Hall Ticket Number :										

Code: 5G554

R-15

III B.Tech. I Semester Regular Examinations Nov/Dec 2017

Design of Machine Elements-I

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Explain the various design considerations in machine elements.

   b) What are the common materials used in design of machine elements? How can the properties of steel be improved?

OR

2. a) Explain various theories of failures.

   b) A critical section in a solid shaft of 50 mm diameter is subjected to a twisting moment of 50 KN-m, a bending moment of 20 KN-m, and an axial compressive thrust of 60 KN. Determine the maximum value of the compressive and shear stress stresses.

UNIT–II

3. a) What is factor of safety? List the factors to be considered while deciding the factor of safety.

   b) Explain how the factor of safety is determined under steady and varying loading by different methods.

OR

4. A hot rolled steel shaft is subjected to a torsional moment that varies from 330 N-m clockwise to 110 N-m counterclockwise and an applied bending moment at a critical section varies from 440 N-m to – 220 N-m. The shaft is of uniform cross-section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m^2 and a yield strength of 410 MN/m^2. Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62.

UNIT–III

5. a) What is meant by a bolt of uniform strength? How these are obtained?

   b) A steam engine of effective diameter 300 mm is subjected to a steam pressure of 1.5 N/mm^2. The cylinder head is connected by 8 bolts having yield point 330 MPa and endurance limit at 240 MPa. The bolts are tightened with an initial preload of 1.5 times the steam load. A soft copper gasket is used to make the joint leak-proof. Assuming a factor of safety 2, find the size of bolt required. The stiffness factor for copper gasket may be taken as 0.5.

OR

6. a) What is an eccentric loaded welded joint? Discuss the procedure for designing such a joint.

   b) A butt welded joint with ground and flush surface is subjected to tensile load which varies from 50 kN to 100 kN. Plates are 10 mm thick. Determine the lengths of weld required for over 2, 500, 000 cycles.

UNIT–IV

7. a) How are the keys classified? Draw neat sketches of different types of keys and state their applications.

   b) Design a cotter joint to connecting piston rod to the crosshead of a double acting steam engine. The diameter of the cylinder is 300 mm and the steam pressure is 1 N/mm^2. The allowable stresses for the material of cotter and piston rod are as follows: σ_t = 50 MPa; τ = 40 MPa; and σ_c = 84 MPa

OR

8. a) Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically.

   Tensile stress = compressive stress = 50 MPa; shear stress = 35 MPa and crushing stress = 90 MPa.

   b) What is the difference between a saddle key and a sunk key?

UNIT–V

9. a) Distinguish clearly, giving examples between pin, axle and shaft.

   b) Design a bushed pin type flexible coupling to transmit 15 kW at 2000 rpm. Allowable shear stress for shafts, keys and bolts = 55 MPa. Allowable bearing stress for bolts and keys = 110 MPa. Allowable bearing pressure for rubber bush = 1 MPa.

OR

10. a) Discuss the function of a coupling. Give at least three practical applications.

    b) A mild steel shaft transmits 23 kW at 200 rpm. It carries a central load of 900 N and is simply supported between the bearings 2.5 meters 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 it gradually applied loads?

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Hall Ticket Number :										

R-15

Code: 5G552

III B.Tech. I Semester Regular Examinations Nov/Dec 2017

Dynamics of Machinery

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) What are the laws solid dry friction? 4M

   b) A plate clutch has three discs on the driving shaft and two discs on the driven shaft, providing four pairs of contact surfaces. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform pressure and μ = 0.3, find the total spring load pressing the plates together to transmit 25 kW at 1600 rpm. If there are six springs each of stiffness 13 kN/m and each of the contact surfaces has worn away by 1.25 mm, find the maximum power that can be transmitted, assuming uniform wear. 10M

