

Total No. of Questions : 4]

SEAT No. :

P8588

[Total No. of Pages : 2

Oct-22/TE/Insem-573

T.E. (Mechanical / Mechanical S/W)

NUMERICAL & STATISTICAL METHODS

(2019 Pattern) (Semester - I) (302041)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates :

- 1) Answer Q1 or Q2, Q3 or Q4.
- 2) Figures to the right side indicate full marks.
- 3) Use of electronic calculator is allowed.
- 4) Assume suitable data, if necessary.

- Q1) a) Draw the flow chart of Bisection Method using accuracy criteria. [6]
 b) Solve the following simultaneous equations using Tri diagonal matrix algorithm (TDMA). [9]

$$5x_1 - x_2 = 5.5$$

$$-x_1 + 5x_2 - x_3 = 5,$$

$$-x_2 + 5x_3 - x_4 = 11.5,$$

$$-x_3 + 5x_4 = 16.5$$

OR

- Q2) a) The upward velocity of a rocket is given at three different times in the following table : [8]

Time, t(s)	Velocity, v(m/s)
5	106.8
8	177.2
12	279.2

The velocity data is approximated by a polynomial as, $v(t) = a_1 t^2 + a_2 t + a_3$. $5 \leq t \leq 12$. Find the values of a_1 , a_2 and a_3 using Gauss elimination with partial pivoting.

- b) Find the fourth root of 32, using Newton Raphson Method. Take accuracy 0.01. [7]

P.T.O.

- Q3) a)** Solve the differential equation by Euler's method to solve the initial value problem over the interval $x = 0$ to 2 with $h = 0.5$ where

$$\frac{dy}{dx} = yx^2 - 1.1y; \text{ where } y(0) = 1. \quad [5]$$

- b)** Given the values of $u(x, y)$ on the boundary of the square is as follows. Evaluate the function $u(x, y)$ satisfying the Laplace equation $\nabla^2 u = 0$. Boundary conditions: Top = 1000; Bottom = 500; Left 2000; Right = 500 with 3×3 grid points. [10]

OR

- Q4) a)** A second order ODE is transformed into first order ODE as, $dy/dx = z$ and $dz/dx = 0.5x - y^2$.

Given that $y(0) = 2$ and $z(0) = 0$. Estimate the value of y and z at $x = 0.2$, take $h = 0.1$. [9]

- b)** Draw the flow chart for solving the Laplace Equation. [6]

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P8589

SEAT No. :

[Total No. of Pages : 2

Oct-22 /TE/Insem-574

T.E. (Mechanical/MechanicalSandwich)

HEAT AND MASS TRANSFER

(2019 Pattern) (Semester-I) (302042)

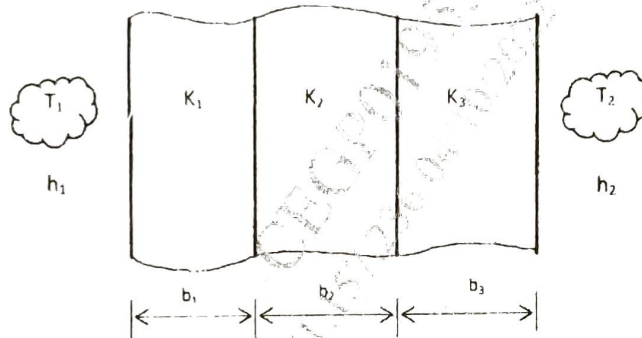
Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4
- 2) Draw neat diagram wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume suitable data if necessary.
- 5) Figures to the right indicate full marks.

- Q1) a) Formulate following composite slab conduction system and equivalent electric circuit. Let A be cross section area and surface area of composite area. [5]



- b) Compare Heat by Conduction and Heat by Convection. [4]
- c) A steel tube of 5cm inner diameter and 8cm outer diameter ($k=16 \text{ W/mK}$), is covered with an insulation of 3cm thickness ($k=0.3 \text{ W/mK}$). A hot gas at 350°C with $h=400 \text{ W/m}^2\text{K}$ flows inside the tube. outer surface of the insulation is exposed to air at 30°C with $h=60 \text{ W/m}^2\text{K}$. Calculate the heat loss from the tube for 20 meter length. [6]

OR

P.T.O.

