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10ME52

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Design of Machine Elements – I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Draw the stress-strain diagram for a ductile material and show the salient points on them. **(05 Marks)**

b. What are the factors to be considered for selection of material for a machine component? **(05 Marks)**

c. A point in a structural member subject to plane stress is shown in Fig.Q1(c). Determine the following :
(i) Normal and tangential stress intensities on plane MN inclined at an angle of 45°.
(ii) Principal stresses and their direction
(iii) Maximum shear stress and the direction of the planes on which it occurs. **(10 Marks)**

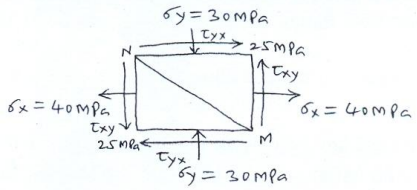

Fig.Q1(c)

2 a. State and explain the theories of failure :
(i) Maximum principal stress theory.
(ii) Maximum shear stress theory. **(06 Marks)**

b. What is stress concentration? Explain the factors affecting the stress concentration. **(06 Marks)**

c. An unknown weight falls through 15 mm on to a collar rigidly attached to the lower end of a vertical bar 2 metres long and 500 sq. mm section. If the maximum instantaneous extension is 2 mm, what is the corresponding stress and the value of unknown weight? Take E = 200GPa. **(08 Marks)**

3 a. Explain briefly the following :
(i) High cycle and low cycle fatigue (ii) Endurance limit. **(04 Marks)**

b. A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4P. The span of the beam is 500 mm and its cross-section is circular with a diameter of 60 mm. Taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum load of P. Take a size factor of 0.85, a surface finish factor of 0.9 and fatigue stress concentration factor of 1. **(16 Marks)**

4 a. Explain the stresses induced in a screw fastening subjected to static dynamic and impact loading. **(12 Marks)**

b. A wall bracket is attached to the wall by means of four identical bolts, two at A and two at B, as shown in Fig.Q4(b). Assuming that the bracket is held against the wall and prevented from tipping about the point C by all four bolts and using an allowable tensile stress in the bolts as 35 N/mm^2, determine the size of the bolts on the basis of maximum principal stress theory. **(08 Marks)**

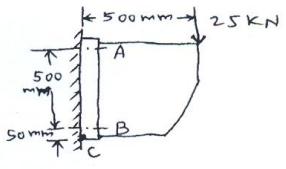

Fig.Q4(b)

PART – B

5 A mild steel shaft transmits 20 kW at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearings 2.5 metres apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not to exceed 56 MPa. What size of the shaft will be required, if it is subjected to gradually applied loads? **(20 Marks)**

6 a. Design a knuckle joint to transmit 120 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. **(10 Marks)**

b. Design a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250 r.p.m. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 1° in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa. **(10 Marks)**

7 a. A double riveted lap joint with zig-zag riveting is to be designed for 13 mm thick plates. Assume σ_t = 80 MPa; τ = 60 MPa ; σ_c = 80 MPa. State how the joint will fail and find the efficiency of the joint. **(10 Marks)**

b. A welded joint as shown in Fig.Q7(b) is subjected to an eccentric load of 2 kN. Find the size of weld, if the maximum shear stress in the weld is 25 MPa. **(10 Marks)**

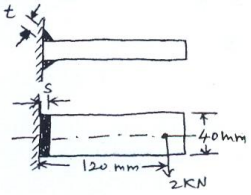

Fig.Q7(b)

8 a. Explain self locking and overhauling in power screws. **(06 Marks)**

b. A vertical two start square threaded screw of 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The nut of the screw is fitted in the hub of a gear wheel having 80 teeth which meshes with a pinion of 20 teeth. The mechanical efficiency of the pinion and gear wheel drive is 90 percent. The axial thrust on the screw is taken by a collar bearing 250 mm outside diameter and 100 mm inside diameter. Assuming uniform pressure conditions, find minimum diameter of pinion shaft and height of nut, when coefficient of friction for vertical screw and nut is 0.15 and that for the collar bearing is 0.20. Take τ = 56 MPa and P_b = 1.4 MPa. **(14 Marks)**

