Hall Ticket No : **Question Paper Code :**

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)

III/IV B. Tech I- Semester Regular Examinations Nov - 2017

DESIGN OF MACHINE ELEMENTS-I

(Open Elective)

Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT –I

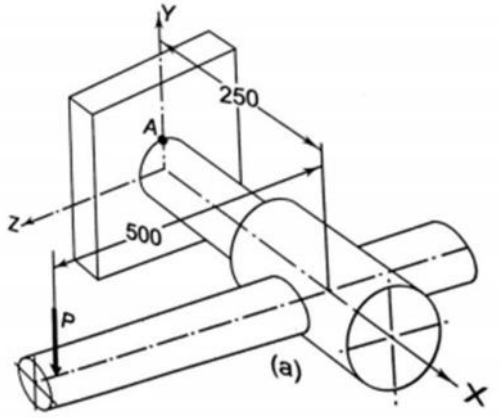
1. a) Explain the BIS designation of plain carbon steel and alloy steel . **(6M)**
   b) Explain design procedure of machine element with example . **(6M)**

(OR)

2. a) Explain manufacturing considerations on welding and forging. **(4M)**
   b) What are the requirements of machining element? **(4M)**
   c) Briefly classify different types of iron. **(4M)**

UNIT- 2

3) a) The shaft of an overhang crank subjected to a force of 1 KN is shown in figure. The shaft is made of plain carbon steel 45C8 and tensile yield strength is 380 N/mm 2 . The factor of safety is 2. Determine the diameter of the shaft using the maximum shear stress theory. **(6M)**



All dimensions are in mm.

b) A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of 250 N/mm^2 . The bar is made of steel 40C8 (Sut = 600 N/mm^2). Calculate the life of the bar for a reliability of 90%. (Assume Ka = 0.44.) **(6M)**

(OR)

4 a) It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 KN. The rods are co-axial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimensions of its components. Select suitable material for the parts. **(7M)**

b) Explain Maximum shear stress and Distortion energy theories of failure? **(5M)**

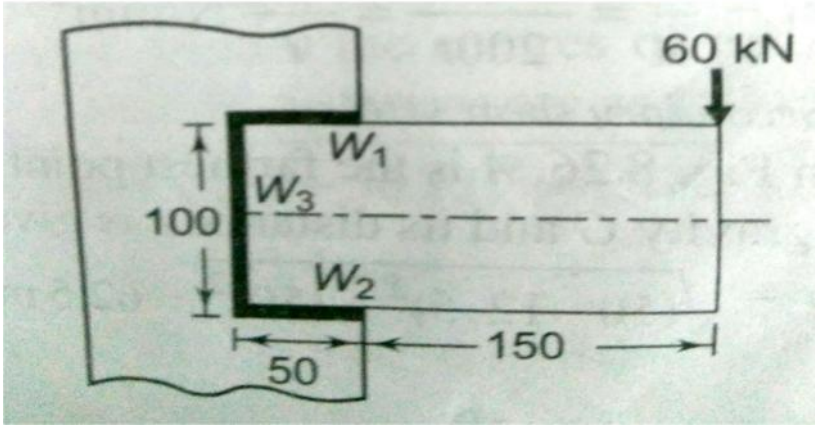
UNIT-III

5 a) The nominal diameter of a triple threaded square screw is 50mm while the pitch is 8mm.It is used with collar having outer diameter of 100mm and inner diameter of 65mm.The coefficient of friction at the thread surface and collar surface can be taken as 0.15.The screw is used to raise a load of 15KN using uniform wear theory of collar friction .Calculate i) torque required to raise the load. ii)Torque required to lower the load. Iii) the force required to raise the load if applied at radius of 500mm. **(8M)**

b) What are the advantages of welded joints over riveted joints and draw the different types of welded joints . **(4M)**