- Q2) a) Write differential equation of heat conduction in Cartesian co-ordinates and reduce it to Fourier's Equation and Unidirectional Poission's Equation. [4]
- b) A plate having a thickness of 0.4cm has an internal heat generation of 200 MW/m^3 and a thermal conductivity of 25 W/mK . One side of the plate is insulated and the other side is maintained of 100°C . Calculate maximum temperature in the plate. What is the temperature at the centre of plate? [7]
- c) Explain the Temperature boundary condition and heat flux boundary condition with example. [4]
- Q3) a) Write the equation for finding critical radius of cylindrical and spherical object. Why critical thickness is not significance in case of slab. [5]
- b) Derive an expression for heat flow rate and efficiency of an infinitely long fin. [8]
- c) Enlist the applications of extended surfaces. [2]

OR

- Q4) a) A cylindrical rod of 2cm diameter & 25cm long extended from a insulated steam vessel at 100°C into air at 30°C . The free end of the rod is insulated. Determine the temperature at free end if rod is made of. [7]
- i) Copper, $K=330 \text{ W/mK}$
- ii) Steel, $K=49 \text{ W/mK}$
- calculate heat transfer in each cases. Take $h = 7 \text{ W/m}^2\text{K}$. Also comment on result.
- b) The purchase department of power plant is planning to purchase insulation for covering steam carrying pipe. The total insulation cost \$25,000 and would have life of 10 years with zero salvage value. The expected annual cash inflow of the insulation is \$10,000. Compute payback period of insulation and conclude whether or not the insulation would be purchased if the maximum desired payback period is 3 years. [6]
- c) Explain the significance of Biot Number. [2]



Total No. of Questions : 6]

SEAT No. :

P8590

[Total No. of Pages : 2

Oct-22/TE/Insem-575

T.E. (Mechanical/Mechanical Sandwich)

DESIGN OF MACHINE ELEMENTS

(2019 Pattern) (Semester - I) (302043)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates :

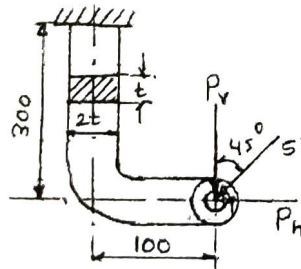
- 1) Answer Q.1 or Q.2, Q.3 or Q.4.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

UNIT - I

- Q1) a) Design a cotter joint to connect two mild steel rods for a pull of 30 kN. The maximum permissible stresses in the tension are 55 MPa, in shear 40 MPa and in crushing 70 MPa. [8]
- b) Design a Knuckle joint to transmit 150 kN for tensile stress 75 MPa, Crushing Stress 150 MPa, Shear stress 60 MPa. [7]

OR

- Q2) a) The effective length of hand lever is 1 meter. The effective overhang from the nearest bearing is 150 mm. The lever and the shaft are made of alloy steel for which tensile yield strength is 460 MPa. If the maximum force exerted at the handle is 300 N. Design the lever and the shaft with a $FOS = 4$. [8]
- b) A frame is subjected to a force of 5 kN as shown in figure. It is made by grey CI with permissible tensile stress is 55 N/mm^2 . Determine Dimensions of cross section of the bracket. Also find Direct and bending stress. [7]



P.T.O.

UNIT - II

- Q3) a)** A 15 kW, 960 rpm motor has a mild steel shaft of 40 mm diameter and 75 mm length. Take $\tau = 56 \text{ MPa}$ and $\sigma_t = 112 \text{ MPa}$. Design the keyway in the motor shaft extension. Also check shear strength of the key against normal strength of the shaft. [5]

- b)** A counter shaft with the bearings 800 mm apart receives 20 kW power at 500 rpm through a pulley 300 mm in diameter and mounted at an overhang of 200 mm. A 360 mm diameter pulley mounted midway span between two bearings. Both pulleys have vertically downwards belt tensions.

Take $\mu = 0.3$, $\theta = 180^\circ$, $FOS = 3$; $S_{ut} = 700 \frac{N}{\text{mm}^2}$, $S_{yt} = 460 \frac{N}{\text{mm}^2}$

Determine diameter of solid shaft. Also determine diameter of hollow shaft for above same data if diameter ratio of 0.6. Calculate ratio of weight of hollow shaft to solid shaft. Consider maximum shear stress theory of failure. [10]

OR

- Q5) a)** It is required to design a bushed-pin type of flexible coupling to connect an output shaft of electric motor to shaft of centrifugal pump. The motor drives 20 kW at 720 rpm. The overall torque is 50 percent more than rated / mean torque. Number of pins 6. Design a bushed type flexible coupling. Take;

For shaft material $S_{yt} = 380 \text{ (N/mm}^2\text{)}$, $FOS = 2$

For key material $S_{yt} = 400 \left(\frac{N}{\text{mm}^2} \right)$, $S_{yc} = 1.5 S_{yt}$, $FOS = 2$

For flange material $S_{ut} = 200 \text{ (N/mm}^2\text{)}$, $FOS = 6$

For Pin material $\tau = 35 \text{ (N/mm}^2\text{)}$, $\sigma_t = 200 \text{ (N/mm}^2\text{)}$

[10]

- b)** Explain the steps for design of muff or sleeve coupling. [5]



Total No. of Questions :6]

SEAT No. :

P8591

[Total No. of Pages :2

Oct-22/TE/Insem -576

T.E. (Mechanical/Mechanical Sandwich)

