Roll No. : ……

Total No. of Questions: 09 **Total No. of Pages : 02**

B.Tech. (ME) (Semester – 4th)

FLUID MACHINES

Subject Code : BTME402-18

Paper ID :

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) **Section A** is **compulsory** and it has **Ten questions**. Each question carries **Two** marks.

2) Attempt **any Four** questions from **Section – B**. Each question carries **Five** marks.

3) Attempt **any Two** questions from **Section – C**. Each question carries **Ten** marks.

Section – A **(10 x 2 Marks = 20 Marks)**

Q1. a) Differentiate between hydraulic energy and mechanical energy with examples?

b) Explain the classification of turbines according to direction of fluid flow with diagram

c) Define the impulse momentum principle?

d) Differentiate between the Mechanical efficiency, Hydraulic efficiency and volumetric efficiency in case of turbine?.

e) Define slip for reciprocating pump and when does the negative slip occurs?.

f) What is priming and its significance.

g) What is Thomas Cavitation Number.

h) Explain with diagram the different types of draft tube.

i) What is the principle of working of reciprocating pump?.

j) What are the various problems commonly experienced during operation of centrifugal pump.

Section – B **(4 x 5 Marks = 20 Marks)**

Q2. Obtain an expression of the force exerted by the jet of water on an unsymmetrical moving curved plate moving with velocity u and when jet strikes tangentially at one of the tips.

Q3. Define the construction and operation of fluid coupling.

Q4. Discuss in detail the working of hydraulic ram with diagram.

Q5. Explain the effect of acceleration and friction in suction and delivery pipes on indicator diagram in reciprocating pump?

Q6. Drive an expression for specific speed of pump.

Section – C **(2 x 10 Marks = 20 Marks)**

Q7. (a) Drive a relation to determine the maximum efficiency of pelton turbine? (4)

(b) Two jets strikes the buckets of a pelton wheel, which is having shaft diameter as 15450 kW. The diameter of each jet is given as 200mm. If the net head on the turbine is 400m, find the overall efficiency of the turbine. Take $C_v = 1.0$ (4)

Q8. A jet of water having a velocity of 30 m/s impinges on a series of vanes mounted on wheel which is rotating at 200 rpm. The jet makes an angle of 20^o with the tangent of wheel at inlet and leaves the wheel with a velocity of 5 m/s at an angle of 130^o to the tangent of wheel at outlet. Water is flowing from outward in a radial direction. The outer and inner radii of the wheel are 0.5m and 0.25m respectively. Draw the triangles of velocities at inlet and outlet and find:

(a) The work done per unit weight of water, and

(b) Efficiency of the wheel. (8)

Q9. Explain with diagram the working of francis Turbine. (8)

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Total No. of Questions: 09 **Total No. of Pages : 02**

B.Tech. (ME) (Semester – 4th)

MATERIALS ENGINEERING

Subject Code : BTME404-18

Paper ID :

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) **Section A** is **compulsory** and it has **Ten questions**. Each question carries **Two** marks.

2) Attempt **any Four** questions from **Section – B**. Each question carries **Five** marks.

3) Attempt **any Two** questions from **Section – C**. Each question carries **Ten** marks.

Section – A **(10 x 2 Marks = 20 Marks)**

Q1. a) Why alloys are harder than pure metals in general?

b) Define grain, grain size, grain boundary with a diagram.

c) Differentiate between polymorphism and allotropy.

d) Differentiate between crystalline and non-crystalline materials.

e) Define Burger vector.

f) State Braggs law.

g) Explain the phenomenon of twinning.

h) Briefly explain lever rule.

i) Explain the phenomenon of slip.

j) What is the role of time in T-T-T curve?

Section – B **(4 x 5 Marks = 20 Marks)**

Q2. (a) What are the factors which determine the degree of substitutional solid solution.

(b) What are the various possible crystalline arrangements? Explain with diagram. (3+5)

Q3. Explain closed packed hexagonal crystal structure with a diagram?

Q4. Determine the percentage volume change that occurs when iron changes from BCC structure to FCC cubic structure.

Q5. Distinguish between normalizing and annealing heat treatments.

Q6. List down the defects which may occur during heat treatment process. What are the causes of these defects? Also suggest appropriate remedies.

Section – C **(2 x 10 Marks = 20 Marks)**

Q7. How engineering materials are classified? What are the various physical properties of materials?

Q8. Describe the phase transformations taking place in hypo- and hyper-eutectoid steels during the hardening process with the help of Iron-carbon equilibrium diagram. What are the factors affecting this process?

Q9. Describe the four-strengthening mechanism of metal.

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Total No. of Questions: 09 **Total No. of Pages : 02**

B.Tech. (ME) (Semester – 4th)

STRENGTH OF MATERIALS - II

Subject Code : BTME403-18

Paper ID :

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) **Section A** is **compulsory** and it has **Ten questions**. Each question carries **Two** marks.
2) **Attempt any Four questions from Section – B. Each question carries Five marks.**
3) **A**ttempt **any Two** questions from **Section – C**. Each question carries **Ten** marks.
4) Assume missing data, if any, suitably.