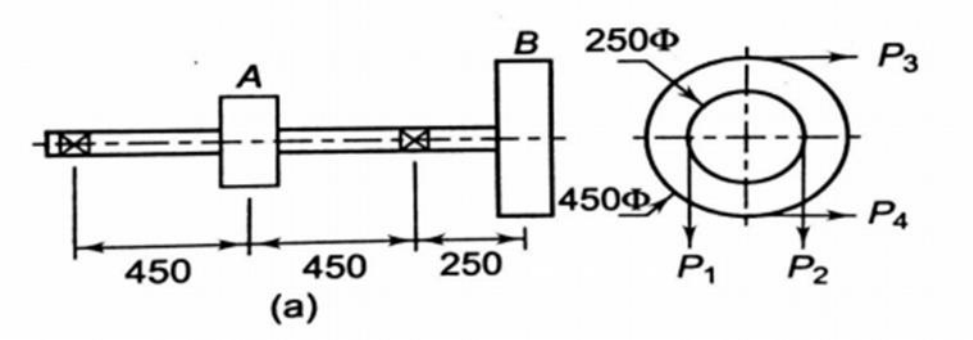
(OR)

6 a) A weld connection as shown in the fig.is subjected to an eccentric load of 60KN in the plane of welds .Determine the size of the welds if permissible shear stress for the weld is 100N/mm^2. Assume static conditions **(12M)**



UNIT –IV

7) A line shaft supporting two pulleys A and B is shown in figure. Power is supplied to the shaft by means of a vertical belt on the pulley A, which is then transmitted to the pulley B carrying a horizontal belt. The ratio of belt tension on tight and loose sides is 3:1. The limiting value of tension in the belts is 2.7KN. The shaft is made of plain carbon steel 40C8 (Sut= 650 N/mm ^{2} and Syt =380 N/mm^2). The pulleys are keyed to the shaft. Determine the diameter of the shaft according to the ASME code if, k_b = 1.5 and k_t = 1.0 **(12M)**



(OR)

8. a)It is required to design a rigid type of flange coupling to connect two shafts the input shaft transmits 7.5 kw power at 180 rpm to the output shaft through coupling .The service factor for the application is 1.5.i.e the designed torque is 1.5 times the rated torque .Select suitable materials for the various parts of the coupling. Design the coupling and specify the dimensions of a components. **(8M)**

b) What is the function of key and classify the keys .Explain sunk key**.** **(4M)**

UNIT –V

9. a) It is required to design a helical compression spring subjected to a force of 500N.Thew deflection of the spring corresponding to this force approximately 20mm.The spring index should be 6, the spring is made up of cold drawn steel wire with ultimate tensile strength of 1000N/mm^2 . The permissible shear stress for the spring wire can be taken as 50 % of ultimate tensile strength .Take G = 81370 N/mm^2 .Design a spring and calculate following

i)wire diameter ii) mean coil diameter iii) no of active coils iv) total number of coils v) free length of a spring vi) pitch of the coil and assume a gap of 1mm between the adjacent coils under maximum load conditions .the spring has square and ground ends. **(10M)**

b)Explain nomenclature of multi leaf spring . **(2M)**

(OR)

10. a) A semi-elliptic multi-leaf spring is used for the suspension of the rear axle of a truck. It consists of two extra full-length leaves and ten graduated-length leaves including the master leaf. The centre-to-centre distance between the spring eyes is 1.2 m. the leaves are made of steel 55Si2Mo90 (Syt =1500 N/mm^2 and E = 207 000 N/mm^2) and the factor of safety is 2.5. The spring is to be designed for maximum force of 30 KN. The leaves are pre-stressed so as to equalize stresses in all leaves. Determine (i) the cross-section of leaves (ii) the deflection at the end of the spring. **(5M)**

b) Explain nipping and shot surging in springs. **(4M)**

c) Draw different end styles of a spring. **(3M)**

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Hall Ticket No : **Question Paper Code :**

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)

III/IV B. Tech I- Semester Regular Examinations Nov - 2017

Engineering Thermodynamics – II

(MECHANICAL)

Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT-1

1. a) What is dryness fraction? Explain the functioning of throttling calorimeter with a neat sketch. Also discuss the limitations of this calorimeter. **(6M)**

   b) A throttling calorimeter is used to measure the dryness fraction of the steam in the steam main which has steam flowing at a pressure of 8 bar. The steam after passing through the calorimeter is at 1 bar pressure and 115 ^{0}C. Determine the dryness fraction of the steam. **(6M)**

(OR)