OR

2. a) Describe with a neat sketch, the working of a single plate friction clutch. 6M

   b) A body is to be moved up on an inclined plane by applying a force parallel to the plane surface. It is found that a force of 3 kN is required to just move it up the plane when the angle of inclination is 10° whereas the force needed increases to 4 kN when the angle of inclination is increased to 15°. Determine the weight of the body and the coefficient of friction. 8M

UNIT–II

3. In a single block brake, the diameter of the drum is 250 mm and the angle of contact is 90^o. The operating force of 700 N is applied at the end of lever which is at 250 mm from the center of the brake block. The coefficient of friction between the drum and the lining is 0.35. Determine the torque that may be transmitted. Fulcrum is at 200 mm from the center of brake with an offset of 50 mm from the surface of contact. 14M

OR

4. a) An aeroplane makes a complete half circle of 50 metres radius, towards left, when flying at 200 km per hr. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 r.p.m. clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it. 8M

   b) Explain the working principle of Epicyclic train dynamometer with neat sketch. 6M

UNIT–III

5. The turning moment diagram for a petrol engine is drawn to a scale of 1mm to 6N-9-9m and the horizontal scale of 1mm to 1°.The turning moment repeat itself after every half revolution of the engine. The area above and below the mean torque line are 305, 710, 50, 350, 980 and 275mm^2. The mass of rotating parts is 40kg at a radius of gyration of 140mm. Calculate the coefficient of fluctuation of speed if the mean speed is 1500rpm. 14M

OR

6. A machine requires a torque of (5000 + 500 sinθ) N-m to drive it. Where q is the angle of rotation of the shaft measure from certain datum. The machine is directly coupled to an engine which produces a torque of (5000 + 600 sin2θ) N-m. The flywheel and other rotating parts attached to the engine have a mass of 500 kg at radius of gyration of 0.4 m. If the mean speed is 150 rpm, find the fluctuation of energy, the total percentage of fluctuation of speed and the maximum and minimum angular acceleration of the flywheel and the corresponding shaft position. 14M

UNIT–IV

7. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks 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 100 mm, between X and Y is 400mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. 14M

OR

8. The following data refer to two cylinder locomotive with cranks at 90° : Reciprocating mass per cylinder = 300 kg ; Crank radius = 0.3 m ; Driving wheel diameter = 1.8 m ; Distance between cylinder center lines = 0.65 m ; Distance between the driving wheel central planes = 1.55 m. Determine:
   a. The fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km/hr.;
   b. The variation in tractive effort; and
   c. The maximum swaying couple. 14M

UNIT–V

9. a) In a single -degree damped vibrating system, a suspended mass of 8kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine the a. Stiffness of the spring, b. Logarithmic decrement, c. Damping factor, and d. Damping co-efficient. 10M

   b) Distinguish between longitudinal, transverse and torsional vibrations. 4M

OR

10.. A steel shaft 1.5m long is 95mm in diameter for the first 0.6m of its length, 60mm in diameter for the next 0.5m of the length and 50mm in diameter for the remaining 0.4m of its length. The shaft carries two flywheels at two ends, the first having a mass of 900kg and 0.85m radius of gyration located at the 95mm diameter end and the second having a mass of 700kg and 0.55m radius of gyration located at the other end. Determine the location of the node and the natural frequency of free torsional vibration of the system. The modulus of rigidity of shaft material may be taken as 80GN/m^2. 14M

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Hall Ticket Number :										

Code: 5G555

R-15

III B.Tech. I Semester Regular Examinations Nov/Dec 2017

Heat Transfer

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) Generate expression for temperature distribution, under 1D steady state heat conduction for cylindrical system.

   b) What is the physical significance of the thermal diffusivity? How it is defined and what are its units?

OR

2. a) What is the thickness required of a masonry wall having thermal conductivity 0.75 W/mK if the heat rate is to be 80% of the heat rate through a composite structural wall having a thermal conductivity of 0.25 W/mK and a thickness of 100 mm? Both walls are subjected to the same surface temperature difference.

   b) What is the overall heat transfer coefficient? How is it defined and how is it related to the total thermal resistance? What are its units?