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10ME53

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Energy Engineering

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain Cyclone burner, along with proper sketch. **(06 Marks)**
b. Explain various coal handling techniques. **(08 Marks)**
c. Prepare a neat sketch for hydraulic ash handling system and explain. **(06 Marks)**

2 a. Give a neat sketch for Benson boiler and write the operating principle. **(08 Marks)**
b. Explain briefly about i) Economiser ii) Air preheater. **(06 Marks)**
c. Derive an expression for chimney height. **(06 Marks)**

3 a. Write the advantages and disadvantages of diesel power plant. **(06 Marks)**
b. Explain with neat sketch, Individual pump injection system and common rail injection system in diesel power plant. **(08 Marks)**
c. What is meant by thermostat cooling in diesel power plants? **(06 Marks)**

4 a. Give a brief note on i) Hydrograph ii) Flow duration curve. **(06 Marks)**
b. Draw a general layout of hydro – electric power plant and explain the functions of each part. **(08 Marks)**
c. Explain briefly about : i) Water hammer effect ii) Surge tank. **(06 Marks)**

PART – B

5 a. Explain with neat sketch, the layout of nuclear power plant. **(08 Marks)**
b. State the functions of moderator, control rods and reflector. **(06 Marks)**
c. Explain with neat sketch, the working of pressurized water reactor. **(06 Marks)**

6 a. Explain with proper sketch, about solar P-V conversion system. **(06 Marks)**
b. Give a brief note on horizontal and vertical axis wind mill system. **(06 Marks)**
c. The incident beam of sunlight has a power density of 1 kW/m^2 in the direction of beam. The angle of inclination is 60^0. Calculate the power collected by the surface, having a total flat area of $120m^2$. **(08 Marks)**

7 a. Give a short note on tidal power plant. **(06 Marks)**
b. Explain briefly about OTEC plants. **(08 Marks)**
c. What is meant by Geothermal energy conversion? **(06 Marks)**

8 a. What are the stages in anaerobic digestion process? Explain. **(06 Marks)**
b. With neat sketch, explain the working of floating type digester. **(08 Marks)**
c. What are the factors affecting the generation of biogas in a digester? **(06 Marks)**

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10ME54

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. State the condition for static equilibrium of a body subjected to a system of, (i) two forces (ii) three forces (iii) member with two forces and a torque. **(06 Marks)**

b. For the mechanism shown in Fig. Q1 (b), find the required input torque for the static equilibrium. The lengths OA = 250 mm and AB = 650 mm, F = 500 N. **(14 Marks)**

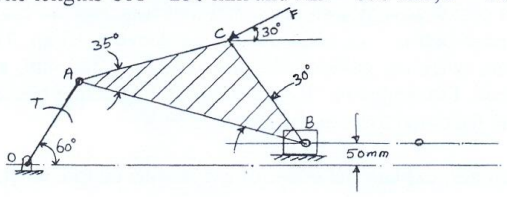

Fig. Q1 (b)

2 a. State and explain D'Alembert's principle. **(05 Marks)**

b. The turning moment diagram of a multicylinder engine has been drawn to a scale of 1 mm = 500 Nm torque and 1 mm to 6° of crank displacement. The intercepted areas between output torque curve and mean resistance line, taken in order from one end, in square millimeter area : -30, +410, -280, +320, -330, +250, -360, +280 and -260. If the mean speed is 800 rpm and fluctuation of speed is not to exceed 2% of mean speed, determine

(i) Mass of the flywheel

(ii) Mean diameter of the flywheel, if the centrifugal stress in the flkywheel rim is limited to 8 N/mm^2.

(iii) Dimensions of the rectangular cross section of the rim by taking the width of the rim as 5 times the thickness. The density of cast iron is 7200 kg/mm^3. **(15 Marks)**

3 a. Derive an expression for friction torque in case of flat collar with uniform pressure theory. **(05 Marks)**

b. An open belt transmits 15 kW power at a belt speed of 900 m/min. The belt embraces 4/9 circumference of the pulley. The thickness of belt is 10 mm. The coefficient of friction between belt and pulley surface is 0.3. Safe working stress in the material is 1.5 MPa. Density of the belt material is 1000 kg/m^3. Determine the width of the belt. **(15 Marks)**

