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10ME52

Fifth Semester B.E. Degree Examination, December 2012
Design of Machine Elements - I

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast TWO question from each part.***
2. ***Use of design data handbook permitted.***
3. ***Assume missing data if any.***

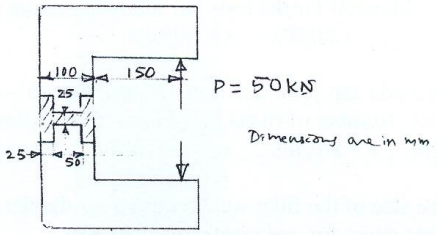
PART - A

1 a. What is mechanical engineering design? Explain. **(03 Marks)**

b. Explain the importance of standards in design. Give examples. **(03 Marks)**

c. Determine the extreme fibre stresses at the critical section of a machine member loaded as shown in fig. Q1(c). Also show the distribution of stresses at this section. **(14 Marks)**

Fig.Q1(c)



2 a. State and explain the following theories of failure :
i) Maximum principal stress theory ii) Maximum shear stress theory. **(05 Marks)**

b. A round rod of diameter 60mm is subjected to an axial tensile load of 10kN and a twisting moment of 3kN-m. The rod is made of steel C30. Factor of safety is 3. Determine whether the design is safe according to : i) Max. Principal stress theory of failure and ii) Max. shear stress theory of failure. **(10 Marks)**

c. A machine member can be considered as a simply supported beam of 1m length. Cross – section of the beam is 60mm × 60mm square. Determine the instantaneous maximum deflection and bending stress if a mass of 15kg falls from a height of 250mm at the mid point of the beam made of steel. **(05 Marks)**

3 a. Explain briefly the following : i) High cycle and low cycle fatigue ii) Stress concentration and its effects. **(04 Marks)**

b. A pulley is keyed to a shaft midway between two bearings. The shaft is made of steel (σ_y = 3890MPa). Bending moment at the pulley varies from -300 N-m to + 500 N – m and the torque varies from -100 N-m to + 200 N-m. The fatigue stress concentration factors for the key way in bending and torsion are 1.6 and 1.3 respectively. The factor of safety is 1.5. Determine the diameter of the shaft. **(16 Marks)**

4 a. Obtain an expression for total load on a bolt in a bolted joint with gasket. **(08 Marks)**

b. A cylinder head is fastened to the cylinder of a compressor using 6 bolts of M20 size. Bolt material is C20 steel. The maximum fluid pressure is 3.5MPa, cylinder diameter is 75mm. A soft gasket is used. Assuming the initial tension required in each bolt is 40kN, determine the factor of safety. **(12 Marks)**

PART - B

5 a. Briefly explain advantages of hollow shafts over solid shafts. **(03 Marks)**

b. A power transmission shaft 1300 mm long is supported in bearings at its extreme ends A & B. A power of 30kW is received at 500rpm through a gear drive located at 400mm to the right of the left extreme end of the shaft. The gear mounted on the shaft has a pitch diameter of 300mm and weights 800N. This gear receives power from a gear located exactly behind. The power is delivered through a belt drive located 500mm to the left of the right bearing. The pulley mounted on the shaft has a diameter of 400mm and weighs 1kN. The belt is directed towards the observer below the horizontal and inclined at 45^0. Ratio of belt tensions is 3. Material of the shaft is C40 steel. Assuming a factor of safety of 2.5 and loading to be with minor shocks, determine the diameter of the solid shaft. **(17 Marks)**

6 a. A mild steel shaft has to transmit 40kW power at 600rpm. The maximum torque to be transmitted is 30% greater than the average torque. Design a rigid flanged coupling for this application. **(10 Marks)**

b. Design a Knuckle joint to connect two mild steel rods. The joint has to transmit a tensile load of 80kN. Material for the rods has following allow the stresses :
$\sigma_t = 80MPa$, $\sigma_{cn} = 120MPa$, $\tau = 40MPa$. **(10 Marks)**

7 a. Design a diamond lap joint for a mild steel flat tie – bar 200mm × 10mm using 21mm diameter rivets. Number of rivets in the joint are g. Allowable stresses are :
$\sigma_t = 120MPa$, $\tau = 80MPa$, $\sigma_{cr} = 210MPa$. Assume hole diameter is equal to the rivet diameter. **(10 Marks)**

b. Determine the size of the fillet weld required for the flat plate loaded as shown in fig. Q7(b). Take allowable stress for weld material as 60MPa. **(10 Marks)**

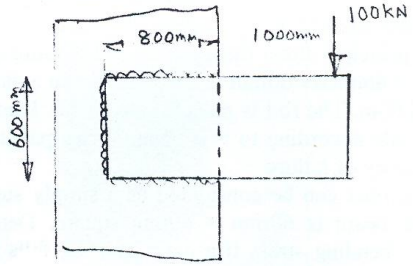


Fig.Q7(b)

