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Seat No.	

S.E.(Mechanical) (Part - II) (Semester - IV) (Revised) Examination, May - 2019

MACHINE TOOLS AND PROCESSES

Sub. Code : 63364

Day and Date : Friday, 24 - 05 - 2019 **Total Marks : 100**

Time : 2.30 p.m. to 5.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Assume suitable data, if necessary.**
4) **Use of Non-programmable Scientific Calculator is allowed.**

Q1) Attempt any four of the following.

a) What are the steps involved in metal casting process? [4]

b) State the function of each element in gating system. [4]

c) Explain important properties of molding sand. [4]

d) Which casting method is used to produce piston in an IC engine? Explain the same in brief. [4]

e) Draw neat sketch of cupola furnace. [4]

Q2) Attempt any four of the following.

a) Define forging. Explain with neat sketch open die forging process. [4]

b) Compare direct & indirect Extrusion process. [4]

c) Explain the process of tube drawing in brief. [4]

d) State the advantages of cold rolling compared to hot rolling. [4]

e) What are the defects associated with the forging process? [4]

P.T.O.

Q3) Write a short note on (Any Three).

a) Examples of injection molding for production of plastic parts [6]

b) Calendaring [6]

c) Application of rolling [6]

d) Cleaning of casting [6]

Q4) Attempt any four of the following.

a) Calculate the gear train for cutting the 6 TPI pitch on work piece if the lead screw of lathe is 4 TPI. The lathe is supplied with a change gear set from 20 to 120 teeth in steps of 5 teeth and an additional gear of 127 teeth. [4]

b) Draw block diagram of turret lathe. Name different parts [4]

c) State work holding devises used on lathe. Draw sketch of any two. [4]

d) Draw block diagram of radial drilling machine. [4]

e) Explain construction of horizontal boring machine. [4]

Q5) Attempt any four of the following.

a) Draw neat sketch of quick return mechanism used in shaper. [4]

b) State classification of planer. Explain working of double housing planer. [4]

c) Explain constructions of horizontal milling machine. [4]

d) Describe gear cutting on milling machine. [4]

e) With the help of neat sketch explain gear shaping process in brief. [4]

Q6) Write a short note on (Any Three).

a) Abrasive jet machining [6]

b) Ultrasonic machining [6]

c) Bar feeding Mechanism [6]

d) Operations performed on milling machine [6]

✪ ✪ ✪

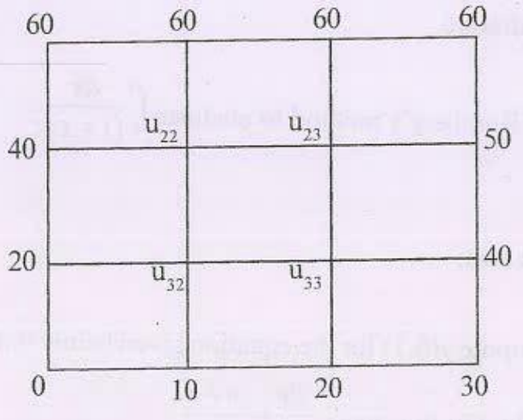
a) Classify the following partial differential equations [6]

i) $U_{xx} - 2U_{xy} + U_{yy} + 3U_y - 4U_x = 3x\text{-}2y$

ii) $(X+1)U_{xx} - 2(x+2)U_{xy} + (x+3)U_{yy} = \cos(x\text{-}2y)$

iii) $U_{xx} + 4U_{xy} + (x^2+4y^2)U_{yy} = \sin(x+y)$

b) Solve $U_{xx}+U_{yy} = 0$ in the square mesh given below. Perform three iterations. [12]



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S.E. (Mechanical Engineering) (Semester - IV)
Examination, May - 2019
APPLIED NUMERICAL METHODS
Sub. Code: 63360

ıy and Date : Tuesday, 14 - 05 - 2019 **Total Marks : 100**

me : 2.30 p.m. to 5.30 p.m.

