Seat
No.

S.Y. B.Tech. (Mechanical Engineering) (Part - II) (CBCS)
(Semester - III) Examination, March - 2023
FLUID MECHANICS
Sub. Code : 73207

Day and Date : Tuesday, 20 - 06 - 2023   Total Marks : 70
Time : 02.30 p.m. to 05.00 p.m.

Instructions :   1)   Question no. 3 and Question no. 4 are compulsory from Section-I.
                 2)   Question no. 7 and Question no. 8 are compulsory from Section-II.
                 3)   Attempt any one question between Question no. 1 and Question no. 2.
                 4)   Attempt any one question between Question no. 5 and Question no. 6.
                 5)   Figures to the right indicate full marks.
                 6)   Draw neat sketches wherever necessary.

SECTION - II

Q1) a)   State and prove Newton's law of viscosity with neat sketch.   [5]

   b)   State or define the following terms: [5]

   i)   Pascal's law

   ii)   Hydrostatic law

   iii) Meta centre

   iv)   Centre of Buoyancy

   v)   Total pressure.

Q2) a)   Define :   [4]

   i)   Stream tube

   ii)   Path line

   iii) Velocity potential function

   iv)   Rotation.

   b)   Derive general continuity equation in three dimensions in Cartesian
        coordinate system for compressible and unsteady flow.   [6]

Q3) a) Derive Euler's equation of motion. [6]

b) State law of conservation of energy. Write the statement of Bernoulli's theorem and Obtain Bernoulli's equation from Euler's equation of motion. [4]

Q4) Solve any two numericals out of the following.

a) A single column 'U' tube manometer, made of glass tubing having a nominal inside diameter of 2.4 mm, has been used to measure pressure in a pipe or vessel containing air. If the limb opened to atmosphere is 10% oversize, find the error in mm of mercury in the measurement of air pressure due to surface tension effects. For mercury surface tension $\sigma = 0.52$ N/m and angle of contact $\theta = 140°$. [7]

b) For the following Stream functions calculate velocity at a point $(1, 2)$:
   i) $\psi = 3xy$
   ii) $\psi = 3x^2y - y^3$

c) A tank has 2 identical orifices on one of its vertical sides. The upper orifice is 3 meters below the water surface and lower one is 5 meters below the water surface. If the value of Cv for each orifice is 0.96, find the point of intersection of the two jets. [8]

SECTION - II

Q5) Derive an expression for the path travelled by free liquid jet issuing from a nozzle. [10]

Q6) a) Define the following terms: [5]
   i) Hydraulic Gradient Line
   ii) Compound pipe
   iii) Equivalent pipe
   iv) Branched pipe
   v) Syphon Pipe

b) Derive the Chezy's formula for loss of head due to fluid friction in a circular pipe flow. [5]

Q7) a) Explain with neat sketch methods of preventing the separation of boundary layer. [5]

b) Explain with neat sketch the following terms: [5]
   i) Bluff body
   ii) Stalling condition for an airfoil.

Q8) Solve any two numericals out of the following.

a) Water at 20°C flows between two large parallel plates separated by a distance of 16 mm. Calculate the maximum velocity and shear stress at the wall, if the average velocity is 0.4 m/s. Take dynamic viscosity of water as 0.01 poise. [7]

b) In a pipe of diameter 350 mm and length 75 m water is flowing at a velocity of 2.8 m/s. Find the head lost due to friction using: [7]

   i) Darcy-Weisbach formula

   ii) Chezy's formula for which C = 55

   Assume kinematic viscosity of water as 0.012 stokes.

c) A flat plate 1.5 m × 1.5 m moves at 50 km/hr in stationary air of density 1.15 Kg/m³. If coefficients of drag and lift are 0.15 and 0.75 respectively. Determine: [8]

   i) The lift force

   ii) The drag force

   iii) The resultant force

   iv) Power required to keep the plate in motion

Summer Examination March - 2023

Subject Name: B.Tech. CBCS_79123_63364_79123_79411 - Machines Tools and Processes_24.06.2023_10.30 AM To 01.00 PM

Subject Code: 79123

Day and Date: - Saturday, 24-06-2023
Time: - 10:30 am to 01:00 pm

Total Marks: 70

Instructions.:

    1) All questions are compulsory
    2) Figures to the right indicate full marks
    3) Use Sketches/Diagrams wherever necessary
    4) Assume suitable data wherever necessary and mention it boldly

Q.1. Solve any two: **[12]**
a) Explain types of core making sand and their properties.
b) Explain with neat sketch metal pouring equipments.
c) Explain working of cupola furnace.

Q.2. Solve any two: **[12]**
a) Define extrusion. Explain direct extrusion process.
b) Explain with neat sketch rolling mill classification.
c) What are the defects associated with extrusion process.