MECHATRONICS

(2019 Pattern) (Semester-I) (302044)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use Graph Paper for Graphical Solution.*
- 4) *Use of electronic pocket Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1) a)** Using a suitable diagram, explain the working of an electromagnetic type flow sensor. **[5]**
- b)** What is MEMS Accelerometer? Explain with sketch. How can it be used in Mobile phones as a compass or Gyroscope? **[5]**

OR

- Q2) a)** Draw a suitable diagram and explain the working of strain gauge for force measurement. **[5]**
- b)** How Optical pyrometer works? Explain with sketch. State some applications of its. **[5]**
- Q3) a)** List and define any five static measurement characteristics. **[5]**
- b)** How can you distinguish between Parallel and Serial communication? **[5]**

OR

- Q4) a)** What is use Electrocardiography? How it works? How much these sensores are reliable from human life point of view? **[5]**
- b)** Draw a suitable circuit diagram and explain the working of a sample and hold circuit. **[5]**

P.T.O.

Q5) a) Draw a suitable flowchart and explain the working of a 4-bit successive approximation register type ADC. [5]

b) How Digital Video Broadcasting of Flood conditions in Konkan Area can be done? Explain with schematic layout. [5]

OR

Q6) a) Explain the importance of the DAQ system in Mechatronics. Explain your answer with the help of suitable example. [5]

b) A 4 bit R-2R type DAC is supplied with 2.56 volts DC reference potential. Determine the full scale output potential and the least significant bit(LSB). [5]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 1

P9001

Oct-22/TE/Insem-506

T.E. (Mechanical / Automobile Engineering)

MACHINING SCIENCE AND TECHNOLOGY

(2019 Pattern) (Semester - I) (302045-B) (Elective - I)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) *Solve Q. 1 or Q. 2, Q. 3 or Q. 4.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non-programmable electronic calculator is allowed.*

- Q1)** a) Explain single point cutting tool Geometry with figure. **[5]**
b) Explain the relation between shear velocity, cutting velocity and chip flow velocity. **[4]**
c) A 300 mm diameter bar is turned at 50 rev/min. with depth of cut 2 mm and feed of 0.3 mm/rev. Calculate power consumption, specific cutting energy and energy consumed with cutting force 1800 N and Feed force 500 N. The total metal removed during the turning operation is $2.5 \times 10^3 \text{ mm}^3$. **[6]**

OR

- Q2)** a) Draw Merchant circle and write the equation of frictional forces and shear forces in terms of cutting force and thrust forces using merchant circle. **[6]**
b) Write the difference between orthogonal and oblique cutting. **[5]**
c) A tool life of 60 minute is obtained at a speed of 25 m/min. and 6 minute at 50 m/min. Calculate following: **[4]**
i) Tool life equation
ii) Cutting speed for 5 min. life

- Q3)** a) Explain thread rolling with neat sketch. **[6]**
b) Explain thread milling with neat sketch. **[5]**
c) Give the advantages and limitations of casting for the manufacture of gears. **[4]**

OR

- Q4)** a) Explain with neat sketch the Gear Hobbing. **[6]**
b) What are the advantages of producing thread by grinding? **[5]**
c) Write a short note on Gear Inspection. **[4]**



Total No. of Questions : 4]

SEAT No. :

P9643

[Total No. of Pages : 1

Oct.-22/TE/Insem-505

T.E. (Mechanical /Automobile Engineering) (Semester - I)
Elective - I : ADVANCED FORMING AND JOINING PROCESSES
(2019 Pattern) (302045-A)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Answer Q. 1 or Q. 2, Q. 3 or Q. 4.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.

- Q1)** a) State and classify the bulk deformation & sheet metal working processes. **[5]**
b) State the assumptions of plasticity theory. **[5]**
c) Define sheet metal formability. State the factors on which formability of sheet metal depends. **[5]**

OR

- Q2)** a) With a schematic explain deep drawing operation. **[5]**
b) A cup of 50 mm diameter and 110 mm height is to be drawn from 0.8 mm thickness sheet. The tensile strength of the sheet is 310 N/mm². Determine i) Blank diameter ii) minimum number of draws required. iii) Force & energy for the first draw with 25% reductions. Assume the corner radius is negligible & constant 'C' for force calculation as 0.6. **[5]**
c) Explain why in a deep drawing % reduction at first stage is limited to maximum to 50%. **[5]**

- Q3)** a) Describe how high velocity forming (HVF) process is beneficial in comparison to conventional forming process. **[5]**
b) Differentiate between active hydro forming & sheet hydro forming. **[5]**
c) Explain the salient features of electro hydraulic forming (EHF). **[5]**

OR

- Q4)** a) State with a schematic the principle of incremental sheet forming. **[5]**
b) Explain stand-off technique and contact techniques of explosive forming with schematic. Also state the advantages and limitations of each technique. **[5]**
c) Differentiate between conventional spinning & metal spinning. **[5]**

