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06ME/AU52

Fifth Semester B.E. Degree Examination, Dec 08 / Jan 09
Design of Machine Elements - I

Time: 3 hrs. Max. Marks:100

Note : ***1. Answer any FIVE full question, choosing atleast TWO questions from each Part.***
2. Use of design data hand book is permitted.

PART - A

1 a. Sketch and explain Biaxial and Tri-axial stresses, Stress Tensor and Principal stresses. **(08 Marks)**

b. A rectangular bar of section 50 × 25mm is subjected to a tensile load of 25kN. Determine the values of normal and shear stresses on a plane 30^0 with the vertical. Also calculate the magnitude and direction of the maximum shear stress. **(08 Marks)**

c. Briefly explain design codes and standards. **(04 Marks)**

2 a. State and explain theories of failure. **(06 Marks)**

b. Briefly explain the impact strength of a bar subjected to axial, bending and torsional loading. **(06 Marks)**

c. An infinite plate with an elliptical cutout having major axis 50mm and minor axis of 25mm, is subjected to tensile load F. Determine the stress concentration factor when i) the load is perpendicular to major axis ii) the load is parallel to the major axis. **(08 Marks)**

3 a. Explain the significance of Goodman and Soderberg relations. **(08 Marks)**

b. A rough finished steel rod having σ_u = 620 MPa, σ_y = 400 MPa, and σ_{-1} = 345 MPa is subjected to completely reversed bending moment of 400 N-m. Determine the diameter of the rod required based on a factor of safety of 2.5. **(12 Marks)**

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

b. A bolt subjected to initial loading of 5kN and final tensile load of 9kN. Determine the size of the both, if the allowable stress is 80 MPa and k = 0.05. **(08 Marks)**

PART – B

5 a. Compare the strength of a hollow shaft with that of a solid shaft for the same diameter and material. The diameter ratio of hollow shaft is 0.75. **(06 Marks)**

b. A steel shaft (C45) transmitting 15 kW at 210 rpm is supported between two bearings 1000mm, apart. On this, two spur gears are mounted. The gear having 80 teeth of module 6mm is located 100mm to the left of the right bearing and receives power from a driving gear such that the tangential force acts vertical. The pinion having 24 teeth and module 6mm is located 200mm to the right of the left bearing and delivers power to a gear mounted behind it. Taking combined shock and fatigue factors 1.75 in bending and 1.25 in torsion, determine the shaft diameter. **(14 Marks)**

6 a. A rigid coupling has four bolts on a pitch circle of 125mm diameter and is transmitting 20 kW power at 720 rpm. The bolts are made of carbon steel (C45) and has the factor of safety 3. Determine the diameter of the bolt. **(06 Marks)**

b. Design a bush pin type flexible coupling to transmit 25 kW at 500 rpm. Select suitable materials for shaft, key and bolts. **(14 Marks)**

7 a. Design a double riveted lap joint with chain riveting for a mild steel plates of 20mm thick taking the allowable values of stress in shear, tension and compression to 60, 90 and 120 MPa respectively. **(12 Marks)**

b. A mild steel plate of 15mm thickness is welded to another plate by two parallel welds to carry a load of 50 kN. Determine the length of weld required : i) load is static ii) load is dynamic. **(08 Marks)**

8 a. Explain self locking and over haul of screw jack. **(06 Marks)**

b. Design a screw jack for a capacity of 10 kN, to lift 200mm height. Select suitable materials and factor of safety. **(14 Marks)**

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06ME53

Fifth Semester B.E. Degree Examination, Dec 08 / Jan 09
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. In a Four bar Mechanism shown in Fig.Q1(a) Torque T_3 and T_4 have magnitudes of 3000 Nm and 2000 Nm respectively. If links AD = 800 mm, AB = 300mm, BC = 700mm and CD = 400mm, find the required torque on the crank for static equilibrium of the mechanism. **(15 Marks)**