Q.3. Write a short note on (Any two):   **[12]**
a) Injecction molding.
b) Rolling.
c) Induction furnace.

Q.4. Solve any two: **[12]**
a) Classify different types of lathe .Give applications of each type of lathe.
b) Draw block diagram of capstan lathe and explain the principle parts.
c) Classify drilling machines.Explain with neat sketch drill holding devices.

Q.5. Solve any two: **[12]**
a) Describe various operations that are performed on milling machines.
b) Explain working of Hydraulic shaper.
c) Explain with neat sketch different types of milling cutters.

Q.6. Write a short note on (Any two):   **[10]**
a) Gear cutting on milling machine
b) Gear shaving.
c) Water jet machining.

Seat
No.

S.Y. B.Tech. (Mechanical) (Semester - III) (CBCS) Examination, March - 2023
ELECTRICAL TECHNOLOGY
Sub. Code : 73204

Day and Date : Friday, 16 - 06 - 2023

Total Marks : 70

Time : 02.30 p.m. to 05.00 p.m.

Instructions :
1) Attempt any Three questions from each section.
2) Figures to the right indicate full marks.
3) Draw neat labeled diagrams whenever necessary.
4) In case of missing data, assume suitable value. State it clearly.

SECTION - I

Q1) a) Explain construction of DC Motor with their parts and function. [6]

b) Derive torque equation of DC motor. [6]

Q2) a) The power input to the rotor of 440V, 50Hz, 6 pole, 3 phase I.M. is 80KW. The rotor frequency is 1.667 Hz. Calculate - Slip, Rotor speed and Rotor copper loss/phase. [6]

b) Draw & explain Torque-Speed characteristics of 3 phase I.M. Explain the importance of stable operating region of N-T characteristics of 3 phase induction motor. [5]

Q3) a) Draw and explain Start Delta starter for three phase I.M. [6]

b) State and explain speed control methods for 3 phase I.M. from stator side. [5]

Q4) Answer any Two [2 × 6 = 12]

a) Explain Reversal of rotation of DC motor.

b) Draw & explain types of 3 phase I.M.

c) State and explain speed control methods for 3 phase I.M. from rotor side.

P.T.O.

SECTION - II

Q5) a) Draw & explain Working principle of single phase Induction Motor. [6]

b) Draw & explain construction, working of DC Servo Motor. State their Applications. [6]

Q6) a) Define Electrical drive. Why nowadays it is popular than mechanical drive?[6]

b) Compare Group drive & Individual drive. [5]

Q7) a) Compare electric heating with coriventioral heating on following aspects-Cleanliness, Pollution, Maintenance, Fuel storage, Precise temperature control & Protection. [6]

b) Explain construction and working of Indirect arc furnace. [5]

Q8) **Answer any Two** [2 × 6 = 12]

a) Write a short note on Stepper motor.

b) Explain 4 quadrant operation of DC motor.

c) Explain construction and working of Direct Resistance heating.

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Seat
No.

S.Y. B.Tech. (Mechanical) (Semester - III) (CBCS)
Examination, March - 2023
APPLIED THERMODYNAMICS
Sub. Code : 73205

Day and Date : Saturday, 17 - 06 - 2023   Total Marks : 70
Time : 02.30 p.m. to 05.00 p.m.

Instructions :   1)   All questions are compulsory.
                 2)   Figures to the right indicate fill marks.
                 3)   Assume suitable data if necessary.
                 4)   Use of steam table, Mollier - chart are allowed.
                 5)   Use of non-programmable calculator is allowed.

Q1) a)   Write note on heat engine, refrigerator and heat pump.   [5]

                                    OR

State Clausious theorem and hence prove that entropy as property.

   b)   A constant volume chamber of $0.3 \, m^3$ capacity contain 2 kg of the gas at
        5°C. The heat is transferred to gas until temperature is 100°C. Find change
        in entropy. Take Cp = 1.985 kJ/kg. K and Cv = 1.507 kJ/kg. K.   [6]

Q2) a)   Explain :   [5]
        i)   Specific steam consumption   ii)   Work ratio
        iii) Relative efficiency   iv)   Cycle efficiency

   b)   In Rankine cycle the steam at inlet to turbine is saturated at a pressure of
        35 bar and the exhaust pressure is 0.2 bar, determine   [7]
        i)   Turbine work   ii)   The pump work
        iii) Rankine efficiency

Q3) a)   How steam condensers are classified? Compare Jet condenser and Surface
        condenser.   [5]

                                    OR

Explain any one fire tube boiler with sketch.

   b)   The following data were obtained from test of surface condenser
        Condenser vacuum = 711 mm of Hg.   [7]
        Hot well temperature = 32 °C
        Inlet temperature of circulating water = 12°C
        Barometer reading = 760 mm of Hg.
        Calculate vacuum efficiency and condenser efficiency

                                                                            P.T.O.