8 a. Obtain an expression for torque required for raising the load in the case of a power screw. **(05 Marks)**

b. Design a screw jack to lift a load of 30kN with the following data : Allowable compressive stress in screw material is 160MPa, Coefficient of friction in threads = 0.14, Coefficient of collar friction = 0.2 , Height of lift = 150mm. **(15 Marks)**

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10ME53

Fifth Semester B.E. Degree Examination, December 2012
Energy Engineering

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Differentiate Stokes firing and pulverized fuel burning of coal. **(06 Marks)**

b. Sketch and explain bowl pulverizing mill. **(07 Marks)**

c. Explain pneumatic ash handling system with a neat sketch. **(07 Marks)**

2 a. Define draught and explain the operation of induced draught system with a neat sketch. **(08 Marks)**

b. Define cooling tower and explain the principle of operation of hyperbolic cooling tower, with a neat sketch. **(08 Marks)**

c. Explain any two boiler accessories used in steam generators. **(04 Marks)**

3 a. Draw the general layout of diesel power plant. **(04 Marks)**

b. Describe the different methods of starting the diesel engine. **(06 Marks)**

c. Explain the necessity of cooling and lubrication of diesel engine. Sketch and explain splash lubrication system. **(10 Marks)**

4 a. Classify hydro-electric power plant. **(04 Marks)**

b. Differentiate between:
   i) Pondage and storage type of hydel power plant.
   ii) Forebay and surge tank. **(06 Marks)**

c. The mean weekly discharge at a hydel power plant site is given below: flow is given in millions of cubic metre per week.

Week	1	2	3	4	5	6	7	8	9	10	11	12
Flow	160	200	300	1100	700	900	700	600	1000	600	400	300

   i) Draw the hydrograph and find the average flow available for the whole period.
   ii) Develop the flow duration curve and plot it.
   iii) Determine the power that can be produced for the mean flow of water if the available head is 100m and overall efficiency of generation is 82%. **(10 Marks)**

PART – B

5 a. Explain nuclear reactor with a neat sketch. **(07 Marks)**

b. Explain pressurized water reactor with a neat sketch. **(07 Marks)**

c. Write note on :
   i) Radiation hazards.
   ii) Radio active waste disposal. **(06 Marks)**

6 a. Explain the methods of harnessing solar energy. **(06 Marks)**

b. Explain how wind energy can be harnessed using horizontal axis wind mill. **(06 Marks)**

c. Wind speed at a location V_i = 30 miles/hr (13.42 m/s) the speed at turbine rotor is 60% of this value and the speed at exit is 30% of V_i. The rotor diameter is 9m, density $\rho = 1.293$ kg/m^3. Calculate:

i) The power available in the wind at the turbine rotor

ii) The power in wind at outlet

iii) The power developed by the turbine

iv) The coefficient of performance. **(08 Marks)**

7 a. Explain the method of harnessing tidal energy. **(06 Marks)**

b. Explain OTEC plant with a neat sketch. **(07 Marks)**

c. With a neat sketch, explain the working of hot dry rock geothermal plant. **(07 Marks)**

8 a. Write short notes on:

i) Photosynthesis

ii) Energy plantation. **(06 Marks)**

b. Classify gasifiers and explain the factors affecting bio-gas generation. **(06 Marks)**

c. Explain bio-gas plant with a neat sketch. **(08 Marks)**

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10ME54

Fifth Semester B.E. Degree Examination, December 2012
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain principle of virtual work application to italic force analysis. **(08 Marks)**

b. Explain the procedure for static force analysis of slider-crank mechanism. **(12 Marks)**

2 a. Discuss the following terms:
i) Co-efficient of fluctuation of energy.
ii) Co-efficient of fluctuation of speed. **(04 Marks)**

b. The turning moment diagram for four stroke gas engine may be assumed for a simplicity to be represented by four triangles. The areas of which from the line of zero pressure are as follows: suction stroke = 0.45×10^{-3} m^2, compression stroke = 1.7×10^{-3} m^2, expansion stroke = 6.8×10^{-3} m^2, exhaust stroke = 0.65×10^{-3} m^2 each m^2 of area represents 3 MN-m of energy.
Assuming the resisting torque to be uniform find the mass of the rim of a flywheel required to keep the speed between 202 and 198 rpm. The mean radius of the rim is 1.2m. **(16 Marks)**

3 a. Derive an expression for the ratio of tensions in a flat belt drive. **(05 Marks)**

b. A leather belt required to transmit 7.5 kW from a pulley 1.2m in diameter running at 250 rpm. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa density of leather 1000 kg/m^3 and thickness of belt 10mm determine the width of the belt taking centrifugal tension into account. **(15 Marks)**