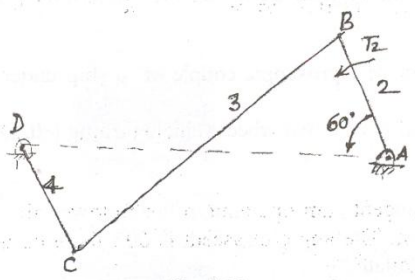

Fig. 1(a)

b. What are the implications of considering friction in static force analysis? **(05 Marks)**

2 a. Explain D'Alemberts Principle and state why it is used. **(06 Marks)**

b. A punching press is required to punch 40mm diameter holes in a plate of 30mm thickness at the rate of 4 holes per minute. It required 6Nm of energy per mm^2 of sheared area. The punch has a stroke of 100mm. The rpm of the Flywheel varies from 320 to 280. If the radius of gyration of flywheel is 1m, find i) the power of the motor and ii) mass of the Flywheel. **(14 Marks)**

3 a. State the Laws of Dry friction. **(06 Marks)**

b. A leather belt is required to transmit 9kW from a pulley 120cm in diameter running at 200 rpm. The angle embraced is 165^0 and the co-efficient of friction between leather belt and pulley is 0.3. If the safe working stress for the leather belt is $140N/cm^2$, the mass of the leather is 1 gm/cm^3 and the thickness of the belt is 10mm, determine the width of the belt taking centrifugal tension into account. **(14 Marks)**

4 a. Explain Static Balancing and Dynamic Balancing. **(06 Marks)**

b. Four masses A, B, C and D having 200kg, 300kg, 240kg and 260kg respectively, revolve at a radius of rotation 270mm, 210mm, 300mm and 360mm respectively. The distance of planes B, C and D measured from A are 270mm, 420mm and 720mm respectively. The angular positions of masses B, C and D measured from A are 45^0, 120^0 and 255^0 respectively. Two balancing masses are placed in planes L and M, which are 500mm apart. The distance of Plane L from A is 120mm and M from D is 100mm. If the balancing masses revolve at a radius of 72mm, find their magnitude and angular position. **(14 Marks)**

PART – B

5 a. Prove that the resultant unbalanced force is minimum when half of the reciprocating masses are balanced by rotating masses i.e. C = ½ . **(06 Marks)**

b. A V – 90 engine has two cylinders which are placed symmetrically. The two connecting rods operate a common crank. The length of the connecting rods are 320mm each and crank radius is 80mm. The reciprocating mass per cylinder is 12kg. If the engine speed is 600 rpm, find the resultant primary and secondary forces. Also find the maximum resultant secondary force. **(14 Marks)**

6 a. Explain the terms Sensitiveness, Isochronism and Effort and Power of a Governor. **(04 Marks)**

b. The length of upper arm and lower arms of a Porter Governor are 200mm and 250mm respectively. Both the arms are pivoted to the axis of rotation. The central load is 150N, the weight of each ball is 20N and the friction of the sleeve together with the resistance of the operating gear is equivalent to a force of 30N at the sleeve. If the limiting inclinations of the upper arm to the vertical are 30^0 and 40^0, determine the range of speed of the Governor. **(16 Marks)**

7 a. Explain the effect of Gyroscopic couple of a ship under i) Steering ii) Pitching and iii) Rolling. **(10 Marks)**

b. Analyze the stability of a two wheel vehicle turning left. Derive the necessary equation. **(10 Marks)**

8 For a symmetrical tangent cam operating roller follower, the least radius of cam is 30mm and roller radius is 15mm. The angle of ascent is 60^0, the total lift is 15mm and the speed of the cam is 300 rpm. Calculate.

a. Principal dimensions of the cam.

b. Acceleration of the follower at the beginning of lift, where the roller just touches the nose and at the apex of circular nose. Assume that there is no dwell between ascent and descent. **(20 Marks)**

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06ME54

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09
Energy Engineering

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions, choosing at least two questions from PART-A and PART-B.*
2. Draw neat sketches.
3. Any missing data may be assumed suitably.