Q4) a) Explain with the help of h-s diagram, the term supersaturated flow and significance of Wilson's line. [5]

OR

Show that, the maximum discharge of steam through a nozzle takes place when the ratio of steam pressure at the throat to the inlet pressure is given by,

$$\frac{P_2}{P_1} = \left(\frac{2}{n+1}\right)^{\frac{n}{n-1}}$$

b) Steam at an initial pressure of 7 bar and in dry saturated condition flows through a convergent divergent nozzle having a throat area 3.5 cm². The pressure at exit plane is 1.4 bar and exit velocity is 700 m/s. The flow from nozzle entrance to throat is reversible and adiabatic, determine the exit area of nozzle and overall efficiency. [7]

Q5) a) Define the following : [5]
i) Diagram efficiency
ii) Blade velocity coefficient
iii) Speed ratio
iv) Stage efficiency

b) In a simple impulse turbine, the nozzles are inclined at 20° to the direction of motion of moving blades. The steam leaves the nozzle at 375 m/s. the blade velocity is 165 m/s. Calculate the suitable angle at inlet and outlet for the blades in order that the axial thrust is zero. The relative velocity of the steam as it flows over the blades is reduced by 15% by friction. Also determine the power developed for a flow rate of 10 kg/s. [7]

Q6) a) Define the term degree of reaction for steam turbine. Show it is 50% for Parson's reaction turbine. [5]

OR

Explain the pressure compounding of impulse turbine showing pressure and velocity variations along the axis of turbine.

b) The following data refers to a particular stage of Parson's reaction turbine. [6]

i) Speed – 1500 rpm
ii) Mean diameter of the rotor – 1m
iii) Stage efficiency – 80%
iv) Speed ratio – 0.7
v) Blade outlet angle – 20°

Find the isentropic enthalpy drop in the stage.

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Seat No.

S.Y. B.Tech. (Mechanical Engineering) (Part - II) (CBCS)
(Semester - III) Examination, March - 2023
METALLURGY
Sub. Code : 73206

Day and Date : Monday, 19 - 06 - 2023   **Total Marks : 70**
Time : 02.30 p.m. to 5.00 p.m.

Instructions :   1)   **All questions are compulsory.**
    2)   **Figures to the right indicate full marks.**

Q1) Solve any two.

a)   What you mean by solid solution differentiate substitution and interstitial solid solution.   **[6]**

b)   What is coring and Dendritic structure? Explain with neat sketches. **[6]**

c)   Explain what cooling curves are. Draw different types of cooling curves and evaluate degree of freedom of anyone   **[6]**

Q2) a)   Draw Iron - Iron Carbide (Fe-Fe3C) Equilibrium diagram, along with all the reactions, phases, and temperatures.   **[8]**

b)   Draw self explanatory sketches of typical micro structures of medium carbon steel and high carbon steel   **[7]**

OR

c)   Classify plain Carbon Steels. Write down properties and applications of plain Carbon Steel.   **[7]**

Q3) Solve any two.

a)   Explain with sketch Stages in Dye Penetrant test.   **[4]**

b)   Draw self explanatory sketch of Gamma-Ray radiography   **[4]**

c)   Differentiate clearly between fatigue and creep testing.   **[4]**

Q4) Solve any two.

  a) Explain the mechanism of transformation austenite into upper and lower bainite. [6]

  b) Draw self explanatory sketches of salt bath furnace and Pit type heat treatment furnace. [6]

  c) Explain in detail the procedure to draw TTT diagram for eutectoid steel. [6]

Q5) a) What is annealing and what are the purposes of annealing? explain any two types of annealing with their purpose. [8]

  b) Explain tempering heat treatment along with the structural changes involved in it. [7]

OR

  c) What are the various heat treatment defects [7]

Q6) Solve any two.

  a) Explain with net sketch process of compacting in powder metallurgy. [4]

  b) Draw self explanatory sketch of Y cone type powder mixer. [4]

  c) Draw Flowchart for manufacturing of self lubricating bearings? [4]

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Seat
No.

S.Y. B.Tech. (Mechanical Engineering) (Part - II) (CBCS) (Semester - IV) Examination, March - 2023

THEORY OF MACHINES - I

Sub. Code : 79122

Day and Date : Wednesday, 21 - 06 - 2023   **Total Marks : 70**

Time : 10.30 a.m. to 01.30 p.m.

Instructions :   1)   Figures to the right indicate full marks.

                 2)   Use of non-programmable calculator is allowed.

                 3)   Assume suitable data if necessary.