Section – A **(10 x 2 Marks = 20 Marks)**

Q1. a) Give practical applications of thick and thin cylinder.

b) Discuss Castigliano's first theorem.

c) What are the basic differences between the closed and open helical spring?

d) What is a compound cylinder?

e) State the most common applications of leaf spring.

f) Which type of stresses are produced in a rotating thin disc of uniform thickness?

g) For a crane hook, locate the plane which is severely stressed and its reason.

h) State the distortion energy theory of failure.

i) Where is the maximum hoop stress in a solid rotating circular disc?

j) With a help of a plot, show the trend of variation of shear stress along the section of a I-shaped beam.

Section – B **(4 x 5 Marks = 20 Marks)**

Q2. A thin spherical shell of diameter 1.5 m has wall thickness of 10 mm. Find change in diameter and change in volume of the shell, if water at a pressure of 2 MPa is admitted into it. Take E = 200 GPa and $\mu = 0.3$.

Q3. Drive expression for the circumferential stress induced in a rim type flywheel due to rotation and having material density ρ.

Q4. A steel rod of 5 m length and 10 mm diameter is subjected to an axial load of 5 kN. Find the strain energy stored in the rod if the load is applied (a) gradually and (b) suddenly. Take E = 200 kN/mm2.

Q5. For a complex stress system, three principal stresses are 2σ, 1.5σ and - 1σ. The stress in simple tension at the elastic limit is 200 N/mm2. Find the value of σ according to (a) the maximum shear stress theory and (b) the total strain energy theory. Take μ = 0.25.

Q6. Determine the resultant stresses at P and Q of the frame shown in figure 1. Also find the position of the neutral axis.

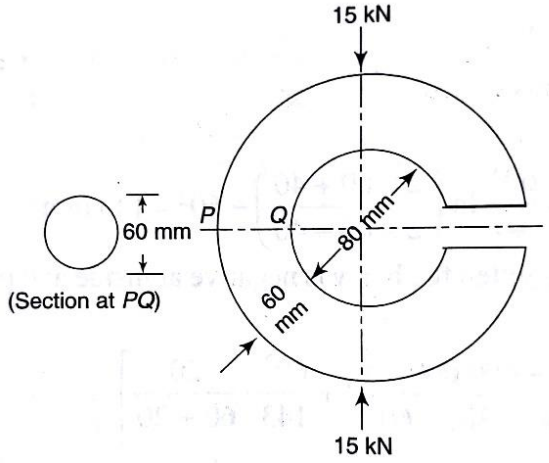

Figure 1

Section – C **(2 x 10 Marks = 20 Marks)**

Q7. A steel hoop of inside diameter 120 mm and outside diameter 180 mm is shrunk on a hollow steel cylinder of inside diameter 75 mm (figure 2). The pressure of shrinkage is 30 MPa. Find the maximum hoop stress induced in the cylinder and the hoop. Also show graphically the hoop stress variation along the radius.

Q8. A T-section beam shown in figure 3 is subjected to a shear force of 10 kN. Draw the shear stress distribution diagram across the section along with stress values.

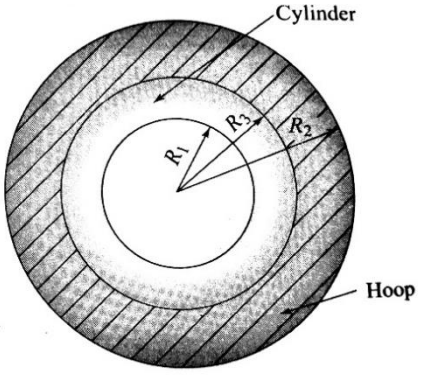

Figure 2

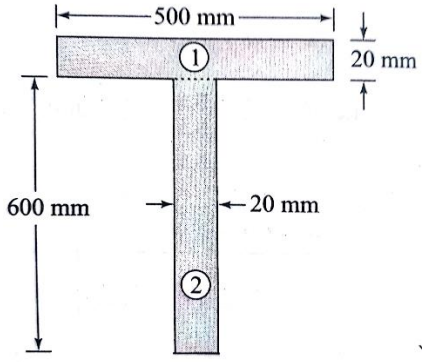

Figure 3

Q9. Drive expression for angle of twist, shear stress and deflection produced in close coiled helical spring under the axial load W.

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Total No. of Questions: 09 **Total No. of Pages : 02**

B.Tech. (ME) (Semester – 4th)

THEROY OF MACHINES - II

Subject Code : BTME405-18

Paper ID :

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) **Section A** is **compulsory** and it has **Ten questions**. Each question carries **Two** marks.
2) **Attempt any Four questions from Section – B. Each question carries Five marks.**
3) **A**ttempt **any Two** questions from **Section – C**. Each question carries **Ten** marks.

