Register Number: ……..

B.E DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Fifth Semester

AUTOMOBILE ENGINEERING

AUE107:Machine Components Design

(Usage of PSG Data book permitted)

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The external appearance is important in
   a) Industrial product b) Consumer durables
   c) Machine elements d) All the above
2. Material used for machine tool beds
   a) Cast iron b) Mild steel
   c) High carbon steel d) Alloy steel
3. The type of spring used in vehicle clutches is,
   a) Helical compression spring b) Helical torsion spring
   c) Leaf spring d) All the above
4. Which of the following loading is considered for the design of axles?
   a) Bending moment only b) Twisting moment only
   c) Combined bending moment and torsion d) Combined action of bending moment, twisting moment and axial thrust
5. When the axes of two shafts are perpendicular and intersecting use
   a) Spur gears b) Bevel gears
   c) Worm gears d) Helical gears
6. A worm gear drive consists of double start worm meshing with a 50 teeth worm wheel. The velocity ratio is
   a) 25 b) 100
   c) 50 d) 75
7. The cross-section of the flywheel arms is usually
   a) rectangular b) *I*-section
   c) L-section d) elliptical
8. The diameter of the hub of the flywheel is usually taken
   a) equal to the diameter of the shaft b) twice the diameter of the shaft
   c) three times the diameter of the shaft d) four times the diameter of the shaft
9. Sommerfeld number is
   a) Similar bearing characteristic number b) Similar to Reynold's number
   c) Dimensionless parameter that contains all the design parameters d) Used to find out dynamic load carrying capacity
10. The rolling contact bearings are known as
    a) thick lubricated bearings b) plastic bearings
    c) thin lubricated bearings d) antifriction bearings

PART B (10 x 2 = 20 Marks)

11. What are the basic requirements of a machine element?
12. Find out the numbers of R10 basic series from 1 to 10.
13. What type of stress is induced in helical compression spring?
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. Mention the some applications of gear drive.
16. What are the merits and demerits of worm –gear drive?
17. What are the various types of stresses induced in a flywheel rim?
18. Draw the turning moment diagram for a four stroke internal combustion engine.
19. Distinguish between full Journal bearing and partial Journal bearing
20. Define the following.(a) Eccentricity of journal bearing (b) minimum film thickness.

PART C (5 x 14 = 70 Marks)

21. a) Explain the general steps of the Design of Machine Elements.

(OR)

b) (i) Explain the modified Goodman diagram for bending stress. (7)

(ii) Explain the following (7)

(a) Gerber theory

(b) Fatigue failure

22. a) A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the

left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and μ = 0.24. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley.

(OR)

b) An automotive single plate clutch, with two pairs of friction surfaces, transmits 300 N-m torque at 1500 rpm. The inner and outer diameters of the friction disc are 170 and 270 mm respectively. The coefficient of friction is 0.35. The normal force on the friction surfaces is exerted by nine helical springs, so that the clutch is always engaged. The clutch is disengaged when the external force further compresses the springs. The spring index is 5 and the number of active coil is 6. The springs are made of patented cold drawn steel wires of Grade 2. (G= 81370 N/mm^2). The permissible shear stress for the spring wire is 30% of the ultimate tensile strength. Design the springs and specify their dimensions.

23. a) Design a pair of spur gears to transmit 20 kW at a pinion speed of 1400 rpm. The transmission ratio is 4 .Assume suitable materials and stresses.

(OR)

b) Two straight bevel gears are used in a speed reducer with a transmission ratio of 2. The wheel is supported on both sides and the pinion is over hanging. The input is from a 25kW electric motor running at 950 rpm. Design the bevel gears.

24. a) The areas of the turning moment diagram for one revolution of a multi-cylinder engine with reference to the mean turning moment, below and above the line, are

– 32, + 408, – 267, + 333, – 310, + 226, – 374, + 260 and – 244 mm^2.

The scale for abscissa and ordinate are: 1 mm = 2.4° and 1 mm = 650 N-m respectively. The mean speed is 300 r.p.m. with a percentage speed fluctuation of ± 1.5%. If the hoop stress in the material of the rim is not to exceed 5.6 MPa, determine the suitable diameter and cross-section for the flywheel, assuming that the width is equal to 4 times the thickness. The density of the material may be taken as 7200 kg / m3. Neglect the effect of the boss and arms.

(OR)

b) 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 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/m^3.

25. a) The load on a 100mm full hydro-dynamic journal bearing is 9000 N. speed of the journal is 320 rpm.

Let l /d =1, c/d= 0.0011. The operating temperature =65^{0}C and minimum oil film thickness =0.022 mm. Select an oil that will closely accord with the stated conditions.

Determine the following,

(a) The friction loss
(b) The hydro dynamic oil flow through the bearing
(c) The amount of leakage
(d) The temperature rice of oil passes through the bearing and
(e) Maximum oil pressure.

(OR)

b) Select a suitable deep groove ball bearing for supporting a radial load of 10kN and an axial load of 3 kN for a life of 4000 hours at 800 rpm. Select from series 63. Calculate the expected life of the selected bearing.

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