Q1) a)   Define :   **[6]**

           i)   Kinematic Link

           ii)   Kinematic Pair

           iii)   Kinematic Chain

           iv)   Mechanism

OR

a)   Explain any two inversions of single slider crank chain mechanism. **[6]**

b)   In a pin jointed four bar mechanism, as shown in Fig. 1, AB = 300 mm, BC = CD = 360 mm and AD = 600 mm. The angle BAD = 60°. The crank AB rotates uniformly at 100 rpm. Locate all the instantaneous centers and find the angular velocity of the link BC. **[6]**
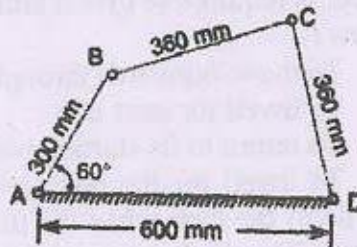
Fig 1

Q2) In the mechanism, as shown in Fig. 2, the crank OA rotates at 20 r.p.m. anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are OA = 300 mm; AB = 1200 mm; BC = 450 mm and CD = 450 mm. For the given configuration, determine : **[12]**
- a) Velocities of sliding at B and D
- b) Angular velocity of CD
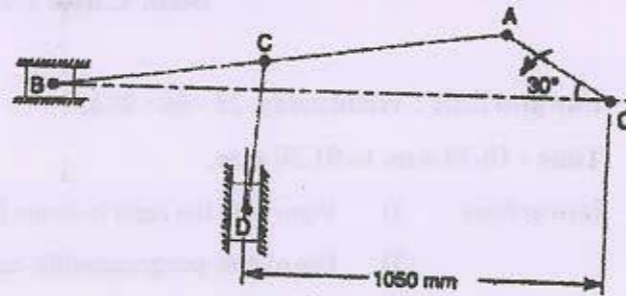- c) Linear acceleration of D
- d) Angular acceleration of CD.

Fig 2.

Q3) a) Define efficiency of a screw jack and derive equation for efficiency of a screw jack. **[5]**

OR

- a) Derive the equation for torque required to overcome in pivot bearing using uniform pressure theory. **[5]**
- b) A conical pivot supports a load of 20 kN, the cone angle is 120° and the intensity of normal pressure is not to exceed 0.3 N/mm². The external diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 rpm and the coefficient of friction is 0.1, find the power absorbed in friction. Assume uniform pressure. **[6]**

Q4) a) List motion of the follower and draw neat sketch of one displacement diagram. **[4]**
- b) A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below : **[8]**
  - i) To move outwards through 40 mm during 120° rotation of the cam
  - ii) To dwell for next 80°
  - iii) To return to its starting position during next 90°
  - iv) To dwell for the rest period of are revolution i.e. 90°. Draw the profile of the cam when the line of stroke of the follower is off-set by 15 mm. The displacement of the follower is to take place with uniform acceleration and uniform retardation.

Q5) a) Explain open belt drive and drive with idler pulley. **[4]**

OR

- a) Derive an equation for belt tension ratio. **[4]**
- b) A 2.5 kW of power is transmitted by an open belt drive the linear velocity of the belt is 2.5 m/s. The angle of lap on smaller pulley is 165°. The coefficient of friction between smaller pulley surface and belt = 0.3. Determine power transmission if Increasing the initial tension in the belt by 8 percent. **[8]**

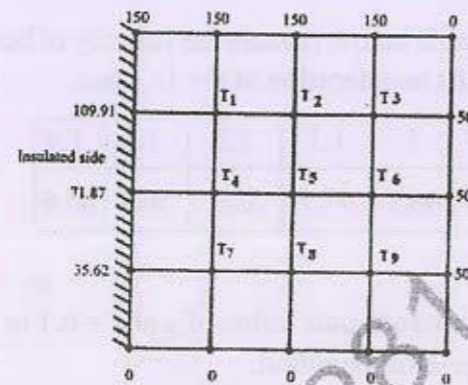*Q6)* a) Define stability and hunting of governor. **[4]**

OR

- a) Explain Isochronism for Porter and Hartnell governor. **[4]**
- b) A Hartnell governor having central sleeve spring and two right angled bell crane level moves between 290 rpm and 310 rpm for sleeve lift of 15 mm. The sleeve arms and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The balls are parallel to the governor axis at lowest equilibrium speed. Determine : **[7]**
  - i) Load on the spring at lowest and highest equilibrium speeds.
  - ii) Stiffness of the spring.