4 A shaft carries four masses A, B, C, and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radii 80mm, 70mm, 60mm and 80mm in planes measured from A at 300mm, 400mm and 700 mm. The angle between the crank measured anticlockwise are A to B 45°, B to C 70° and C to D 120° the balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100mm between X and Y is 400mm and between Y and D is 200mm. If the balancing manes revolved at a radius of 100mm find their magnitudes and angular position. **(20 Marks)**

PART – B

5 The cranks and connecting roads of a 4-cylinder in – line engine running at 1800 rpm are 60mm and 240mm each respectively and the cylinder are spaced 150mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine :
i) Unbalanced primary and secondary force.
ii) Unbalanced primary and secondary couples with reference to central plane of the engine. **(20 Marks)**

6 a. Define the following with respect to the working of governor:
   i) Sensitiveness.
   ii) Hunting of governor. **(04 Marks)**

   b. In an engine governor of the porter type the upper and lower arms are 200mm and 250mm respectively and pivoted on the axis of rotation. The mass of the central load is 15kg the mass of each ball is 2kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 24N at the sleeve. The limiting inclination of the upper arms to the vertical are 30° and 40° find taking friction into account range of speed of the governor. **(16 Marks)**

7 a. Derive an expression for the gyroscopic couple. **(04 Marks)**

   b. The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45m and a speed of 3000 rpm clock wise when looking from stern. Determine the gyroscopic couple and its effect upon the ship:
   i) When the ship is steering to the left on a curve of 100m radius at a speed of 36 km/hr.
   ii) When the ship is pitching with a SHM the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme position of pitching is 12°. **(16 Marks)**

8 In a four stroke petrol engine the crank angle is 4° after IDC when the suction valve open and 50° after BDC when the suction valve closes. The lift is 10mm, the hole radius is 2.5mm and the least radius of the cam 20mm. The shaft rotates at 600 rpm the cam is of the circular type with a circular nose and flank while the follower is flat faced. Determine the maximum velocity, maximum acceleration and retardation of the valve. What is the minimum force exerted by the springs to overcome the inertia of moving parts weighting 250 gram. **(20 Marks)**

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10ME55

Fifth Semester B.E. Degree Examination, December 2012
Manufacturing Process – III

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. With neat sketches, explain the classification of metal working processes on the basis of force applied. **(10 Marks)**

b. Derive an expression for true stress and true strain. **(05 Marks)**

c. An aluminum alloy having σ_0 (uniaxial flow stress) as 500 MPa is subjected to three principal stresses, σ_x (Tensile) 200 MPa, $\sigma_y = 100$ MPa (Tensile), σ_z = 50 MPa (compressive) and shear stress = 50 MPa, will the material exhibit yielding. If not, what is the safety factor? **(05 Marks)**

2 a. Discuss the effect of various parameters on metal working process. **(10 Marks)**

b. Explain deformation zone geometry. **(05 Marks)**

c. Determine engineering strain, true strain and reduction,
i) For a bar which is doubled in length.
ii) For a bar which is halved in length. **(05 Marks)**

3 a. Derive an expression for forging pressure and load in open die forging by slab analysis in sliding friction at the interface and draw friction hill. **(10 Marks)**

b. A circular disc of lead of radius 150 mm and thickness 50 mm is forged to half its original thickness by open die forging. Determine the maximum forging force if the coefficient of friction between job and the die is 0.25. The average yield stress is 4 N/mm^2. **(05 Marks)**

c. Explain briefly the forging defects. **(05 Marks)**

4 a. With a neat sketch, explain different types of rolling mill arrangements. **(10 Marks)**

b. Calculate rolling load if steel sheet is not rolled 30% from a 40 mm thick slab using (900 mm) diameter roll. The slab is 760 mm wide. Assuming $\mu = 0.3$, the plain strain flow stress is 140 MPa at entrance and 200 MPa at the exit during rolling and 200 MPa at the exit during rolling and power required for hot reduction. Take N = 100 rpm and $\lambda = 0.5$ for hot rolling. **(10 Marks)**

PART – B

5 a. Write a note on estimation of redundant work in drawing. **(07 Marks)**

b. Explain with a neat sketch, tube drawing process. **(07 Marks)**

c. Explain optimal cone angle and dead zone formation in drawing. **(06 Marks)**

6 a. With a neat sketch, explain backward extrusion process. Why power involved in backward extrusion is much lesser than direct extrusion. **(06 Marks)**

b. With a neat sketch explain impact extrusion process. **(06 Marks)**

c. List out defects in extrusion and explain any one. **(08 Marks)**

7 a. Explain the following operations with neat sketches: i) Rubber forming ii) Stretch forming. **(10 Marks)**

b. With neat sketches, explain the following dies:
i) Progressive dies ii) Combination dies. **(10 Marks)**

8 a. With a flow chart explain the operations involved in making powder metallurgy parts. **(08 Marks)**

b. Explain with a neat figure unconfined explosive forming process. **(06 Marks)**

c. Explain with a neat figure electromagnetic forming process. **(06 Marks)**

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