ıstructions :
1) **All questions are compulsory.**
2) **Make suitable assumptions/data if required and state clearly.**
3) **Draw neat sketches wherever necessary.**
4) **Figures to the right indicate full marks.**
5) **Use of calculator is allowed.**

1) a) Explain accuracy and precision with help of neat sketch. [4]

b) Solve any two [2×6=12]

i) Use false position method to find the root correct to three decimal places of $f(X) = x^3 - 4x+1=0$.

ii) Using Newton's iterative method, find the real root of $x^3 = 6x - 4$ which lies between 0 and 1 correct to five decimal places.

iii) Use Muller's method to find a root the equation $x^3-7x^2+6x+5= 0$, using $X_0 = 0; X_1 = 1; X_2 = 2$.

2) Solve any two

a) Solve the following equations by Gauss-Jordon method. [2×8=16]

$$x + y + z = 9$$
$$2x - 3y + 4z = 13$$
$$3x + 4y + 5z = 40$$

P.T.O.

b) Solve the system of equations using LU Decomposition.

$$5x-2y+z=4$$
$$7x+y-5z=8$$
$$3x+7y+4z=10$$

c) Solve the following equations by Gauss-jacobi method.

$$27x+6y-z=85$$
$$x+y+54z=110$$
$$6x+15y+2z=72$$

3) a) An experiment on the life of cutting tool at different cutting speeds are given below: [6]

Speed v:	350	400	500	600
Life T (min):	61	26	7	2.6

Fit a relation of the form $v = aT^b$.

b) Find the value of y at x=3 from the following data using Lagrange's interpolation formula. [6]

x:	0	1	2	4
y:	1	3	9	81

c) Calculate the mean and standard deviation for the following data: [6]

Series	Frequency	Series	Frequency	Series	Frequency
15-20	2	35-40	15	55-60	16
20-25	5	40-45	20	60-65	13
25-30	8	45-50	20	65-70	11
30-35	11	50-55	17	70-75	5

4) Solve any two [2×8=16]

a) Find the first and second derivative of the function tabulated below at x=0.6.

x:	0.4	0.5	0.6	0.7	0.8
y:	1.5836	1.7974	2.0442	2.3275	2.6511

using Stirlings formula

b) Evaluate $\int_2^4 (2x^2+1)dx$ using two associated points of Gaussian Quadrature.

c) Use Romberg's method to evaluate $\int_0^1 \frac{dx}{(1+x)}$.

5) Solve any two: [2×8=16]

a) Compute y(0.1) for the equation given below with y(0)=1, using Euler's method in five steps $\frac{dy}{dx}=\frac{y-x}{y+x}$.

b) Using Runge-Kutta method of fourth order, find y(0.8) correct to four decimal places for the equation given below if y(0.6) = 1.7379 in two steps.

$$\frac{dy}{dx}=y-x^2$$

c) Find the dominant eigen value and the corresponding eigen vector of

$$\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

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S.E. (Mechanical) (Semester - IV) Examination, May - 2019
ANALYSIS OF MECHANICAL ELEMENTS
Sub. Code: 63361

Day and Date : Thursday, 16 - 05 - 2019 **Total Marks : 100**
Time : 2.30 p.m. to 5.30 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 labeled sketches wherever necessary.**
5) **Use of non programmable calculator is allowed.**

Q1) a) Two steel rods and one copper rod each of 50mm diameter together support a load of 60 KN as shown in Fig.1. Take E_s=200 Gpa and E_C=100 GPa. **[12]**