UNIT–II

3. a) The walls of a refrigerator are typically constructed by sandwiching a layer of insulation between sheet metal panels. Consider a wall made from fiberglass insulation of thermal conductivity 0.046 W/mK and thickness 50 mm and steel panels, each of thermal conductivity 60 W/m K and thickness 3 mm. If the wall separates refrigerated air at 4°C from ambient air at 25°C, what is the heat gain per unit surface area? Coefficients associated with natural convection at the inner and outer surfaces may be approximated as $5 W/m^2K$.

   b) Generate an expression for heat dissipation in straight triangular fin.

OR

4. Stainless steel (AISI 304) ball bearings, which have uniformly been heated to 850°C, are hardened by quenching them in an oil bath that is maintained at 40°C. The ball diameter is 20 mm, and the convection coefficient associated with the oil bath is $1000 W/m^2K$.

   a. If quenching is to occur until the surface temperature of the balls reaches 100°C, how long must the balls be kept in the oil? What is the center temperature at the conclusion of the cooling period?

   b. If 10,000 balls are to be quenched per hour, what is the rate at which energy must be removed by the oil bath cooling system in order to maintain its temperature at 40°C?

UNIT–III

5. a) Generate momentum equation for hydrodynamic boundary layer over a flat plate.

   b) A plate of length 750mm and width 250mm has been placed longitudinally in a stream of crude oil which flows with a velocity of 5m/s. if the oil has a specific gravity of 0.8 and kinematic viscosity of 1 stoke, find

      i. Boundary layer thickness at the middle of plate.
      ii. Shear stress at the middle of plate.
      iii. Friction drag on one side of the plate.

OR

6. a) A horizontal, high-pressure steam pipe of 0.1-m outside diameter passes through a large room whose wall and air temperatures are 23°C. The pipe has an outside surface temperature of 165°C and an emissivity of 0.85. Estimate the heat loss from the pipe per unit length.

   Use Properties: air (T_f = 367 K): k =0.0313 W/mK, Kinematic viscosity 22.8 $*10^{-6} m^2/s$, α= 32.8 $*10^{-6}$ m^2/s, Pr=0.697, β=2.725 $*10^{-3} K^{-1}$.

   b) How does the local convection heat or mass transfer coefficient vary with distance from the leading edge for laminar flow over a flat plate? For turbulent flow?

UNIT–IV

7. a) Water at the atmospheric pressure is to be boiled in the polished copper pan. The diameter of the pan is 350 mm and is kept at the 115°C.Find the following

      i. Power of the burner.
      ii. Rate of the evaporation in kg/h.
      iii. Critical heat flux for these conditions.

   b) How modes of heat transfer are associated with film boiling?

OR

8. a) Consider two large parallel plates, one at 1000k with the emissivity 0.8 and other is at 300k having emissivity 0.6.A radiation shield is placed between them. The shield has the emissivity as 0.1 on side facing hot plate and 0.3 on the side facing cold plate. Find percentage reduction in the radiation heat transfer as the result of radiation shield

   b) What is Planks distribution? What is Wien's displacement law?

UNIT–V

9. a) Generate expression for effectiveness by NTU method for the parallel flow heat exchanger.

   b) The overall temperature rise of the cold fluid in a cross-flow heat exchanger is 20°C and overall temperature drop of the hot-fluid is 30°C.The effectiveness of heat exchanger is 0.6. The heat exchanger area is 1 m^2 and overall heat transfer coefficient is 60 $w/m^{2\circ}C$. Find out the rate of the heat transfer. Assume both fluids are unmixed.

