SB-164

Total No. of Pages : 3

Seat No.	

S.Y.B.Tech.(Mechanical) (Part-II) (Semester - IV) (CBCS)
Examination, January - 2023
THEORY OF MACHINES-I
Sub. Code : 79122

Day and Date : Tuesday, 24 - 01 - 2023 **Total Marks :70**

Time :2.30 p.m. to 5.00 p.m.

Instructions :
1) **Answer all questions.**
2) **Figures to the right indicate full marks.**
3) **Use of non-programmable calculator is allowed.**
4) **Assume suitable data if necessary.**

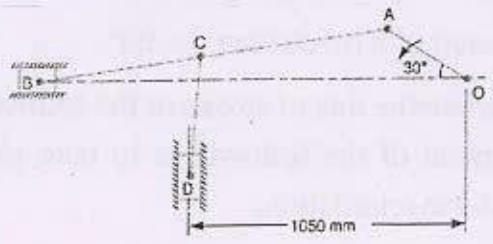
Q1) a) Explain the following terms:
i) Kinematic link
ii) Kinematic pair
iii) Kinematic chain **[6]**

OR

Sketch and explain lower and higher pair with examples. **[6]**

b) Sketch and explain elliptical trammel. **[6]**

Q2) In the mechanism, as shown in Fig. 2.4, 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:
i) Velocities of sliding at B and D,
ii) Angular Velocity of CD,
iii) Linear acceleration of D, and
iv) Angular acceleration of CD. **[12]**



P.T.O.

Q3) a) Derive an expression for torque required to lower the load by a screw jack. [5]

OR

Explain the following terms: [5]

i) Coefficient of Friction.

ii) Limiting Angle of friction.

iii) Angle of Repose.

b) A conical pivot bearing supports a vertical shaft of 200 mm diameter, It is subjected to a load of 30 KN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 r.p.m, assuming

i) Uniform pressure; and

ii) Uniform wear. [6]

Q4) a) Draw Displacement, Velocity and Acceleration Diagrams when the follower Moves with Uniform acceleration and retardation. [4]

OR

Explain with neat sketch different types of followers. [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 100° rotation of the cam;

ii) To dwell for next 80°;

iii) To return to its starting position during next 90°, and

iv) To dwell for the rest period of a revolution i.e.,90°.

Draw the profile of the cam when the line of stroke of the follower is offset by 15mm. The displacement of the follower is to take place with uniform acceleration and uniform retardation.

Q5) a) Explain with neat sketch any two types of belt drives. [4]

b) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 r.p.m. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160° and maximum tension in the belt is 2500 N. [8]

Q6) a) Explain Isochronism for Porter and Hartnell Governor. [4]

OR

State the different types of governors. What is the difference between centrifugal and inertia type governors? [4]

b) A porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the range of speed, sleeve lift, Governor effort and power of the governor when the friction at the sleeve is neglected. [7]

QP Code: 1747QP

Seat No.	

Total No. of Pages: 2

January - February (Winter) Examination - 2023

Subject Name: Bachelor of Engineering_79121_Fluid and Turbo Machinery_23.01.2023_02.30 PM To 05.00 PM

Subject Code: 79121

Day and Date: Monday, 23-01-2023 MECH.

Time: 02:30 pm to 05:00 pm

Total Marks: 70

Instructions.:

1) Figures to the right indicate full marks
2) Use of Scientific calculator is allowed
3) Assume suitable data wherever necessary and mention it boldly

Special Instruction.:

Que. No. 4 and Que. No. 8 are Compulsory. Attempt any Two questions from Que. No. 1, 2 and 3. Attempt any Two questions from Que. No. 5, 6 and 7.

Q.1. Attempt the following questions **[10]**

a) Explain Euler's equations for rotodynamic machine

b) Explain different efficiencies of turbine

Q.2. Attempt the following questions **[10]**

a) Explain construction & working of Francis turbine

b) Write a short note on draft tube

Q.3. Attempt the following questions **[10]**

a) Define and Classify pumps.

b) Explain different heads available for Centrifugal pump.

Q.4. Attempt the following questions (Any Two) **[16]**

a) A 137 mm diameter jet of water issuing from a nozzle impinges on the buckets of a pelton wheel and the jet is deflected through an angle of 165° by the buckets. The head available at the nozzle is 400 m. Assuming co-efficient of velocity as 0.97, speed ratio as 0.46, and reduction in relative velocity while passing through buckets as 15%, find:

(i) The force exerted by the jet on buckets in tangential direction,

(ii) The power developed.