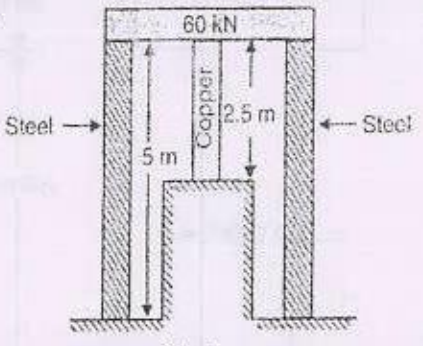

Fig. 1

b) The bar ABCD of uniform cross section 20 mm in diameter is subjected to load as shown in fig.2 Determine **[6]**
i) Total elongation of the bar
ii) Maximum stress in the bar
iii) Strain in each part

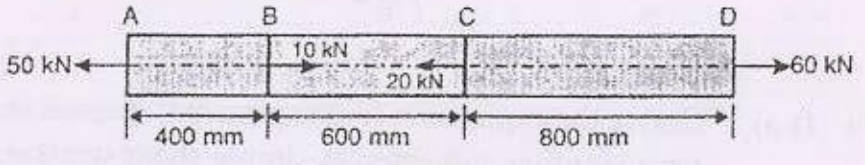

Fig. 2

OR

A hollw shaft of external diameter 120mm transmits 300 KW power at 200 rpm. Determine internal diameter of the shaft it the maximum stress is not to exceed 60N/mm^2. **[6]**

P.T.O.

) Draw SFD and BMD for loading condition shown in fig.3. Locate point of contraflecture if any. [16]

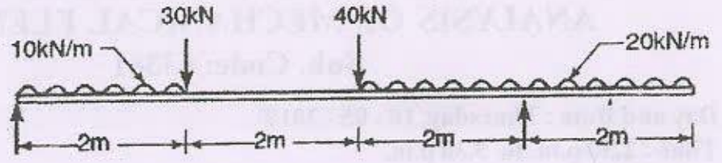

Fig. 3

) A beam of I section is simply supported over a span of 4 m. determine the load that the beam can carry per meter length, if the allowable stress in the beam is 30.82 N/mm² (Tensile). [16]

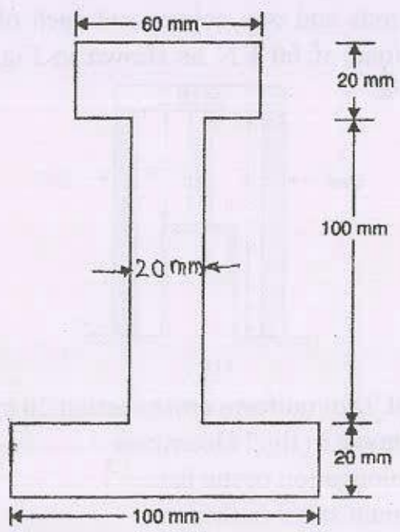

Fig.4

4) a) Derive the expression for the principal stresses and maximum shear stress for a member subjected to simple shear stresses. Show the locations of principal planes and planes of maximum shear. [9]

b) The I section beam section shown in figure is 320mm x 140mm with web 10 mm thick and flange 18 mm thick. Find the stresses and show the shear stress distribution if it has to resist a shear force of 40 kN. [9]

OR

The stresses of the two perpendicular planes passing a point in a strained material are 100 MPa (tensile), 80 MPa (compressive), and 60 MPa (Shear) as shown in figure. Determine the normal and shear stress components on a plane at 60° to that of 100 MPa stress and also the resultant and its inclination with normal components on the plane.

5) a) Derive the equation of slope and deflection of a simply supported beam of length L subjected to uniformly distributed load over whole length using double integration method. [8]

b) A cantilever beam of span 4m is carrying a point load of 20 kN at a distance of 3 m from the fixed end. If the moment of inertia of the beam is $1x10^8$ mm4 and the modulus of elasticity is $21x10^4$ N/mm², Determine by moment areas method, the slope and deflection of cantilever at the free end. [8]

OR

State the importance of theories of failure and explain the maximum shear theory (Guest's theory). [8]