2. a) i) Why saturated liquid line on PV diagram for a pure substance is steeper than that of the saturated vapor line. Explain. **(3M)**

   ii) Find the enthalpy and entropy of steam when the pressure is 2MPa and the specific volume is 0.09m3/kg. **(3M)**

   b) Steam initially at 0.3Mpa, 250C is cooled at constant volume. i) At what temperature will the steam become saturated vapor? ii) What is the quality at 80C? What is the heat transferred per kg of steam in cooling from 250C to 80C? **(6 M)**

UNIT-2

3. a) Explain the working of reheat Rankine cycle with a schematic and T-s diagram. **(5M)**
   b) A steam power plant operates on the ideal reheat Rankine cycle. Steam enters the high pressure turbine at 8 MPa and 500^{o}C and leaves at 3MPa. Steam is then reheated at constant pressure to 500^{o}C before it expands to 20 kPa in the low pressure turbine. Determine the turbine work output in kJ/kg and the thermal efficiency of the cycle. Also show the cycle on a T-s diagram with respect to the saturation lines? **(7M)**

(OR)

4. a) A simple Rankine cycle works between pressure of 30 bar and 0.04 bar, the initial condition of steam being dry saturated , calculate the cycle efficiency, work ratio, and specific steam consumption. **(6M)**

   b) Explain binary vapour power cycle with neat sketch. **(6M)**

UNIT-3

5. a) Derive the condition for maximum discharge for flow through nozzle. **(6M)**
   b) The inlet conditions to a steam nozzle are 10 bar and 250^c C. The exit pressure is 2 bar. Assuming isentropic expansion and negligible inlet velocity, determine **(6M)**
   i) Throat area ii) The exit velocity and iii) The exit area of the nozzle

(OR)

6. a) Explain the working of high level jet condenser with a neat sketch **(4M)**
   b) During trail on a steam condenser, the following observations were recorded.
   Condenser Vacuum is 680mm of Hg, Barometer reading is 764mm of Hg. Mean condenser temperature is 36.2^0C, Hot well temperature is 30^0C, Condensate formed is 1780 kg per hour, Quality of cooling water is 1250kg/min. Circulating cooling water inlet and exit temperatures are 20^0C and 32^0C respectively **(8M)**
   Determine i) condenser vacuum corrected to standard barometer
   ii) Vacuum efficiency iii)Condenser efficiency
   iv) Condition of the steam as it enters the condenser.
   Assume Rair as 0.287kJ/kgK, Cp of water as 4.186kJ/kgK

UNIT-4

7. a) What is meant by compounding of steam turbine? Explain pressure-velocity compounding of impulse turbine with a neat sketch. **(6M)**
   b) In a simple impulse turbine, nozzles are inclined at 20^o to the direction of motion of moving blades. Steam leaves the nozzle at 375 m/s when blade speed is 165 m/s. The relative velocity of steam as it flows over the blades is reduced by 15% due to friction. Find the suitable inlet and exit angles of blade such that the axial thrust is zero. Also determine the power developed when flow rate of steam is 10 kg/s. **(6 M)**

(OR)

8. a) Write differences between Impulse and Reaction Turbines **(6M)**
   b) Derive an expression for maximum blade efficiency of Parson's reactions turbine. **(6M)**

UNIT-5

9. a) Compare VCRS with VARS **(6M)**
   b) 30 tonnes of ice from and at 0^oC is produced in a day of 24 hrs by an ammonia refrigerator. The temperature range in compressor is from 298K to 258K. The vapour is dry saturated at the end of compression. Assume a 60% COP of the theoretical cycle and calculate power (in kW) required to drive the compressor. Latent heat of ice is 335 kJ/kg. **(6M)**

Temp (K)	Enthalpy (kJ/kg)		Entropy (kJ/kgK)
T_{sat}	h_f	h_g	s_f
298	100.04	1319.22	0.3473
258	-54.56	1304.99	-0.21338

10. a) Explain the following **(6M)**
    i) Specific humidity ii) Relative humidity iii) DBT iv) WBT
    v) Cooling and dehumidification process vi) Heating and humidification process
    b) List out the desirable properties of a refrigerant **(6M)**

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ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)
III/IV B. Tech I- Semester Regular Examinations Nov - 2017
HYDRAULIC MACHINERY AND SYSTEMS
(MECHNICAL)

Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

Unit-I

1. a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of jet. **(4M)**

   b) A jet of water having a velocity of 15m/s strikes a curved vane which moving with a velocity of 5m/s. The vane is symmetrical and it so shaped that the jet is deflected through 120^0. Find the angle of the jet at inlet of the vane so that there is no shock. What is the absolute velocity of the jet at outlet in magnitude and direction and the work done per unit weight of water? **(8M)**

(OR)

2. a) Prove that the force exerted by a jet of water on a fixed semi-circular plate in the direction of the jet when the jet strikes at the centre of the semi-circular plate is two times the force exerted by the jet on a fixed vertical plate. **(8M)**

   b) The head of water from the centre of orifice which is fitted to one side of the tank is maintained at 2m of water. The tank is not allowed to move and the diameter of orifice is 100mm. Find the force exerted by the jet of water on the tank. Take c_v=0.97. **(4M)**

Unit-II

3. a) With a neat sketch explain the layout of a hydro -electric plant. **(6M)**

   b) Determine the power given by the jet of water to the runner of a Pelton wheel which is having tangential velocity as 20m/s. The net head on the turbine is 50m and discharge through the jet water is $0.03m^3/s$. The side clearance angle is 15^o. Take c_v=0.975. **(6M)**

(OR)

4. a) A reaction turbine works at 450 r.p.m under a head of 120 m. Its diameter at inlet is 120 cm and the flow area is 0.4 m^2. The angles made by absolute and relative velocities at inlet and outlet are 20^o and 60^o with the tangential velocity. Assume whirl at outlet to be zero. Determine:
   a. The volume flow rate
   b. The power developed
   c. Hydraulic efficiency **(10M)**
   b. What is a draft tube? Why is it used in a reaction turbine? **(2M)**

Unit-III

5. a) Define the specific speed of a turbine? What is the significance of the specific speed? **(4M)**

   b) What is meant by governing of turbines? Explain with a neat sketch the governing of a Pelton turbine. **(8M)**

(OR)

6. a)Explain the procedure to obtain main characteristic curves of hydraulic turbines. **(6M)**

   b) A turbine develops 9000 kW when running at 100 rpm. The head on the turbine is 30 m. If the head on the turbine is reduced to 18 m, determine the speed and power developed by the turbine. **(4M)**

Unit-IV

7. a) Describe the principle and working of a reciprocating pump with a neat sketch. **(6M)**

   b) A single acting reciprocating pump, running at 50 r.p.m., delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine:
   (i) the theoretical discharge of the pump, (ii) Co-efficient of discharge, and (iii) Slip and the percentage slip of the pump. **(6M)**

(OR)

8. a) What do you mean by manometric efficiency of a centrifugal pump? **(2M)**

   b) What is priming. Why is it necessary. **(4M)**

   c) Obtain an expression for minimum speed for starting a centrifugal pump. **(6M)**

Unit-V

9. a) Draw a neat sketch and explain the principle and working of a hydraulic press. **(6M)**
   b) What is a hydraulic intensifier? Explain its principle and working. **(6M)**

(OR)

10. Write a short note on
    1. Fluid amplification
    2. Closed loop and open loop systems
    3. Hydraulic crane
    4. Hydraulic jack **(12M)**

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ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)

III/IV B. Tech I- Semester Regular Examinations Nov - 2017

Theory of Machines - II

(MECHANICAL)

Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

Unit-1

1. a) The turbine rotor of a ship has a mass of 2.2 tonnes and rotates at 1800 rpm clockwise when viewed from the aft. The radius of the gyration of the rotor is 320 mm. Determine the gyroscopic couple and its effect when the
   i ship turns right at a radius of 250 m with a speed of 25kmph
   ii) ship pitches with the bow rising at an angular velocity of 0.8 rad/s **(8 M)**
   b) Derive the expression for gyroscopic couple **(4M)**

(OR)

2. a) Define sensitiveness and hunting of governor**.** **(4 M)**

   b) Each arm of the porter governor is 300mm long and is pivoted on the axis of rotation. Each ball has a mass of 6kg and sleeve weighs 18 kg. The radius of rotation of the ball is 200mm when the governor begins to lift and 250 mm when the speed ismaximum. Determine the maximum and the minimum speeds and the range of speed of the governor. **(8 M)**