OR

10. a) Why are baffles used in a shell-and-tube heat exchanger?

   b) The flow rates of the Hot and cold-water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s respectively. The inlet temperature on the hot and cold sides is 75°C and 20°C respectively. The exit temperature of the hot water is 45°C.If the individual heat transfer coefficient on both side are $650w/m^{2\circ}C$.Calculate the area of the heat exchanger.

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Hall Ticket Number :										

Code: 5GA51

R-15

III B.Tech. I Semester Regular Examinations Nov/Dec 2017

Managerial Economics and Financial Analysis

(Common to CE, ME & ECE)

Max. Marks: 70 Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT-I

1. What are the different methods of measuring Price Elasticity of demand? Given the following information, calculate the price elasticity using percentage and arc methods and comment on the nature of the good:
   P = 12; Q = 10 and P_1 = 15; Q_1 = 8.

OR

2. Briefly discuss the various methods of Demand forecasting.

UNIT-II

3. Define Isoquant and Isocost line. Graphically show the optimal or cost minimizing choice of inputs. Also graphically show the long-run and short-run expansion path of a firm.

OR

4. Define Production Function and write the Cobb-Douglas production function. Suppose in the Cobb-Douglas production function, $\alpha + \beta > 1$, what does it imply about the returns to scale? If $\alpha + \beta = 1$ and $\alpha + \beta < 1$, what do they imply?

UNIT-III

5. Discuss in brief the short-run and long-run equilibrium conditions under Monopolistic market. Why do firms under Monopolistic market operate with Excess Capacity?

OR

6. Briefly discuss the various forms of business organizations. Write a short comment on PPP model.

UNIT-IV

7. Define Capital. What are the different types of capital? Elaborate.

OR

8. What are the different methods of capital budgeting? Find out the Net Present Value of a project with an initial investment of Rs. 10,000/-; even cash inflow of Rs. 500/- for a period of 2 years with 5% interest rate and zero scrap value.

UNIT-V

9. What is Balance Sheet? What are the different sections of a balance sheet? Chart out assets and liabilities of a firm with suitable examples.

OR

10. What are turnover and solvency ratios? Calculate current ratio from the following information:

Particulars	Rs.
Inventories	50,000
Trade receivables	50,000
Advance tax	4,000
Cash and cash equivalents	30,000
Trade payables	1,00,000
Short-term borrowings	4,000

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Hall Ticket Number :										

R-15

Code: 5G553

III B.Tech. I Semester Regular Examinations Nov/Dec 2017

Machine Tools

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer *all five* units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) List various types of chips. What factors are responsible for formation of chips? 7M

   b) Identify various cutting tool materials and emphasize their importance in metal cutting. 7M

OR

2. a) Draw a Merchant's circle diagram and derive expressions to show relationships among the different forces acting on the cutting tool and different parameters involved in metal cutting. 7M

   b) Write a short note on Taylor's tool life equation. 7M

UNIT–II

3. a) What are the basic parts of an engine lathe? Discuss the function of headstock. 7M

   b) Describe about multi-spindle automatic lathe machine in detail. 7M

OR

4. Contrast automatic and semi automatic machine tools. 14M

UNIT–III

5. a) Predict various tool holding devices used in drilling machine? Brief them. 7M

   b) Explain the process of Quick return mechanism in context to shaper. 7M

OR

6. a) Illustrate the method of indexing in milling machine. 7M

   b) Summarize the working principle of fine boring machine. 7M

UNIT–IV

7. a) How broaching is done on horizontal push-type broaching machines 7M

   b) Discuss the theory of grinding process and give grinding wheel specification. 7M

OR

8. a) Describe the process of centerless grinding process with a neat sketch. 7M

   b) What is surface grinding? Identify its applications in context to industrial applications. 7M

UNIT–V

9. a) List various types of drilling jigs. 7M

   b) Demonstrate the process of lapping. How honing and lapping differ 7M

OR

10. a) Explain the constructional features of speed and feed units of broaching tool. 7M

    b) Why a clamping device is necessary in jigs and fixtures? Name and explain the various types of clamps used in Jigs and fixtures. 7M