Section – A **(10 x 2 Marks = 20 Marks)**

Q1. a) What is free body diagram?

b) Write the condition of equilibrium for a two-force system.

c) What is primary and secondary unbalance force?

d) What is the need of balancing in machines.

e) Define pressure angle in reference to gears with the help of a neat sketch.

f) State D'Alembert's principle.

g) Write the advantages of helical gear over spur gear.

h) Define velocity ratio in context to gear train.

i) What is gyroscopic couple?

j) Explain the term "kinematic synthesis".

Section – B **(4 x 5 Marks = 20 Marks)**

Q2. A connecting rod is suspended from a point 25 mm above the centre of small end and 650 mm above its centre of gravity, its mass being 37.5 kg. When permitted to oscillate, the time period is found to be 1.87 seconds. Find the dynamical equivalent system constituted of two masses one of which is located at small end centre.

Q3. A pair of 20° full-depth involute gears having 30 and 50 teeth respectively of 4 mm module is in mesh. The smaller gear rotates at 1000 rpm. Determine sliding velocities at engagement and at disengagement of a pair of teeth. Assume addendum = 1 module.

Q4. Explain the tabular method to analyse epicyclic gear train with suitable example. Why is this method preferred to analytical method?

Q5. Derive the following expressions, for an uncoupled two cylinder locomotive engine:(a) Swaying couple ; and (b) Hammer blow.

Q6. Describe the classifications of synthesis problem.

Section – C **(2 x 10 Marks = 20 Marks)**

Q7. Four masses A (200 kg), B (300 kg), C (400 kg) and D (200 kg) are attached to a shaft and are rotating at 80 mm, 70 mm , 60 mm and 80 mm radii respectively. Angular placements as measured anti clockwise are from mass A to mass B 45°, from Mass B to mass C 70° from mass C to mass D 120° respectively. Distances of the planes containing B, C, D as measured from plane containing mass A are 300 mm, 400 mm and 700 mm respectively. Balancing masses are to be placed in planes X and Y at a radius of 100 mm. Distance between A and X is 100 mm, between X and Y is 400 mm and between Y and D 200 mm. Find the balancing masses and their angular positions.

Q8. Following are the details of rotor of ship rotating in anti-clockwise direction when viewed from the rear (stern) of the ship.

Mass of the rotor = 3000 kg RPM = 2500 Radius of gyration = 0.5m

Determine the gyroscopic couple and discuss its effect when:

(i) When the ship is steering to right through a curve of 100m at a speed of 25 km/Hr.

(ii) Ship is pitching 60 above and below the normal position with a simple harmonic motion of time period 30 seconds and the bow (fore end) is descending down with its maximum velocity

(iii) Ship is rolling and its angular velocity is 0.05 rad/sec anticlockwise when viewed from stern (rear end).

Q9. In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise.

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Total No. of Questions: 09 **Total No. of Pages : 02**

B.Tech. (ME) (Semester – 4th)

APPLIED THERMODYNAMICS

Subject Code : BTME401-18

Paper ID :

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) **Section A** is **compulsory** and it has **Ten questions**. Each question carries **Two** marks.
2) **Attempt any Four questions from Section – B. Each question carries Five marks.**
3) **A**ttempt **any Two** questions from **Section – C**. Each question carries **Ten** marks.

Section – A **(10 x 2 Marks = 20 Marks)**

Q1. a) Name the four processes involved in Rankine cycle.

b) Explain Stoichiometric combustion.

c) Differentiate between sensible heat and latent heat

d) What is degree of superheat

e) Classify condensers

f) Differentiate between Impulse and Reaction Turbine

g) What is convergent – divergent nozzle.

h) Define Compression ratio.

i) What is the effect of friction on combined velocity triangle?

j) Discuss application of Impulse turbine.

Section – B **(4 x 5 Marks = 20 Marks)**

Q2. Describe the use of combined velocity triangle of impulse turbine.

Q3. What is the effect of super saturation on discharge and heat drop?

Q4. In one stage of a reaction turbine, both the fixed and moving blades have inlet and outlet blade tip angles of 35º and 20º respectively. The mean blade speed is 80m/s and the steam consumption is 22500 kg per hour. Determine the power developed in the pair, if the isentropic heat drop for the pair is 23.5KJ/kg.

Q5. Derive the condition for maximum efficiency of an Impulse Turbine.

Q6. Discuss binary vapour cycle.

Section – C **(2 x 10 Marks = 20 Marks)**

Q7. A steam turbine receives steam superheated steam at a pressure of 17 bar and having a degree of superheat at 110 º C. The exhaust pressure is 0.07 bar and the expansion of

steam takes place isentropically. Calculate 1. the heat supplied, 2. the heat rejected, 3. net work done and 4. the thermal efficiency.

Q8. Derive a condition for maximum efficiency of a reaction turbine.

Q9. Derive a condition for maximum discharge through a nozzle.