6) a) Explain the concept of equivalent length and slenderness ratio of the column. Discuss the limitations of Euler's formula: [8]

b) In an axially loaded shaft shown in figure, load is gradually increased to 80 kN. Find the total strain energy produced in the bar. Use $E=2.1x10^5$N/mm². [8]

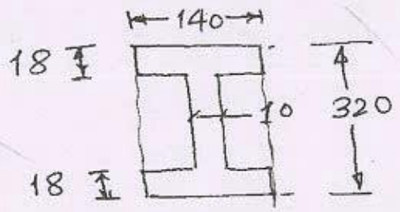

Fig 4b

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) a) Explain with neat sketch open cycle gas turbine with Reheat and draw its T-S Diagram. **[8]**

b) A gas turbine unit receives air at 100 kPa and 300 K and compresses it adiabatically to 620 kPa with efficiency of the compressor 88 %. The fuel has a heating value of 44180 kj/kg and the fuel air ratio is 0.017 kg fuel/kg air. The turbine internal efficiency is 90 %. Calculate the compressor work, turbine work and thermal efficiency. Take Cp for air and gases 1.005 kJ/kg K and ϒ 1.4. **[8]**

OR

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 t.. bine are 80% and 85% respectively. The air fuel ratio used is 90:1. If the flow rate of air is 3 kg/s, find **[8]**

i) The compressor power and turbine power

ii) Net Power developed

Take Cp= 1.0 kJ/ kgK and γ =1.4 of air and gas. Calorific value of fuel 41800kJ/kg.

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Total No. of Pages : 4

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S.E. (Mechanical) (Part - II) (Semester - IV) (Revised)
Examination, May - 2019
FLUID AND TURBO MACHINERY
Sub. Code: 63362

y and Date : Monday, 20 - 05 - 2019 **Total Marks : 100**

ne : 2.30 p.m. to 5.30 p.m.

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

l) a) Show that the maximum hydraulic efficiency of pelton wheel is given by $nh = \frac{1+\cos\phi}{2}$ where 'ϕ' is bucket outletangle. **[8]**

b) A pelton wheel has to be designed for the following data power to be developed = 6,000 KW Net head available = 300m, speed = 550 rpm; Ratio of jet diameter to wheel diameter = 1/10; and overall efficiency = 85%. Find the number of jets; diameter of the jet, diameter of the wheel and the quantity of water required. **[8]**

OR

c) A pelton wheel produces 1000 hp under a gross head of 200m. Its nozzle has a diameter of 10 cm and the losses in pipe line due to friction amount to 90 Q^2 where 'Q' is the discharge in m^3/s. Assuming the gross head and efficiency of the wheel to be constant and ev for the nozzel as 0.98, find the discharge and overall efficiency. If the power produced is reduced to 800 hp by operating the needle in the nozzle, determine the discharge. **[8]**

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Seat No.	

Total No. of Pages : 3

S.E. (Mechanical) (Part - II) (Semester - IV)
Examination, May -2019
THEORY OF MACHINES - I
Sub. Code : 63363

Day and Date : Wednesday, 22 - 05 - 2019 **Total Marks : 100**

Time : 2.30 p.m. to 6.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicates full marks.**
3) **Assume if necessary, suitable dara and state clearely.**
4) **Use of nonprogrammable calculator is permitted.**

Q1) a) Explain Gruebler's criterion of degrees of freedom of plane mechanism. Also give examples of locked chain, constrained chain and un-constrained chain. **[8]**

OR

a) Define kinematic pair. Also Explain classification of kinematic pairs with neat sketch. **[8]**

b) A reciprocating engine has connecting rod 20 cm long and crank 5 cm long. By using Klein's construction, determine velocity and acceleration of piston and angular acceleration of connecting rod when the crank has turned through 45^0 from IDC clockwise and is rotating at 240 r.p.m. **[8]**