(iii) Also draw velocity triangle diagram

b) The following data is given for a francis turbine,
Net head H = 60 m: Speed N = 700 r.p.m.; shaft power = 294.3 kW: Overall efficiency = 84%; hydraulic efficiency = 93%; flow ratio = 0.20: breadth ratio n =0.1: Outer diameter of the runner = 2 times inner diameter of runner. The thickness of vanes occupies 5% of circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine

i. Guide blade angle

ii. Runner vane angle at inlet and outlet

iii. Diameter of runner at inlet and outlet

iv. Widh of wheel at inlet

c) A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 r.p.m. against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at outer periphery of impeller.

Q.5. **Attempt the following questions** **[10]**

a) What is Compressor? What are the applications of compressed air?

b) Obtain the condition for minimum work in two stage compressor.

Q.6. **Attempt the following questions** **[10]**

a) Write short note on centrifugal compressor.

b) Explain with neat sketch working of axial flow compressor.

Q.7. **Attempt the following questions** **[10]**

a) Write short note on fuels used in gas turbine power plants.

b) Explain the thermodynamic processes in gas turbine cycle with p-v and T-s diagram.

Q.8. **Attempt the following questions (Any Two)** **[14]**

a) A single stage reciprocating compressor takes in 7.5 m^3/min of air at 1 bar and 27° C and delivers it at 5 bar. The clearance is 5% of stroke. The expansion and compression index is 1.3. Calculate:

1. The temperature of delivery air

2. Volumetric Efficiency

3. Power of compressor

b) A rotory compressor working between 1 bar and 2.5 bar has internal and external diameters of impeller as 300mm and 600mm respectively. The vane angle at inlet and outlet are 30° and 45° respectively. If the air enters the impeller at 15 m/s. Find speeds of impeller in rpm and workdone by compressor per kg of air.

c) The air enters the compressor of an open cycle gas turbine at pressure of 1 bar and temperature of 20° C. The pressure of the air after compression is 4 bar. The isentropic efficiency of compressor and turbine are 80% and 85% respectively. The air fuel ratio used is 90:1. If the flow rate of the air is 3 kg/s, find

1. The compressor power and turbine power

2. Net power developed

Take Cp=1 kJ/KgK and The expansion and compression index = 1.4 of air and gas. Calorific value of fuel = 41800 kJ/kg.

Seat No. 04223

S.Y. B.Tech. (Mechanical) (Semester - IV) (CBCS) (Revised) Examination, January - 2023

APPLIED NUMERICAL METHODS

Sub. Code : 79119

Day and Date : Friday, 20 - 01 - 2023 **Total Marks : 70**
Time : 2.30 p.m. to 5.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Use of Non-Programmable calculators series fx-82 ES, fx-82 ES Plus, fx-82 MS are only allowed.**
3) **Figures to the right indicate full marks.**
4) **Assume suitable data, if necessary and mention it clearly.**

Q1) a) Find root of equation $x^3 - 9x + 1 = 0$ lying between 2 & 3, using bisection method. Perform FOUR iterations. **[5]**

b) Using Muller method, find the root of equation $\cos x - xe^x = 0$. Perform only TWO iterations. **[6]**

OR

b) Find the positive root of $2x^3 - 3x - 6 = 0$ by Newton - Raphson method. Perform FOUR iterations. **[6]**

Q2) a) Solve by Gauss elimination method. **[6]**

$-6z + y + x = -12$

$4y + x - z = -5$

$3x - z - y = 4$

b) Solve using Gauss-Jacobi method. **[6]**

$2x - 3y + 20z - 25 = 0$

$20x + y - 2z - 17 = 0$

$3x + 20y - z + 18 = 0$

OR

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

$x_1 + 5x_2 + x_3 = 14$

$2x_1 + x_2 + 3x_3 = 13$

$3x_1 + x_2 + 4x_3 = 17$

P.T.O.