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Q1) a) The beam is subjected to linear distributed load. The equation to determine the point of maximum deflection (i.e. the value of x, where $f(x) = \dfrac{dy}{dx} = 0$) from the resulting elastic curve is given by

$f(x) = -5x^4 + 2160000x^2 - 1.296 \times 10^{11} = 0$ start with initial guesses of $x = 250$ cm and $x = 375$ cm. Use Bisection method to determine the point of maximum deflection (i.e.x) Perform 3 iterations. **[5]**

b) Using Muller method, find the root of equation

$f(x) = x^3 + 2x^2 + 10x - 20 = 0$ perform only ONE iteration . Assume root lies between $x_1 = 0$ and $x_3 = 2$ **[6]**

OR

b) Find the roots of

$x^2 + xy - 10 = 0$

$y + 3xy^2 - 57 = 0$

by Newton-Raphson method, with initial values, $x_0 = 1.5$ and $y_0 = 3.5$ perform ONE iteration in detail. **[6]**

P.T.O.

Q6) Solve the following.

a) The wall is made up of bricks as shown in figure. The surfaces of wall are maintained at different temperatures. Due to difference in temperatures, heat transfer takes place due to conduction as per the Laplace Equation of heat conduction which is **[8]**

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$

Find the temperatures of wall at different intermediate mesh points using Numerical method. Perform rough calculations and Two iterations only.

Figure: Top row values 150, 150, 150, 150, 0. Left side values 109.91, Insulated side, 71.87, 35.62. Mesh points T_1 T_2 T_3 | T_4 T_5 T_6 | T_7 T_8 T_9. Right side values 50, 50, 50. Bottom row 0, 0, 0, 0.

b) Give classification of Second Order Partial Differential Equations and classify following equation: **[4]**

$$\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + (x^2 + 4y^2)\frac{\partial^2 u}{\partial y^2} = \sin(x+y)$$

OR

b) Derive Crank-Nicholson formula for Parabolic equations. **[4]**

Q2) a) Consider three walls in Cartesian co-ordinate system. These are represented by following equations. If these walls are intersecting each other at one point then find the point of intersection of walls by using Gauss elimination method. **[6]**

$$2x + 2y - z = 6$$
$$x + y + 2z = 8$$
$$-x + 3y + 2Z = 4$$

b) Solve using Gauss-Siedel method. Perform FOUR iterations only. **[6]**

$$10x - 5y - 2z = 3$$
$$4x - 10y + 3z = -3$$
$$x + 6y + 10z = -3$$

OR

b) Use LU decomposition method to solve the following equations **[6]**

$$7x + 2y - 5z = -18$$
$$x + 5y - 3z = -40$$
$$2x - y - 9z = -26$$

Q3) a) Find the $f(9)$ using Newton's divided difference formula **[6]**

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

b) The observation of growth of disease is noted down per week. It is summarized below:

Weeks (x)	1	2	3	4	5	6
No. of patients (y)	49	54	60	73	80	86

It is found that the data is increased linearly with respect to week. Fit straight line $y = ax+b$ to predict the number of patients. **[6]**

OR

b) Find the missing term in the following table using Lagrange's interpolation formula: **[6]**

x	0	1	2	3	4
y	1	3	9	–	81

-2-

Q4) a) The vertical distance covered by rocket from t=8 to t = 30 second is given by $x = \int_8^{30} \left\{ 2000 ln \left| \frac{140000}{140000 - 2100t} \right| - 9.8t \right\} dt$ use two segment (n=2) Trapezoidal rule to find the distance covered from t = 8 to t = 30. **[6]**

b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's 3/8th rule. **[6]**

OR

b) The table below reveals the velocity of body during the time 't' specified. Find its acceleration at t = 1. 1 sec. **[6]**

t	1	1.1	1.2	1.3	1.4
$y = V$	43.1	47.7	52.1	56.4	60.8

Q5) a) Find approximate value of y at $x = 0.1$ in one step by using Fourth order Runge-Kutta method. **[5]**

Given $\frac{dy}{dx} + y + xy^2 = 0$ and $y(0) = 1$

b) Find the value of y (0.1) by Taylor's series method **[6]**

$$\frac{dy}{dx} = x^2 + y^2 \text{ Given, } y(0) = 1$$

OR

b) Use Power method to find dominant (Larger) Eigen value and the corresponding Eigen vector for the following matrix correct to one decimal point. **[6]**

$$\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix}$$

Also find the other Eigen value.

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Seat
No.

S.Y.B.Tech. (Mechanical Engg) (Semester - III) (CBCS)
Examination, March - 2023
ENGINEERING MATHEMATICS-III
Sub. Code : 73203

Day and Date : Thursday, 15 - 06 - 2023   Total Marks: 70
Time : 2.30 p.m. to 05.00 p.m.

Instructions: 1)   Attempt any three questionsfrom each section.
                 2)   Figures to the right indicate full marks.
                 3)   Use of no-Programmable calculator is allowed.
                 4)   Assume suitable data if necessary.