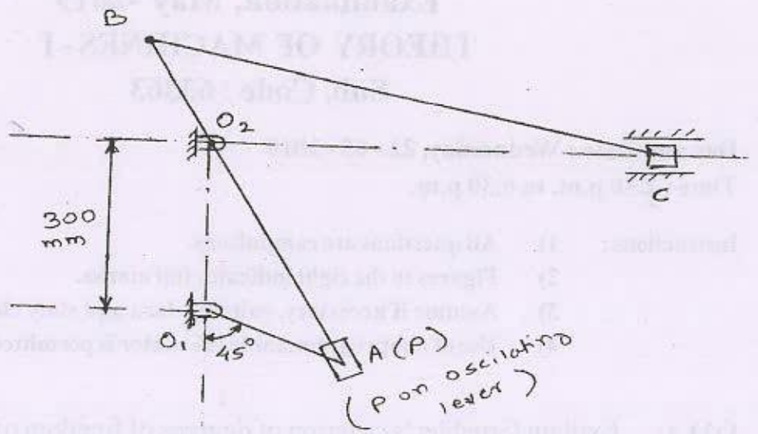
Q2) Draw the velocity and acceleration diagram for the Withworth mechanism shown in following figure. The crank O_1A rotates at 120 rpm clockwise. Determine; **[18]**

a) Velocity and acceleration of ram c

P.T.O.

b) Angular acceleration of link BC.

Various link lengths are; O_1O_2 = 300 mm, O_1A = 200 mm, PB = 700 mm, BC = 800 mm.



3) a) Derive the equation of efficiency of screw jack with square threads. **[8]**

OR

a) Derive the equation of torque required to overcome the friction in conical pivot bearing considering uniform pressure theory. **[8]**

b) A conical pivot with angle of cone as 100^0 supports a load of 18 KN. The external radius is 2.5 times the internal radius and the shaft rotates at 150 rpm. If the intensity of pressure is to be 300 KN/m2 and coefficient of friction is 0.05, what is the power lost in friction? **[8]**

4) a) Explain classification of followers with neat sketch. **[6]**

b) Construct the profile of a cam to suit the following specifications:

Cam shaft diameter = 40 mm; Least radius of cam = 25 mm; Diameter of roller = 25mm Angle of lift = 120°; Angle of dwell = 45° Angle of fall = 150°, angle of dwell = 45°, Lift of the follower = 40 mm; During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off- set 12.5 mm from the centre of the cam. **[12]**

5) a) Explain slip and creep of belt. **[6]**

OR

a) Explain belt transmission dynamometer with neat sketch. **[6]**

b) A shaft is rotating at 200 rpm and drives another shaft at 300 rpm and transmits 6 Kw power through a belt. The belt is 100 mm wide and 10 mm thick. The distance between shafts is 4 m. The smaller pulley is 0.5 m in diameter. Calculate stress in belt if it is open belt drive. Take $\mu = 0.3$. **[10]**

6) a) Explain and derive the equation for height of Porter governor. **[6]**

OR

a) Explain Effort and Power of a Governor. **[6]**

b) A Hartnell governor having a central sleeve spring and two right-angledbell crank levers moves between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15mm. The sleeve armsand the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120mm from thegovernor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine: loads on the spring at the lowest and the highest equilibrium speeds, and stiffness of the spring. (Neglect the obliquity effect of arms). **[10]**

* * *

) a) Explain the construction of francis & kaplanturbines along with working by drawing neat sketch. **[8]**

b) Design a francis turbine runner with the following data. Net head, H = 68m, speed N = 750 rpm, output power P = 330 KW, $\eta h = 94\%$, $\eta_0 = 85\%$, flow ratio $\phi = 0.15$, breadth ratio n = 0.1, inner diameter of runner is (½) cuter diameter. Also assume 6% of circumferential area of the runner to be occupied by the thickness of the vanes. Velocity of flow remains constant throughout and flow is radio at exit. **[8]**