PART - A

1 a. List the different types of fuels used for steam generation. **(04 Marks)**
b. With a neat sketch explain the Furnace for combustion of Fine coal particles. **(08 Marks)**
c. Enumerate and explain the steps involved in handling of the coal. **(08 Marks)**

2 a. What do you understand by the term Draught? Classify different types of Draughts. Explain with a neat sketch the balanced draught. **(08 Marks)**
b. What are the benefits of air-preheater. **(04 Marks)**
c. Determine the height of chimney to produce a static draught of 20mm water, the mean flue gas temperature in the chimney is 270°C and atmospheric air temperature is 20°C. Barometer reads 760mm Hg. The gas constant for air is 287 N-m / kg k° and for chimney gas is 255 Nm/kg°k. **(08 Marks)**

3 a. What are the applications of diesel Electric power plants? **(05 Marks)**
b. What are the advantages and disadvantages of Air – cooling system? **(06 Marks)**
c. For a diesel power station discuss briefly Lubricating system. **(04 Marks)**
d. Draw general schematic arrangements of Diesel power plants. **(05 Marks)**

4 a. What is a unit hydrograph? What are the limitations to the use of unit hydrograph? **(06 Marks)**
b. The mean weekly discharge for 12 weeks of a river is given below.

Week	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
Discharge m^3/sec	100	200	300	1200	600	900	800	600	1000	600	400	200

i) Draw Hydrograph and flow duration curve.
ii) If the head available is 100m and overall efficiency of generation is 85%. Find the power available at mean flow of water. **(10 Marks)**
c. Explain the functions of surge tank. **(04 Marks)**

PART - B

5 a. What is Nuclear reactor? Explain nuclear reactor with its various elements. **(08 Marks)**
b. Differentiate between Boiling water reactor and pressurized water reactor. **(06 Marks)**
c. Write a short notes on:
i) Radiation hazards. ii)Radio active waste – disposal. **(06 Marks)**

6 a. With a neat sketch explain Flat plate solar collector. **(08 Marks)**
b. Briefly explain principle of working of solar cell. **(06 Marks)**
c. Sketch and explain the Horizontal axis wind mill. **(06 Marks)**

7 a. What are the advantages and limitations of Tidal power generation? **(08 Marks)**
b. With a neat sketch explain working principles of open cycle of OTEC system. **(08 Marks)**
c. Enlist different geothermal energy sources. **(04 Marks)**

8 a. What is the difference between biomass and biogas? **(04 Marks)**
b. Give a list of the materials used for biogas generation. **(05 Marks)**
c. What are the factors affecting biogas generation. **(05 Marks)**
d. Write short notes on pyrolysis and gasifiers. **(06 Marks)**

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06ME55

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09
Turbomachines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define Turbomachines. Give at least 4 different classifications of turbomachines. **(06 Marks)**

b. Define specific speed of pumps. Show that specific speed of pump is given by $N_s = \frac{N\sqrt{Q}}{H^{3/4}}$ **(06 Marks)**

c. A turbine model of 1:10 develops 2.0 kW under a head of 6mts at 500 rpm. Find the power developed by the prototype under a head of 40m. Also find the speed of prototype and its specific speed. Assume the turbine efficiencies to remain same. **(08 Marks)**

2 a. Draw the inlet and exit velocity triangles for a radial flow power absorbing turbomachine with (i) Backward curved vane (ii) Radial vane (iii) Forward vane. Assume inlet whirl velocity to be zero. Draw and explain the head-capacity relations for the above 3 types of vanes. **(10 Marks)**

b. Show that for maximum utilization the work output per stage of an axial flow impulse machine (with equiangular rotor blades) is double that of a 50% reaction stage which has the same speed. Assume that axial velocity remains constant for a 50% reaction machine. **(10 Marks)**