Q3) a) Find $f(x)$ as a polynomial in x and hence find $f(0)$ for the following data by Newton's divided difference formula. **[7]**

x	–1	1	2	3
$f(x)$	–21	15	12	3

b) Find the best relation of the type R = aV + b, for the data below: **[5]**

V	60	65	70	75	80	85	90
R	109	114	118	123	127	130	133

OR

b) Fit a second degree parabola to the following: **[5]**

x	1	2	3	4	5
y	2	3	5	8	10

Q4) a) Find the value of cos(1.74) from the following table. **[6]**

x	1.7	1.74	1.78	1.82	1.86
$y = \sin x$	0.9916	0.9857	0.9781	0.9691	0.9584

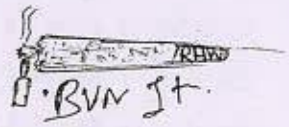
b) The velocity v of a particle at distance S from a point on its path is given by the table below. Estimate the time taken by the particle to travel 60 feet, using Simpson's 1/3rd rule. **[6]**

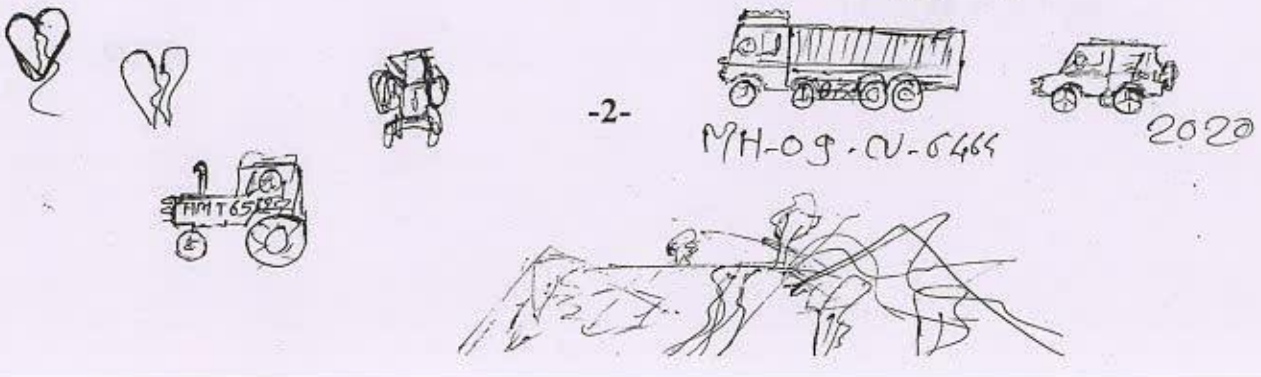
S (in feet)	0	10	20	30	40	50	60
v (in *ft*/s)	47	58	64	65	61	52	38

OR

b) Use 2-point Gaussian Quadrature and solve $\int_{-2}^{2} e^{-\frac{x}{2}} dx$. **[6]**

Q5) a) Apply Runge - Kutta method to find approximate value of y at $x = 1.1$ in one step. Given $\frac{dy}{dx} = x^2 + y^2$ and $y(1.0) = 1.5$. **[6]**





b) Find the value of $y(0.1)$ by Picard's method

$\frac{dy}{dx}=\frac{(y-x)}{(y+x)}$ Given, $y(0) = 1$. [5]

OR

b) Use Power method to find the largest Eigen value and the corresponding Eigen vector for the following matrix. [5]

$$\begin{vmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{vmatrix}$$

Q6) a) Solve $u_{xx} + u_{yy} = 0$ in $0 \le x \le 4$, and $0 \le y \le 4$ given that

$u(0, y) = 0$; $u(4, y) = 8 + 2y$; $y(x,0) = x^2/2$; $y(x,4) = x^2$ with $\Delta x = \Delta y = 1$.

Prepare the mesh and perform FOUR iterations. [8]

b) Classify the following partial differential equations: [4]

i) $\frac{\partial^2 u}{\partial x^2}+4\frac{\partial^2 u}{\partial x \partial y}+4\frac{\partial^2 u}{\partial y^2}-\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}=0$

ii) $(1+x^2)\frac{\partial^2 u}{\partial x^2}+(5+2x^2)\frac{\partial^2 u}{\partial x \partial t}+(4+x^2)\frac{\partial^2 u}{\partial t^2}=0$

OR

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

Seat No.	

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

Day and Date : Monday, 23 - 01 - 2023 **Total Marks : 70**
Time : 10.30 a.m. to 1.00 p.m.