OR

c) A kaplan turbine produces 60,000 kw under and head of 25m with an overall efficiency of 90%. Taking the value of speed ratio 'ku' as 1.6, flow ratio ψ as 0.5 and the hub diameter as 0.35 times the outer diameter, find the diameter and speed of the turbine. **[8]**

) a) Explain the construction & working of centrifugal pump by drawing a neat sketch. **[8]**

b) Write short notes on. (any two) **[10]**

i) Cavitation

ii) Multistaging of pumps

iii) Priming & its need

OR

c) Find the power required to drive a centrifugal pump which delivers 40 liters of water per second to a height of 20m through a 150mm diameter and 100m long pipeling. The overall efficiency of pump is 70% and Daray's f = 0.06 for the pipeline. Assume inlet losses in section pipe equal to 0.33m. **[10]**

·) a) Define and explain different efficiencies of Reciprocating compressor. **[8]**

b) Write Short notes on any two: **[10]**

i) Construction and Working of Vane blower.

ii) Explain effect of clearance volume on reciprocating compressor performance and define volumetric efficiency.

iii) Workdone in Two stage reciprocating air compressor.

OR

c) Solve following two problems.

i) Find the percentage saving in work by compressing air in two stages from 1 bar to 7 bar instead of in one stage. Assume compression index 1.35 in both the cases and optimum pressure and complete intercooling in two stage compressor. **[5]**

ii) A single Stage reciprocating air compressor is required to compress 1 kg of air from 1 bar to 4 bar. The initial temperature is 27 °C. Compare the work requirement in the following cases. **[5]**

1) Isothermal Compression

2) Compression with $PV^{1.2}$ = constant

5) a) Explain construction and working of axial flow compressor with neat sketch. Also define degree of reaction for the axial flow compressor. **[8]**

b) Air at temperature of 290 K enters a ten stages axial flow compressor at rate of 3 kg/s. The pressure ratio is 6.5 and the isentropic efficiency is 90 %, the compression process being adiabatic. The compressor has symmetrical blades. The axial velocity of 110 m/s is uniform across the stage and the mean blade speed of each stage is 180 m/s. Determine the direction of the air at entry to and exit from the rotor and stator blades and also the power given to the air. Assume Cp = 1005 J/kgK, $\Upsilon = 1.4$. **[8]**

OR

c) A centrifugal air compressor compresses the air from 1 bar to 4 bar. Inner and outer diameters of the impeller are 0.2 m and 0.4 m respectively. The impeller blade angle at inlet and exit are 30° and 40° respectively. Air enters the impeller blade radially at a speed of 15 m/s, Determine, **[8]**

i) Speed of impeller in rpm.

ii) Work done per kg of air.

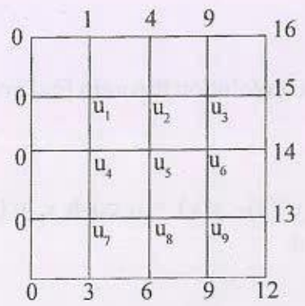
iii) Thickness of the impeller blades for a mass flow rate of air as 0.5 kg/s if the impeller has 30 blades and width of each impeller blade is 5.5 cm. Assume the specific volume of air as 0.82 m^3/kg and velocity of flow is constant.

Take Cp = 1.005 kJ/kg K and $\Upsilon = 1.4$.

Q6) Attempt any one of the following.

a) A tightly stretched string with fixed end points $x = 0$ and $x = \pi$ is initially at rest in its equilibrium position. If it is set vibrating by giving to each of its points an initial velocity $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0.05 \sin x - 0.06 \sin 2x$. Then find the displacement $y(x, t)$ at any point of string at any time. **[16]**

b) Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in figure by Gauss-Siedal iterative method by performing three iterations. **[16]**



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Seat No.

