



B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Fifth Semester

AUTOMOBILE ENGINEERING

AUE107: Machine Components Design

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Series factor for R20 series is,
 - a) $\sqrt[10]{20}$
 - b) $\sqrt{20}$
 - c) $\sqrt[20]{10}$
 - d) $\sqrt[3]{20}$
2. Hooke's law holds good up to
 - a) yield point
 - b) elastic limit
 - c) plastic limit
 - d) breaking point
3. The maximum shear stress theory is used for
 - a) brittle materials
 - b) ductile materials
 - c) plastic materials
 - d) non-ferrous materials
4. The type of spring used in door hinges is,
 - a) Helical compression spring
 - b) Muti leaf spring
 - c) Spiral spring
 - d) Helical torsion spring
5. The face angle of a bevel gear is equal to
 - a) Pitch angle + addendum angle
 - b) Pitch angle - addendum angle
 - c) Pitch angle + dedendum angle
 - d) Pitch angle - dedendum angle
6. The range of helix angle for a single helical is,
 - a) 15^0 to 25^0
 - b) 20^0 to 45^0
 - c) 10^0 to 15^0
 - d) 5^0 to 15^0
7. The maximum fluctuation of speed of flywheel is,
 - a) Difference between maximum and minimum speeds during the cycle
 - b) Difference between maximum and mean speeds during the cycle
 - c) Difference between mean and minimum speeds during the cycle
 - d) Mean of maximum and minimum speeds during the cycle

8. The spokes of the flywheel are subjected to,
- a) Direct shear stress
 - b) Torsional shear stress
 - c) Tensile stress
 - d) Compressive stress
9. The last two digits of the bearing designation give the bore diameter of rolling contact bearing when multiplied by,
- a) 10
 - b) 5
 - c) 20
 - d) 50
10. In case of full journal bearing, the angle of contact of the bushing with the journal is
- a) 60°
 - b) 90°
 - c) 270°
 - d) 360°

PART B (10 x 2 = 20 Marks)

- 11. Define endurance limit.
- 12. What are the different types of loads that can act on machine components?
- 13. Mention some applications of Springs.
- 14. A shaft running at 400 r.p.m. transmits 10 kW. Assuming allowable shear stress in shaft as 40 MPa, find the diameter of the shaft.
- 15. How do gears fail?
- 16. What is specific feature of meter gears?
- 17. Define 'coefficient of fluctuation of energy'.
- 18. What is the procedure for determining the cross-sectional dimensions of flywheel arms?
- 19. Specify the materials by which the rolling contact bearing are made?
- 20. Find the bearing pressure of the journal bearing for the following data:
Load on the journal = 12 kN, Length of the Journal = 150mm, Diameter of the journal = 80mm.

PART C (5 x 14 = 70 Marks)

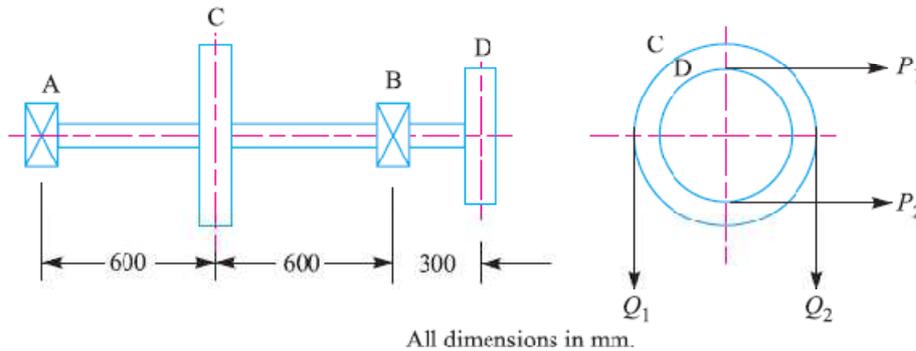
21. a) Explain the basic procedure of Machine design process.

(OR)

- b) Write short notes on the following:

- (i) Endurance limit (6)
- (ii) Notch sensitivity and (4)
- (iii) Soderberg line (4)

22. a) A horizontal shaft AD supported in bearings at A and B and carrying pulleys at C and D is to transmit 75 kW at 500 r.p.m. from drive pulley D to off-take pulley C , as shown in Fig.



Calculate the diameter of shaft. The data given is: $P_1 = 2 P_2$ (both horizontal), $Q_1 = 2 Q_2$ (both vertical), radius of pulley $C = 220$ mm, radius of pulley $D = 160$ mm, allowable shear stress = 45 MPa.

(OR)

- b) A rail carriage weighing 200kN and running at 5km/hour is brought to rest by four buffer springs of close coiled helical type during connection with another carriage which is already at rest.

The mean coil diameter is 5 times the wire diameter. The deflection of each spring is 220mm, to bring the carriage to rest. Safe shear stress for the spring material is 400 N/mm^2 . Calculate the maximum load on the spring, diameter of wire and coil, number of turns and free length of spring, Assume the ends of spring are squared and ground. Modulus of rigidity is $8 \times 10^4 \text{ N/mm}^2$.

23. a) A pair of C.I spur gear is to be designed to transmit 15 kW. Pinion has 24 teeth runs at 250 rpm. Velocity ratio is 2.8:1

(OR)

- b) Design a worm gear reducer to transmit 10hp. From the input shaft running at 1800 rpm, to the output shaft which is to run at 100 rpm. Calculate the efficiency of the drive.

24. a) Design and draw a cast iron flywheel used for a four stroke I.C engine developing 180 kW at 240 r.p.m. The hoop or centrifugal stress developed in the flywheel is 5.2 MPa, the total fluctuation of speed is to be limited to 3% of the mean speed. The work done during the power stroke is $\frac{1}{3}$ more than the average work done during the whole cycle. The maximum torque on the shaft is twice the mean torque. The density of cast iron is 7220 kg/m³.

(OR)

- b) The turning moment diagram for an engine is drawn to the following scales: 1 mm = 3100 N-m ; 1 mm = 1.6°
The areas of the loops above and below the mean torque line taken in order are: 77, 219, 588, 522, 97,116, 1200 and 1105 mm².
The mean speed of the engine is 300 r.p.m. and the permissible fluctuation in speed is ± 2 per cent of mean speed.
The stress in the material of the rim is not to exceed 4.9 MPa and density of its material 7200 kg/m³. Assuming that the rim stores $\frac{15}{16}$ of the energy that is stored by the flywheel, estimate (a) Diameter of rim; and (b) Area of cross-section of rim.

25. a) Design a hydrodynamic full journal bearing of 200mm x 200mm to support 20 kN. Calculate the operating parameters and check for necessity for cooling, speed of journal is 1500 rpm.

(OR)

- b) A 6207 radial bearing is to operate in the following work cycle.
Radial load of 4500 N at 150 rpm for 30% of time
Radial load of 6750 N at 600 rpm for 10% of time
Radial load of 2250 N at 300 rpm for 60% of time
The inner-ring rotates; loads are steady, what is the expected average life of the bearing.