SECTION-A

Q1) Solve the following.

a)   Solve (D^3-D^2+3D+5) $y=e^x \cos 3x$ **[6]**

b)   Solve (D^3+3D^2+2D) $y=x^2$ **[6]**

Q2) Solve the following.

a)   Followings are the marks in Statistics (x) and Mathematics (y) of the
      students.   **[6]**

x	56	55	58	58	57	56	60	54	59	57
y	68	67	67	70	65	68	70	66	68	66

Calculate the coefficient of correlation and the line of regression of y on x.

b)   Fit a stright line $y=a+bx$ to the following data.   **[5]**

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

Q3) Solve the following.

a)   Evaluate $\int_0^\infty t^3 e^{-t} \sin t \, dt$.   **[5]**

b)   Find inverse Laplace transform of $\dfrac{1}{(s+1)(s^2+1)}$ **[6]**

P.T.O.

Q4) Attempt any two from the following.

a) Solve $x^3 \dfrac{d^3 y}{dx^3} + 2x^2 \dfrac{d^2 y}{dx^2} + 2y = \dfrac{1}{x} + x$ [6]

b) Fit a curve of the form $y = ab^x$ to the following data.   [6]

x	1	2	3	4	5	6	7	8
y	1	1.2	1.8	2.5	3.6	4.7	6.6	9.1

c) Using Laplace transforms method solve $\dfrac{d^2 y}{dx^2} - 3\dfrac{dy}{dx} + 2y = 4t + e^{3t}$ ‿en $y(0) = 1$ and $y'(0) = -1$.   [6]

SECTION-II

Q5) Attempt the following questions.

a) If $\vec{V} = xyz\,\overline{i} + 2x^2 y\,\overline{j} + (xz^2 - y^2 z)\,\overline{k}$ then find $div\,\vec{V}$, $curl\,\vec{V}$ and show that $curl\,\vec{V}$ is solenoidal.   [6]

b) Find the directional derivative of $\phi = x^2 y^2 + y^2 z^2 + z^2 x^2$ at the point $P(1,1,2)$ in the direction of the tangent to the curve $x = e^{-t}$, $y = 2\sin t + 1$ and $z = t - \cos t$ at $t = 0$.   [5]

Q6) Attempt the following questions.

a) Expand the function $f(x) = x\sin x$ as a Fourier series in the interval $-\pi \le x \le \pi$.

Hence deduce that $\dfrac{1}{1.3} - \dfrac{1}{3.5} + \dfrac{1}{5.7} - \dfrac{1}{7.9} + \dots = \dfrac{\pi - 2}{4}$ [7]

b) Find the half range cosine series for $f(x) = (x-1)^2$ in the interval $0 \le x \le 1$.

Heance show that $\dfrac{1}{1^2} + \dfrac{1}{2^2} + \dfrac{1}{3^2} + \dots = \dfrac{\pi^2}{6}$ [5]

Q7) Attempt any one from the following.

a) Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in the following figure by Gauss-Seidel method. Carry out two iterations.   [11]

b) Solve the partial differential equation $\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$ with boundary conditions $\dfrac{\partial u}{\partial x}(0,t) = \dfrac{\partial u}{\partial x}(l,t) = 0$ for $t > 0$ and intial condition $u(x,0) = x$, $0 < x < l$.   [11]

Q8) Attempt any Two from the following.

a) If $\overline{r} = x\overline{i} + y\overline{j} + z\overline{k}$ and $|\overline{r}| = r$ then prove that $\nabla^2 f(r) = f''(r) + \dfrac{2}{r} f'(r)$ [6]

b) Obtain the Fourier series for the function $f(x) = \begin{cases} \pi x & ; \ 0 \le x \le 1 \\ \pi(2-x); & 1 \le x \le 2 \end{cases}$ [6]

c) Using method of separation of variables, solve $\dfrac{\partial u}{\partial x} = 2\dfrac{\partial u}{\partial t} + u$ with $u(x,0) = 6e^{-3x}$.   [6]

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Q6) a) What are the assumptions made in the Euler's column theory? **[5]**

b) A solid round bar of 4m long and 50 mm in diameter was found to extend 4.6 mm under a tensile load of 50 kN. This bar is used as strut with both ends hinged. Determine the cripping load for the bar. **[6]**

OR

b) A tension bar 4 m long is made up of two parts, one part 2.5 m long has a cross sectional area of 1000 mm² and another 1.5m long having cross sectional area of 2000 mm² as shown in fig. 5. If an axial load of 100 kN is gradually applied. Find the total strain energy produced in the bar. Take E = 2 ×10⁵ N/mm². **[6]**

Fig. 5
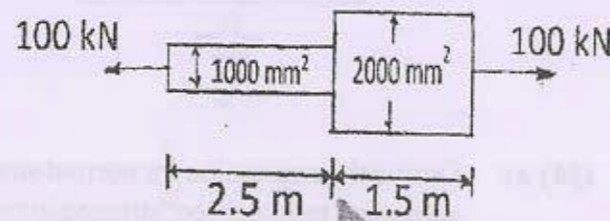
Total No. of Pages : 4

Seat No.