4 a. What do you mean by static and dynamic balancing? **(05 Marks)**

b. A shaft carries four masses in parallel planes A, B, C, D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine (i) The magnitude of the masses at A and D (ii) The distance between planes A and D. (iii) The angular position of the mass at D. **(15 Marks)**

PART – B

5 a. Explain why only partial balancing is possible in reciprocating masses. **(05 Marks)**

b. A four crank engine has the two outer cranks set at 120° to each other, and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks.
If the length of each crank is 300 mm the length of each connecting rod is 1.2 m and the speed of rotation is 240 rpm. What is the maximum secondary unbalanced force? **(15 Marks)**

6 a. Define the following with respect to the working of governors : (i) Sensitiveness (ii) Isochronism (iii) Effort of a governor (iv) Stability of a governor. **(08 Marks)**

b. The arms of a porter governor are each 300 mm long and are hinged on the axis of rotation. The mass of each ball is 5 kg and mass of the sleeve is 15 kg. The radius of rotation of the ball is 200 mm, when the governor begins to lift and 250 mm, when the governor is at the maximum speed. Determine (i) Range of speed neglecting the sleeve friction. (ii) Range of speed, if the frictional force at the sleeve is 30 N. **(12 Marks)**

7 a. With neat sketches, explain the effect of gyroscopic couple on steering, pitching and rolling of a ship. **(08 Marks)**

b. An aeroplane flying at 240 km/h turns towards the left and completes a quarter circle of 60 m radius. The mass of the rotary engine and the propeller of the plane is 450 kg with a radius of gyration of 320 mm. The engine speed is 2000 rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aircraft and its effect.
In what way is the effect changed when the,
(i) Aeroplane turns towards right.
(ii) Engine rotates clockwise when viewed from the front (nose end) and the aeroplane turns left and right? **(12 Marks)**

8 The following data relate to a circular cam operating a flat faced follower:
Least diameter = 40 mm, Lift = 12 mm, Angle of action = 160°, Speed = 500 rpm. If the period of acceleration of the follower is 60° of the retardation during the lift, determine
(i) Principle dimensions of CAM.
(ii) Acceleration of the main points.
What is the maximum acceleration and deacceleration during the lift? **(20 Marks)**

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Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Manufacturing Process – III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

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

b. Differentiate between cold working and hot working. **(05 Marks)**

c. Explain the concept of true stress and true strain. **(05 Marks)**

2 a. Explain the effect of the following on metal working processes:
(i) Hydrostatic pressure (ii) Strain rate (iii) Friction. **(15 Marks)**

b. Explain briefly the formation of stresses in metal working. **(05 Marks)**

3 a. Explain the probable defects obtained in forgings. **(06 Marks)**

b. With a neat sketch explain the working of board drop hammer. **(08 Marks)**

c. List and explain briefly the die-design parameter in forging dies. **(06 Marks)**

4 a. Explain with neat sketches any three types of rolling mills. **(12 Marks)**

b. Calculate the rolling load if a steel sheet is hot rolled from a 40 mm thick slab of width 760. The reduction in thickness achieved is 30% and the roll diameter is 900 mm. The plain strain flow stress is 140 MPa at entrance and 200 MPa at the exit from the roll gap because of the increasing velocity. Assume the coefficient of friction as 0.3. If the roll speed is 100 rpm, what is power required to drive the rolls? **(08 Marks)**

PART – B

5 a. Explain with a neat sketch the rod drawing operation. **(08 Marks)**

b. With neat sketches, explain any three types of tube drawing process. **(12 Marks)**

6 a. Give the classification of extrusion process and explain hydrostatic extrusion. **(08 Marks)**

b. Explain in detail the deformation equipments and defects in extrusion. **(12 Marks)**

7 a. Explain the following operations with neat sketches:
(i) Deep drawing (ii) Roll bending **(10 Marks)**

b. With a neat sketch, explain the working of a progressive die in sheet metal forming. **(10 Marks)**

8 a. With neat sketches, explain the following forming methods:
(i) Explosive forming
(ii) Electromagnetic forming. **(12 Marks)**

b. Discuss with flow chart powder metallurgy process. **(08 Marks)**

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10ME56

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Turbo Machines

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Assume missing data, if any.***