Unit-2

3. a) Explain the concept of equivalent offset inertia forces **(4 M)**

   b) In a vertical double acting steam engine, the connecting rod is 4.5 times the crank. The weight of the reciprocating parts is 120 kg and the stroke of the piston is 440mm. The engine runs at 250 rpm. If the net load on the piston due to steam pressure is 25 kN when the crank has turned through an angle of 30^0 from the the top dead centre, determine the
   i) thrust in the connecting rod
   ii) thrust on the cylinder walls
   iii) crank effort
   iv) thrust on the crank shaft bearing **(8M)**

(OR)

4. a) Define coefficient of fluctuation of energy and speed **(4M)**
   b) The turning moment diagram for a petrol engine is drawn to a vertical scale of 1mm = 500 Nm and a horizontal scale 1mm = 3^0. The turning moment diagram repeats itself after every half revolution of the crank shaft. The areas above and below the mean torque line are 260, -580, 80, -380, 870 and -250 mm^2. The rotating parts have a mass of 55kg and radius of gyration of 2.1 m. if the engine speed is 1600rpm; determine the maximum fluctuation of energy and coefficient of fluctuation of speed. **(8M)**

Unit-3

5. a) Why is balancing necessary for rotors of high speed engines? **(4 M)**
   b) Four masses A, B, C and D carried by a rotating shaft at radii 80 mm, 100 mm, 160 mm and 120 mm respectively are completely balanced. Masses B, C and D are 8 kg, 4 kg and 3 kg respectively. Determine the mass A and the relative angular positions of the four masses if the planes are spaced 500 mm apart. **(8 M)**

(OR)

6. a) What is meant by hammer blow and swaying couple in a 2-cylinder uncoupled locomotive **(4 M)**

   b) Derive the expression for the unbalanced forces in V-Engines. **(8 M)**

Unit-4

7. a) Define logarithmic decrement and damping ratio**.** **(4 M)**

   b) In a single degree damped vibrating system, the suspended mass of 8 kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine the
   i) stiffness of the spring
   ii) logarithmic decrement
   iii) critical damping coefficient
   iv) damping factor **(8 M)**

(OR)

8. a) Define magnification factor and transmissibility ratio **(4M)**
   b) A mass of 10 kg is suspended from one end of a helical spring the other end being fixed. The stiffness of the spring is 10 N/mm. the viscous damping causes the amplitude to decrease to one – tenth of the initial value in four complete oscillations. If a periodic force of 150cos50t N is applied at the mass in the vertical direction, find the amplitude of the forced vibrations. **(8 M)**

Unit-5

9. a) Define critical speed of a shaft. **(2 M)**
   b) A shaft of 40 mm diameter and 2.5 m length has a mass of 15 kg per meter length. It is simply supported at the ends and carries three masses of 90 kg, 140 kg and 60 kg at 0.8 m, 1.5 m and 2 m respectively from the left support. Taking E= 200GPa find the frequency of the transverse vibration. **(10 M)**

(OR)

10. a) What is meant by torsionally equivalent length of a shaft as referred to a stepped shaft? Derive the expression for the equivalent length of a shaft which has several steps. (**6 M)**

    b) The flywheel of an engine driving a dynamo as shown in figure 1has a mass of 180 kg and radius of gyration of 30mm. the shaft at the flywheel end has an effective length of 250 mm and is 50 mm dia. The dynamo mass is 120kg and its radius of gyration is 22.5 mm. the dynamo shaft is 43 mm dia and 250 mm effective length. Calculate the position of node and frequency of torsional oscillation. C=83kN/mm^2. **(6 M)**

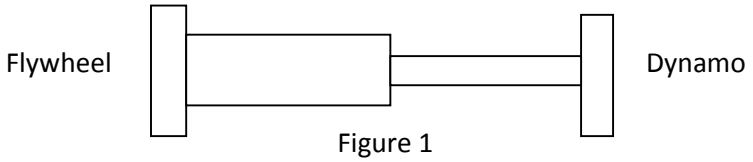

Figure 1

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