylinder subjected to internal pressure, the tangential stress is the criteria for determine the thickness of the cylinder wall?

f) What is the functional difference between a brake and a clutch?

g) Why one end of the connecting rod is bigger than the other end? What is meant by whipping of a connecting rod and what is its effect?

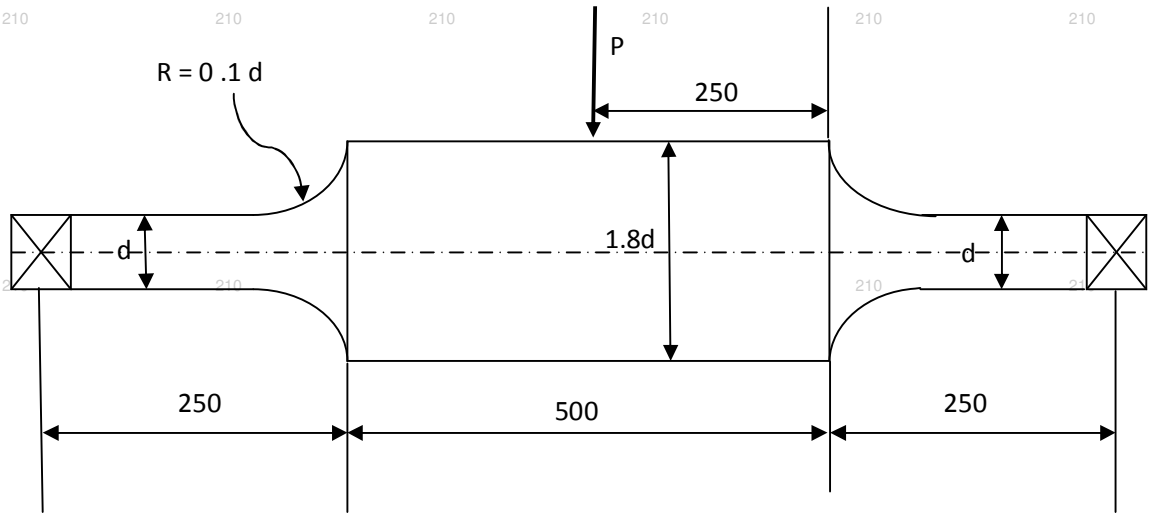
h) What do you mean by virtual or formative bevel gear?

i) Why Cast Iron is preferred as the gear material?

j) Why ball and roller bearings are called antifriction bearings?

Q2. **a)** What do you mean by stress concentration factor? Explain the mechanism of fatigue failure. **(2.5)**

b) **(10)**



The above figur shows a shaft with load varying from 6 kN to 20 kN. Determine the dimensions of the shaft if it made of steel having ultimate strength = 830 N/mm^2 and Yeild strength = 620 N/mm^2. The shaft is machine finished. Consider factor of safty = 1.5, surface finish factor = 0.8, size factor = 0.75 , reliability factor = 1.0, temperature factor =1.0 , notch sensitivity factor = 0.7. All dimensions are in mm.

Q3. **a)** Sketch the different types of ends used for pressure vessels and state their applications. **(2.5)**

b) A closed pressure vessel consists of a cylindrical shell enclosed by hemispherical ends. The pressure vessel is required to contain air at a pressure of 4 MPa. The shell is 450 mm inside diameter. The vessel joint is a double welded butt joint with joint effiency 85%. The vessel is made of plain carbon steel having allowable strength 100 N/mm^2. The shape factor is 1.07. Design the pressure vessel. **(10)**

Q4. **a)** What do you understand by uniform pressure theory and uniform wear theory with respect to design of a friction clutch? Which theory is most suitable for design of clutch plate? **(2.5)**

b) Design a suitable clutch for the speed gear box of a lathe machine to transmit 15 kW at 1500 rpm. Due to space limitation, the outer diameter is limited to 125 mm. Consider the clutch to be designed is axial friction clutch with woven asbestos friction lining having co-efficient of friction as 0.25. The maximum operating temperature is limited to 250^0. Take overload as 25%. Maximum pressure at inner radius is 0.35 N/mm^2. Allowable bearing pressure is within the range of 0.3 to 0.7 N/mm^2. The ratio of inner diameter to outer diameter is 0.65. **(10)**

Q5. **a)** Explain by drawing the sketch the different terms used in case of journal bearings such as journal, clearance, eccentricity, attitude angle. **(2.5)**

b) A shaft rotating at 1250 rpm is supported by two single-row deep-groove ball bearings. The forces acting on ball bearing are 6500 N radial load and 3500 N axial thrust. The shaft diameter is 40 mm and expected life of the bearings is 550 hour. Select suitable bearings. **(10)**

Q6. **a)** Why the tangential component of gear tooth force is called 'useful' component in design of gear? What are the advantages of helical gears over spur gears? **(2.5)**

b) Design a pair of helical gears to transmit 25 kW power at a speed reduction ratio of 4:1. The input shaft rotates at 1250 rpm. Take helix and normal pressure angles equal to 25^0 and 20^0 respectively. Both pinion and gear are made of steel having following data. The number of teeth on the pinion may be taken as 30. **(10)**

Name of the part	Permissible stress	BHN
Pinion	50 MPa	350
Gear	40 MPa	310

Young's modulus for shaft, gear and pinion is 0.2 X 10^6 N/mm^2. The gears are required to be designed against bending failure of the teeth under dynamic condition. The wear and lubrication factor is 1.25 and velocity factor is 0.46. Face width is 15 times normal module. Profile error is 0.015.

Q7. **a)** What is the effect of piston crown thickness and diameter on heat flow? And how the wear of the piston rings prevented? **(2.5)**

b) Design a connecting rod for a carburetor engine from the following data: **(10)**
Diameter of piston is 100 mm, weight of the reciprocating part is 1.75 kg, length of the connecting rod is 315 mm, stroke is 140 mm, speed is 2500 rpm, compression ratio is 4:1 and maximum explosion pressure is 2.25 MPa. Material for the connecting rod is 37Mn2 with yield strength 450 N/mm^2. Allowable bearing pressure is $12N/mm^2$. Material for the bolt is 35Ni1Cr60 having allowable tensile strength 120 N/mm^2. Gasket factor is 0.2.

Q8. **a)** What do you mean by self-energizing and self-locking brake? **(2.5)**

b) What do you mean by basic static load capacity, basic dynamic load capacity and life of bearing? **(3)**

c) Describe the steps, which you will be considering for design for crank pin? **(3)**

d) Describe the type of stress produced in i) flywheel rim and ii) flywheel arms. **(4)**