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

SECTION - I

Q1) a) Explain the concept of Back EMF for DC motor and state its importance. [6]

b) A speed of 200 V dc shunt motor is to be changed from 1000 rpm to 600 rpm. Find the resistance required in series with the armature. The motor draws 17.5 Ampere constant current. Assume Ra = 0.4 ohm. [6]

Q2) a) Draw & explain construction of 3 phase I.M. [6]

b) Derive torque equation of 3 phase I.M. [5]

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

b) Draw & explain Reversal of rotation of 3 phase I.M. [5]

Q4) Answer any Two. [2×6=12]

a) Explain speed control methods for DC shunt motor.

b) Draw & explain various Power stages of 3 phase I.M.

c) Explain VFD control block diagram to control speed of 3 phase I.M.

P.T.O.

SECTION - II

Q5) a) With neat diagram explain Permanent Capacitor type Induction Motor. State its applications. [6]

b) What is Servo Motor? State the types. Explain any one in detail. [6]

Q6) a) Compare Electrical drive and Mechanical drive on following aspects- Pollution, Maintenance cost, Efficiency, Speed control, Operating life and Space requirement. [6]

b) With the help of neat diagram explain Group drive & individual drive. [5]

Q7) a) State the advantages of electric heating over conventional heating. [6]

b) Explain construction and working of Indirect Resistance heating. [5]

Q8) Answer any Two. [2×6=12]

a) Draw & explain construction, working of any one type of Stepper Motor. State its Applications.

b) What are the factors to consider, while selecting a motor for a particular application?

c) An electric furnace is used to melt 50 kg of Tin per hour. The melting temperature of Tin is 235°C and room temperature is 15°C. The latent heat of fusion for Tin is 13.35 K. Cal. Kg. The specific heat of Tin is 0.055 K.Cal/Kg°K. If the input to the furnace is 5 KW, find furnace efficiency.

Seat No.	

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

Day and Date : Wednesday, 25 - 01 - 2023 **Total Marks :70**

Time :10.30 a.m. to 1.00 p.m.

Instructions :
1) **All questione are compulsory.**
2) **Figure to the right indicate full marks.**
3) **Assume suitable data if necessary.**
4) **Use of steam table. Mollier-chart are allowed.**
5) **Use of non-programable calculate is allowed.**

Q1) a) Define entropy and explain principle of increase of entropy. **[5]**

OR

Give statement of Zeroth law, First law, second law and third law of thermodynamics. **[5]**

b) 0.05 m^3 of air at a pressure of 8 bar and temperature of 280° expands to eight times of its original volume and final temperature after expansion is 25° calculate change of entropy of during the process. Assume Cp=1.005KJ/Kg. K and Cv=0.712kJ/kg. K. **[6]**

Q2) a) Draw Rankine cycle on P-V, T-S and H-S diagram. **[5]**

b) A steam engine operates onideal Carnot cycle is supplied with dry saturated steam at 15 bar. The isentropic expansion of steam. The isentropic expansion of steam continues till it is exhausted at 0.10 bar. Assuming liquid to be saturated at entry to boiler. Determine. **[7]**

i) Work ratio

ii) Thermal efficiency

iii) Specific fuel consumption in kg/kW h

P.T.O.

Q3) a) Classy boilers. Compare water tube boiler and fire tube boiler. **[5]**

OR

How steam condensers are classified? Compare jet condenser and surface condenser. **[5]**

b) In surface condenser, the vacuum maintained is 700 mm of Hg. The barometer reading is 754 mm of Hg, if the temperature of condensate is 18° C determine. **[7]**

i) Mass of air per Kg of air

ii) Vacuum efficiency

Q4) a) What is the function of the nozzle? Describe types of steam nozzles with neat sketch. **[5]**

OR

Derive the expression for critical pressure ratio for maximum discharge through nozzle. **[5]**

b) It is proposed to design steam nozzle for the following data: **[7]**

Initial pressure-30 bar, initial temperature-450°C, Back pressure-6 bar, Nozzle efficiency--90%, Mass flow rate-2 kg/s, initial steam velocity-60m/s.

Assuming circular cross section, calculate the inlet, throat and exit diameter of the nozzle.