3 a. Define degree of reaction and utilization factor with mathematical expressions. Show that $\epsilon = \frac{V_1^2 - V_2^2}{V_1^2 - RV_2^2}$ where ϵ is utilization factor, R is degree of reaction and V_1 & V_2 are absolute velocities at the inlet and exit. **(10 Marks)**

b. Air enters a rotor in an axial flow turbine with a tangential component of absolute velocity equal to 600 m/s in the direction of rotation. At the rotor exit, the tangential component of absolute velocity is 100 m/s in a direction opposite to that of rotation. The tangential blade speed is 250 m/s. Draw inlet & exit velocity triangles. Find
(i) Change in total enthalpy.
(ii) Change in total temperature across the rotor.
(iii) Power in kW for a flow rate of 10 kg/s. **(10 Marks)**

4 a. Show that polytropic efficiency (infinitesimal stage efficiency) is given by (Draw the T-S diagram) $\eta_p = \left(\frac{n-1}{n}\right)\left(\frac{\gamma}{\gamma-1}\right)$,
where n = polytropic process of index n, γ = ratio of specific heat. **(10 Marks)**

b. A low pressure air compressor develops a pressure 1400 mm of water gauge (WG). If the initial and final states of air are P_1=1.01 bar, T_1=305 K and T_2=320 K, determine compressor and infinitesimal stage efficiencies. **(10 Marks)**

PART – B

5 a. Explain the surging phenomena in compressors with the help of head-discharge curves. **(08 Marks)**

b. An axial-flow compressor stage draws air with inlet stagnation condition of 1 bar and 35^0C. Assuming a 50% reaction stage with a flow coefficient of 0.52 and the ratio $\Delta V_u/u = 0.25$, find the rotor blade angles at the inlet and exit as well as mean rotor speed. The total-to-total efficiency of the stage is 0.87 when the stage produces a total-to-total pressure ratio of 1.23. Find the pressure coefficient and power input to the system, assuming work input factor to be 0.86. The mass flow rate is 12 kg/s. **(12 Marks)**

6 a. Applying Bernoulli's equation between the inlet and exit of the impeller of a centrifugal pump, show that the static pressure rise is given by

$$p_2 - p_1 = \frac{\rho}{2}\left[V_{m1}^2 + U_2^2 - V_{m2}^2 \operatorname{cosec}^2\beta_2\right]$$

Where, V_{m1}= velocity of flow at inlet = V_1, V_{m2}= velocity of flow at exit.
β_2= Blade angle at exit, U_2= Blade speed at exit.
ρ = density of fluid, p1 & p2 = Static pressure at inlet & exit. **(08 Marks)**

b. A centrifugal pump discharges 0.15 m^3/sec of water against a head of 12.5m. Speed of impeller is 600 rpm. The outer & inner diameters of impeller are 500mm and 250mm respectively and the vanes are bent back at 35° to the tangent at exit. If the area of flow remains 0.07 m^2 from inlet to outlet, find (i) Manometric efficiency of pump (ii) Vane angle at inlet (iii) Loss of head at inlet to impeller when discharge is reduced by 40% without changing the speed. **(12 Marks)**

7 a. For a single stage impulse turbine, prove that the maximum blade efficiency is given by

$(\eta_b)_{max} = \frac{\cos^2\alpha_1}{2}(1+KC)$ Where $K = V_{r_2}/V_{r_1}$ and $C = \cos\beta_2/\cos\beta_1$, α_1 = nozzle angle,

β_1, β_2 = are rotating blade angles at inlet & exit.

V_{r_1}, V_{r_2} are relative velocities at inlet and exit. **(08 Marks)**

b. The following particulars relate to a two-row velocity compounded impulse wheel.
Steam velocity at nozzle outlet = 650 m/s
Mean blade speed = 125 m/s
Nozzle outlet angle = 16°
Outlet angle of first row of moving blades = 18°
Outlet angle of fixed guide blades = 22°
Outlet angle of second row of moving blades = 36°
Steam flow = 2.5 kg/s
The ratio of relative velocity at outlet to that at inlet is 0.84 for all blades. Determine
(i) Axial thrust on blades (ii) Power developed (iii) The efficiency of the wheel. **(12 Marks)**