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Hall Ticket Number :										

Code: 5G551

R-15

III B.Tech. I Semester Regular Examinations Nov/Dec 2017

Applied Thermodynamics - II

(Mechanical Engineering)

Max. Marks: 70 Time: 3 Hours

Answer all five units by choosing one question from each unit (5 x 14 = 70 Marks)

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UNIT–I

1. a) A simple ideal Rankine cycle with water as working fluid operates between the pressure limits of 17.5 Mpa in the Boiler and 30 kPa in the condenser. What is the minimum temperature required at the turbine inlet such that the quality of the steam leaving the turbine is not below 80%. When operated at this temperature, determine the cycle efficiency of the cycle

   b) Draw the Regenerative Rankine cycle on T-s and h-s diagrams and compare steam rate of Reheat cycle with that of simple Rankine cycle.

OR

2. a) In a steam power plant, which is working on reheat cycle, the initial steam pressure and maximum temperature are 150 bar and 550 ^{0}C respectively. If the condenser pressure is 0.1 bar and the moisture at the condenser inlet is 5 %, and assuming ideal processes, determine

   i) reheat pressure **ii)** The cycle efficiency **iii)** Steam rate

   b) Draw the Reheat Rankine cycle on T-s and h-s diagrams and compare steam rate of Reheat cycle with that of simple Rankine cycle.

UNIT–II

3. a) Explain the working of blow off cock with neat sketch?

   b) Differentiate between Water tube and Fire tube boilers with proper examples?

OR

4. a) A 30 meter high chimney is used to produce a natural draught of 15 mm of water. The temperature of the hot gasses inside the chimney is 2870 C and the outside air is 270 C. Find the mass of air used per kg of fuel

   b) Define draught and explain the types of draughts

UNIT–III

5. a) Write the effect of friction on flow through steam nozzle?

   b) Steam at pressure of 10 bar and 0.9 dry discharges through a nozzle having throat area of 350 mm^2. If the back pressure is 1.4 bar.

      i. Find final velocity of the steam

      ii. Cross sectional area of the nozzle at exit for maximum discharge.

OR

6. a) Explain the working of a high level Counter flow jet condenser with a neat diagram?

   b) Explain the working of central flow type surface condenser with a neat sketch?

UNIT–IV

7. a) In single stage impulse turbine, the nozzle angle is 30^0 and the blade speed is 215 m/s. The steam speed is 550 m/s. The blade velocity coefficient is 0.85. Assuming axial exit and a flow rate of 700 kg/hr, determine:
   i. Blade angles
   ii. Absolute velocity of steam at exit
   iii. The power output of the turbine

   b) Explain pressure compounding in steam turbines with neat sketch.

OR

8. a) Draw the diagram of velocity triangles of an impulse turbine blade?

   b) The velocity of steam leaving the nozzles of a impulse turbine is 1200 m/s and the nozzle angle is 20^0. The blade velocity is 375 m/s and the blade velocity coefficient is 0.75. Assuming no loss due to shock at inlet, calculate for a mass flow of 0.5 kg/s and symmetrical blading
   i. blade inlet angle
   ii. driving force on the wheel
   iii. axial thrust on the wheel
   iv. Power developed by the turbine.

UNIT–V

9. a) The speed of rotation of a blade group of a reaction turbine is 3000rpm. The mean blade velocity is 100m/s. the blade speed ratio is 0.56 and the exit angle of the blade is 20^0C. if the mean specific volume of the steam is 0.65mm^3/kg, and the mean height of the blades is 25mm. calculate the mass flow steam through the turbine. Neglect the effect of blade thickness on the annulus area and assume 50% reaction blading.

   b) Derive an equation for condition of maximum efficiency of reaction turbine

OR

10. a) Discuss briefly the methods of governing a simple steam engine.

    b) Explain various parts of steam engine

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