Q5) a) What is compounding? Explain any one method with neat sketch in detail. **[5]**

b) In a De lavel turbine, steam issues from the nozzle with a velocity of 850 m/s. the nozzle angle is 20°. Mean blade velocity is 350 m/s. the blades are symmetrical. The mass flow rate is 1000 kg/min. Friction factor is 0.8. Determine, **[7]**

i) Blade efficiency

ii) Blade angle

iii) Power developed

iv) Axil thrust on bearing

Q6) a) Derive the expression for gross stage efficiency for Parson's turbine. **[5]**

OR

Explain the turbine trobles like erosion, corrosion, fouling and vibrations. **[5]**

b) The outlet angle of the blade of Parson's turbine is 20° and axial velocity of flow of steam is 0.5 times the mean blade velocity. Draw velocity diagram for a stage consisting of one fixed and one moving row of blade given that the mean diameter is 71 cm and the speed of rotation is 3000 rpm. Find inlet angle of the blade. **[6]**

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Seat No.	

S.Y. B. Tech. (Mechanical Engineering) (Semester - III) (CBCS)

Examination, January - 2023

ENGINEERING MATHEMATICS - III

Sub. Code : 73203

Day and Date : Friday, 20 - 01 - 2023 **Total Marks : 70**

Time : 10.30 a.m. to 1.00 p.m.

Instructions :
1) Attempt any three questions from each section.
2) Figures to the right indicates full marks.
3) Use of non-programmable calculator is allowed.
4) Assume suitable data if necessary.

SECTION - I

Q1) Solve the following:

a) Solve $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = e^x + \cos x.$ **[6]**

b) Solve $\left(D^3 - 2D^2 + D\right)y = x^2 + x.$ **[6]**

Q2) Solve the following:

a) Find the equations to the lines of regression and the coefficient of correlation for the following data: **[6]**

x	1	2	3	4	5	6	7	8	9	10
y	10	12	16	28	25	36	41	49	40	50

b) Fit a curve of the form $y = ax^b$ to the following data: **[5]**

x	2	4	6	8	10
y	4.077	11.084	30.128	81.897	222.62

P.T.O.

Q3) Solve the following:

a) Find $L\left[\frac{e^{-2t}\sin^2 3t}{t}\right]$. [5]

b) Using convolution theorem find inverse Laplace transform of $\frac{s^2}{(s^2+a^2)^2}$. [6]

Q4) Attempt any two from the following:

a) Solve $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}-3y=(x\log x)^2$. [6]

b) Fit a second degree parabolic curve to the following data: [6]

x	1	1.5	2	2.5	3	3.5	4
y	1.1	1.3	1.6	2	2.7	3.4	4.1

c) Using Laplace transforms, find the solution of initial value problem $y'''(x)+2y''(x)-y'(x)-2y(x)=0$, $y(0)=y'(0)=0$ and $y''(0)=6$. [6]

SECTION - II

Q5) Attempt the following questions:

a) Prove that $(y^2-z^2+3yz-2x)\vec{i}+(3xz+2xy)\vec{j}+(3xy-2xz+2$ $\vec{k}$ is solenoidal and irrotational. [6]

b) Find the directional derivative of $\phi=x^2y+y^2z+z^2x$ at the point P(1, 2, 1) in the direction of the normal to the surface $x^2+y^2-z^2x=1$ at Q(1, 1, 1). [5]

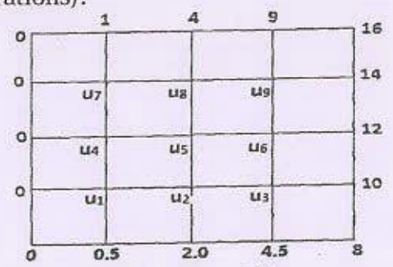
Q6) Attempt the following questions:

a) Obtain the Fourier series to represent $f(x)=\frac{1}{4}(\pi-x)^2$, $0<x<2\pi$. [7]

b) Express $f(x)=|x|$, $-l<x<l$ as Fourier series. [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 figure by Gauss-Seidel method. (Carry out two iterations). [11]



b) Solve the differential equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ subject to the following conditions: [11]

i) u is finite for all t.

ii) $u=0$ for $x=0$, π for all t.

iii) $u=\pi x-x^2$ for $t=0$ and between $x=0$ and $x=\pi$.

Q8) Attempt any two from the following:

a) If $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$ and $r=\sqrt{x^2+y^2+z^2}$, prove that $\nabla\cdot\left(r\nabla\frac{1}{r^3}\right)=\frac{3}{r^4}$. [6]

b) Obtain the Fourier series of $f(x)=x^2$ in the interval $-\pi\le x\le\pi$ and hence show that $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\ldots=\frac{\pi^2}{6}$. [6]

c) Solve the equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ for the following data by Gauss-Seidel method. Carry out two iterations. [6]