8 a. State the functions of a draft tube. Show that the efficiency of draft tube is given by $\eta_d = \frac{v_1^2 - v_2^2 - 2gh_f}{v_1^2}$; where v_1 is absolute velocity of water at rotor exit; v_2 is absolute velocity of water at draft tube exit, h_f is loss of head due to friction. **(08 Marks)**

b. A Kaplan turbine working under a head of 20m develops 11772 kW of shaft power. The outer diameter of runner is 3.5m & hub diameter is 1.75m. The guide blade angle at the extreme edge of the runner is 35°. The hydraulic and overall efficiencies of the turbines are 88% and 84% respectively. If the velocity of whirl is zero at outlet, determine:
(i) Runner vane angle at the inlet & outlet at the extreme edge of the runner.
(ii) Speed of turbine. **(12 Marks)**

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06ME56

Fifth Semester B.E. Degree Examination, Dec.08/Jan.09
Engineering Economics

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions choosing at least two questions from each part.***
2. ***Interest factors tables permitted.***

Part A

1 a. Explain with suitable / relevant examples different engineering economic problems an engineer confronts with, in day-to-day life. **(05 Marks)**

b. An engineering economist solves problems and takes appropriate decisions using time honoured scientific method. Explain with a suitable diagram. **(05 Marks)**

c. Explain how cash flow diagrams (CFD) are helpful to the decision maker to understand and solve engineering economic problems. Draw neat sketches of different versions of cash flow diagrams, and give borrower's and lender's perspectives for cash flow diagrams. **(10 Marks)**

2 a. A person takes a loan of Rs.12000/- from a bank at an interest of 18% P.A. Find the amount if the interest is compounded, i) Annually ii) Half-yearly (Semi-Annually) iii) Quarterly and iv) Monthly. **(12 Marks)**

b. Calculate the effective interest rate "ieff" of a nominal compound interest rate of 18% P.A., when compounded i) Half yearly and ii) Monthly. **(08 Marks)**

3 a. List and explain the conditions for present worth comparisons. **(10 Marks)**

b. Two devices are available to perform a necessary function for 3 years. The initial cost (negative) for each device at time 0 and subsequent annual savings (positive) are shown in the following table. Compare the net present worth of these two devices when the required interest rate is 8%. Draw the cash flow diagram. **(10 Marks)**

	YEAR			
	0	1	2	3
Device A	12000	5500	5500	5500
Device B	15000	6000	6000	8000

(P/A, 8, 3) = 2.5771; (P/A, 8, 2) = 1.78326; (P/F, 8, 3) = 0.79383

4 a. With examples give definitions of Asset life. Why land prices do not get depreciated? **(10 Marks)**

b. Explain the concept and philosophy of use of a sinking fund. **(10 Marks)**

Part B

5 a. What do you understand by Minimum Acceptable Rate of Return (MARR) and Internal Rate of Return (IRR). **(10 Marks)**

b. Explain with examples the various causes of depreciation. **(10 Marks)**

6 a. With a neat sketch explain the composition of costs traditionally used in accounting for the price of a manufactured product. **(10 Marks)**

b. Explain life cycle costing with a neat sketch. **(10 Marks)**

7 a. Write the balance sheet equation. Following is the year end details of a company:

Equity	200000
Bank Balance	10000
Dividend payable	72000
Provision for tax	40000
Preference shares	135000
Land and building	200000
Debtors	265000
Bills payable	20000
Plant and equipment	80000
Bills receivable	20000
General reserves	40000
Cash in hand	15000
Stock	77000
Creditors	160000

Prepare the Balance sheet. **(10 Marks)**

b. Define the following with suitable equations: i) current ratio ii) acid test ratio iii) debt equity ratio iv) Gross profit ratio v) Net profit margin ratio. **(10 Marks)**

8 Write short notes on any four of the following:

a. Intuition an analysis.
b. Present worth by the "72 rule".
c. Annuity contract for guaranteed income.
d. Tactics and strategy.
e. Comparisons of assets having unequal lives
f. Sales budget OR Production budget. **(20 Marks)**