S.Y. B.Tech. (Mechanical) (Semester - IV) (CBCS) Examination, March - 2023
ANALYSIS OF MECHANICAL ELEMENTS
Sub. Code : 79120

Day and Date : Saturday, 17 - 06 - 2023   **Total Marks : 70**
Time : 10.30 a.m. to 1.00 p.m.

Instructions :
1) All questions are compulsory.
2) Assume suitable data wherever necessary and state it clearly.
3) Figures to the right indicate full marks.
4) Draw neat and labelled sketches whenever necessary.
5) Use on non-programmable calculator is allowed.

Q1) a) Three bars made up of copper, zinc and aluminium are of equal length and have cross section area 500 mm², 750 mm² and 1000 mm² respectively. They rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 250 kN as shown in fig .1, calculate the load carried by each rod as well as stresses generated in each rod.

Take the value of E for copper = 1.3 ×10⁵ N/mm², for zinc = 1×10⁵N/mm² and for aluminium = 0.8×10⁵ N/mm². **[8]**

Fig. 1
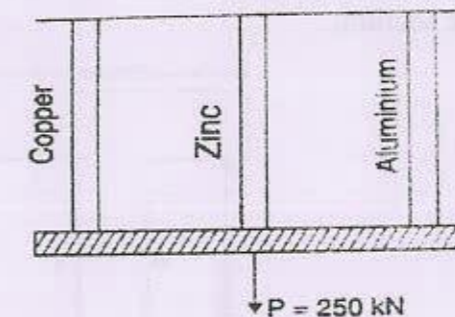
b) Define the following terms: **[4]**
i) Bulk Modulus
ii) Poisson's Ratio

OR

b) Draw stress - strain diagram of ductile and brittle meterial subjected to axial loading and explain the important points of diagram. **[4]**

P.T.O.

Q2) a) Draw shear force diagram or bending moment diagram for loading condition shown in fig. 2. [7]
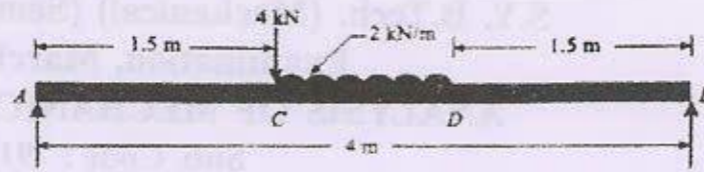

Fig. 2

b) Derive the expression for maximum torque transmitted by circular solid shaft. [4]

OR

b) To shafts of the same material and of same lengths are subjected to the same torque, if the first shaft is of a solid circular section and the second shaft is of hollow circular section, whose internal diameter is 2/3 of the outer diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shaft. [4]

Q3) a) The shear force acting on a beam at an I-section with unequal flanges is 50 kN. The section is shown in fig. 3. The moment of inertia of the section about neutral axis is 2.849×10^8 mm⁴. Calculate the shear stress at neutral axis and also draw shear stress distribution over the depth of the section. [12]
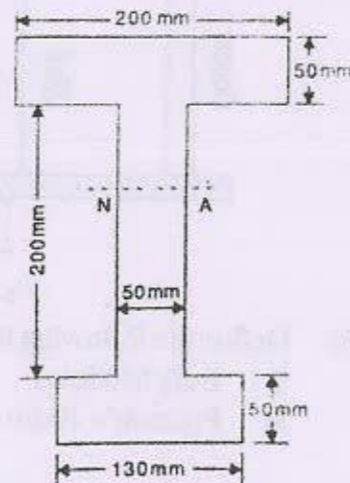

Fig. 3

OR

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b) Two wooden planks 50 mm × 150 mm each are connected together to form a cross-section of a beam as shown in fig. 4. If a bending moment of 3400 Nm is applied about the horizontal neutral axis, find the stresses at the extreme fibres of the cross-section. [12]
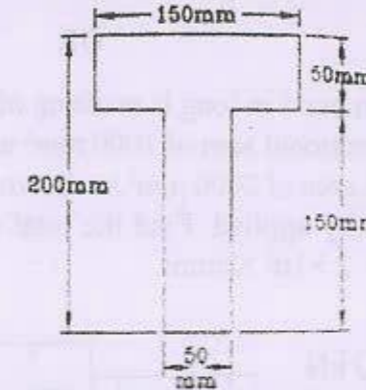

Fig 4

Q4) a) Derive the expression for normal stress and tangential stress when member subjected to like direct stresses in two mutually perpendicular directions. [6]

b) At a point in a strained material the principal tensile stresses across two perpendicular planes, are 80 N/mm² and 40 N/mm². Determine normal stress, shear stress and resultant stress on a plane inclined at 30° with the major principal plane. [6]