PART – A

1 a. Differentiate between a positive displacement machine and a turbomachine. **(05 Marks)**

b. Define specific speed of a turbine. Derive an expression for specific speed of a pump. **(08 Marks)**

c. Tests on a turbine runner 1.25 m in diameter at 30 m head gave the following results: Power developed 736 KW speed 180 rpm, Discharge 2.7 m^3/s
Find the diameter, speed and discharge of a runner to operate at 45 m head and give 1472 kW power at the same efficiency. What is the specific speed of both the turbines? **(07 Marks)**

2 a. For a compression process, show that the isentropic efficiency is given by,

$$\eta_C = \frac{P_r^{\frac{\gamma-1}{\gamma}} - 1}{P_r^{\frac{\gamma-1}{\gamma\eta_P}} - 1}$$ **(08 Marks)**

b. Define the following for a compression process :
(i) Total to total efficiency (ii) Static to static efficiency **(04 Marks)**

c. A 16 stage axial flow compressor is to have a pressure ratio of 6.3 and tests have shown that a stage efficiency of 89.5% can be obtained. The intake conditions are 288 K and 1 bar pressure. Find
(i) Overall efficiency (ii) Polytropic efficiency (iii) Preheat factor **(08 Marks)**

3 a. Define degree of reaction (R). Derive an expression relating utilization factor with degree of reaction. **(10 Marks)**

b. Water approaches the impeller of a mixed flow pump with an absolute velocity having tangential and axial components each of 17 m/s. At the rotor exit the radial and tangential components of the absolute velocity are 13 m/s and 25 m/s respectively. The tangential blade speed at inlet and exit are 12 m/s and 47 m/s. Find
(i) Change in enthalpy across the rotor.
(ii) Total change in pressure across the rotor.
(iii) Change in static pressure.
(iv) Degree of reaction. **(10 Marks)**

4 a. The internal and external diameters of the impeller of a centrifugal pump are 20 cm and 40 cm respectively. The pump is running at 1200 rpm. The Vane angle of impeller at inlet is 20°. The water enters the impeller radially and velocity of flow is constant. Calculate workdone by the impeller / kg of water for the following two cases:
(i) When vane angle at outlet is 90°.
(ii) When Vane angle at outlet is 100°
Draw the corresponding velocity triangles. **(10 Marks)**

b. Derive head-capacity relationship for centrifugal pumps and explain the effect of discharge angle on it. **(10 Marks)**

PART – B

5 a. Write a note on compounding of steam turbines and explain any two types of compounding with neat sketches. **(10 Marks)**

b. A simple impulse turbine has a mean blade speed of 200 m/s. The nozzles are inclined at 20° to the plane of rotation of the blades. The steam velocity from nozzles is 600 m/s. The turbine uses 3500 kg/hr of steam. The absolute velocity at exit is along the axis of turbine. Determine

(i) Inlet and exit angles of blades.
(ii) Power output of turbine.
(iii) Diagram efficiency. **(10 Marks)**

6 a. With a neat sketch, explain the working of Kaplan turbine. Mention the functions of draft tube. **(10 Marks)**

b. The penstock supplies water from a reservoir to the Pelton wheel with a gross head of 500 m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of penstock is 2 m^3/s. The angle of deflection of the jet is 165°. Determine the power given by the water to the runner and also hydraulic efficiency of the Pelton wheel. Take speed ratio 0.45 and C_V 1.0 **(10 Marks)**

7 a. Derive an expression for minimum starting speed of a centrifugal pump. **(06 Marks)**

b. Define the following with respect to centrifugal pumps:
(i) Manometric head (ii) Manometric efficiency (iii) Overall efficiency. **(06 Marks)**

c. A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine
(i) Vane angle at inlet (ii) Workdone by impeller on water/s (iii) Manometric efficiency. **(08 Marks)**

8 a. Explain the phenomenon of surging and stalling in centrifugal compressors. **(06 Marks)**

b. With a neat sketch, explain the parts of a axial flow compressor. **(06 Marks)**

c. An axial flow compressor has the following data entry condition 1 bar, 20°C degree of reaction 50% mean blade ring diameter 36 cm, Rotational speed 18000 rpm blade height at entry 6 cm, Blade angle at rotor and stator exit 65° axial velocity 180 m/s mechanical efficiency 0.967.
Find
(i) Guide blade angle at outlet.
(ii) Power required to drive the compressor. **(08 Marks)**

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