OR

b) The stresses at a point in a bar are 200 N/mm² (tensile) and 100 N/mm² (compressive). Using Mohr's circle method determine the normal stress, shear stress and resultant stress on a plane inclined at 60° to the axis of the major stress. [6]

Q5) a) Derive an expression for slope and deflection of a simply supported beam of length L, carrying UDL over the entire length of beam. [6]

b) A cantilever beam of length 3m carrying a point load of 50 kN at a distance of 2m from the fixed end. If $I = 10^8$ mm⁴ and $E = 2 \times 10^5$ N/mm². Find the slope at the free end and deflection at the free end. [6]

Q5) Write about Biodiversity Hot spots and explain detail about Western Ghats.[10]

OR

Explain in detail Causes, effects and control measures of Thermal and Radioactive pollution.

Q6) What are urban problems related to energy? Add note on rain water harvesting.

[10]

OR

What is disaster management? Explain with floods and earthquake.

मराठी रूपांतर

सूचना :   1)   सर्व प्रश्न आवश्यक आहे.

2)   उजवीकडील अंक पूर्ण गुण दर्शवितात.

प्र.1) खालीलपैकी योग्य पर्याय निवडा.   [10 × 1 = 10]

i)   ज्या पृष्ठभागावरून पावसाचे वाहत जाणारे पाणी एकत्र केले जाते त्याला .... म्हणतात.

अ)   पावसाच्या पाण्याचे संकलन   ब)   पाणलोटक्षेत्र

क)   पाणी स्थापना   ड)   वरीलपैकी काहीही नाही

ii)   खालीलपैकी कोणते अक्षय संसाधने / उर्जा स्त्रोत आहे?

अ)   पेट्रोलियम / तेल   ब)   युरेनियम

क)   पवन ऊर्जा   ड)   कोळसा

-4-

Seat No.

All Course (Semester - IV) (CBCS) Examination, March - 2023

ENVIRONMENTAL STUDIES (पर्यावरण अभ्यास)

Sub. Code : 78928/83229/64275/51077/84775/79118

Day and Date : Sunday, 18 - 06 - 2023   **Total Marks : 70**

Time : 10.30 a.m. to 01.30 p.m.

Instructions :   1)   All questions compulsory.

3)   Figures to the right indicate full marks.

Q1) Multiple Choice Question.   [10 × 1 = 10]

i)   The surface area from which runs off rainwater is collected is called
_____.

a)   Rainwater Harvesting   b)   Catchment Area

c)   Water establishment   d)   None of the above

ii)   Which of the following is the Renewable source of energy?

a)   Petroleum   b)   Uranium

c)   Wind   d)   Coal

iii)   Which of the following is the most environmental friendly agriculture practice?

a)   Organic farming   b)   By chemical fertilizer

c)   By pesticides   d)   None of the above

iv)   Which of the following is a point source of water pollution?

a)   Agricultural lands   b)   Suburban land

c)   Factory   d)   None of the above

v) The order of basic processes involved in succession is _____.

a) Nudation->stabilization->competition and co action->Invasion->reaction

b) Nudation->Invasion-> competition and co action->reaction->stabilization

c) Invasion-> Nudation->competition and co action->Reaction->stabilization

d) Invasion->stabilization-> competition and co action->Reaction->nudation

vi) The primary producers in a forest ecosystem are _____.

a) Bacteria and other micro-organism

b) Carnivores

c) Herbivores

d) Chlorophyll containing trees and plants

vii) The basic requirements/needs of human beings are provided by _____.

a) Industrialisation   b) Agriculture

c) Nature   d) Urbanisation

viii) The ozone layer is becoming thin due to the gas _____.

a) CO   b) CFCS

c) CO_2 d) NO_2

ix) 'El Nino' this Phenomenon is associated with _____.

a) Climate change   b) Air pollution

c) Water Pollution   d) Radiation effect

-2-

x) The pyramid of numbers is inverted in the case of _____.

a) Parasitic food chain   b) Grassland ecosystem

c) Forest ecosystem   d) Lake ecosystem

Q2) Answer any three from following.   [3 × 5 = 15]

a) Describe the structure of pond ecosystem.

b) Define deforestation and list causes of deforestation.

c) Define soil erosion and list the causes.

d) Explain genetic, species and ecosystem diversity with examples.

e) What are the causes of marine pollution?

Q3) Write short note on any three.   [3 × 5 = 15]

a) Mitigation of pollution due to mining

b) Man- wildlife conflicts

c) Deforestation

d) Noise pollution

e) Biomass energy

Q4) Explain in detail Air (Prevention and Control of Pollution) Act.   [10]

OR

Briefly discuss the various types of terrestrial and aquatic ecosystem.

-3-