S.E. (Mechanical Engg.) (Semester - III) (Revised) Examination, April -2019

ENGINEERING MATHEMATICS-III

Sub. Code : 63350

Day and Date : Friday, 26 - 04 - 2019 Total Marks : 100

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) All questions are compulsory.
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) Attempt any Three of the following.

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

b) Solve $(D^2 - D + 1)y = x^3 - 3x^2 + 1$. **[6]**

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

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

Q2) Attempt Any one of the following.

a) The differential equation of a shaft which is whirling with the line bearings horizontal is given by $EI\frac{d^4y}{dx^4} - \frac{W\omega^2}{g}y = W$, where W is the weight of the shaft and ω is the whirling speed. Taking the shaft of length $2l$ with the origin as is centre and short bearing at both ends, show that

$$y = \frac{g}{2\omega^2}\left[\frac{\cos mx}{\cos ml} + \frac{\cosh mx}{\cosh ml} - 2\right], \text{where} \quad m^4 = \frac{W\omega^2}{EIg}. \quad \textbf{[16]}$$

P.T.O.

b) i) A body falling vertically under gravity encounters resistance of atmosphere and satisfies equation of motion $\frac{d^2x}{dt^2}+k\frac{dx}{dt}=g$, where g being gravitational constant. Solve the differential equation and show that as time increases to infinity velocity approaches to $\frac{g}{k}$ and distance fallen by body from rest in time t is x = $\frac{gt}{k}-\frac{g}{k^2}\left(1-e^{-kt}\right)$. **[8]**

ii) The differential equation of the motion of a body is $\frac{d^2x}{dt^2}+\omega_0^2x=f_0\sin nt$, where $n\neq\omega_0$. If initially $x=0$ and $\frac{dx}{dt}=0$ when t = 0, determine the motion. **[8]**

Q3) Attempt Any Two of the following.

a) Find the directional derivative of $\phi=x^2+2y^2-3z^2$ at point $P(1,2,1)$ in the direction **[8]**

i) Normal to the surface $xy^2+yz^3=4$ at (1,1,1).

ii) Tangent to the curve $x=t^2+t, y=2t, z=2-t$ at t = 1.

b) i) Find the angle between the tangent to the curve $\vec{r}=t^2\vec{i}-2t\vec{j}+t^3\vec{k}$ at the points $t=1$ and $t=2$. **[4]**

ii) Prove that $curl\left(\vec{a}\times\vec{r}\right)=2\vec{a}$, where $\vec{a}$ is constant vector and $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$ is position vector of a particle. **[4]**

c) Show that the vector field $\vec{F}=\left(z^2+2x+3y\right)\vec{i}+\left(3x+2y+z\right)\vec{j}+\left(y+2zx\right)\vec{k}$ is irrotational but not solenoidal and hence find the scalar potential function. **[8]**

SECTION - II

Q4) Attempt Any Three from the following.

a) Find $L\left\{t^3\sin t\right\}$ and hence find the value of the integral $\int_0^\infty e^{-t}t^3\sin t\ dt$. **[6]**

b) Find $L\left\{e^{2t}\int_0^t\frac{e^{-4t}\sin 3t}{t}dt\right\}$. **[6]**

c) Find $L^{-1}\left\{\frac{4s+5}{(s-1)^2(s+2)}\right\}$. **[6]**

d) Using convolution theorem find inverse Laplace transform of $\frac{1}{s^2\left(s^2+a^2\right)}$ **[6]**

e) Solve $y''(x)-y(x)=a\cosh x$, $y(0)=y'0=0$using Laplace transform method. **[6]**

Q5) Attempt Any Two from the following.

a) Find the Fourier series to represent the function $f(x)$ given by $f(x)=\begin{cases}-k, & -\pi<x<0\\ k, & 0<x<\pi\end{cases}$. Hence show that $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\ldots=\frac{\pi}{4}$. **[8]**

b) Obtain the Fourier series for the function $f(x)=2x-x^2$ in $0\le x\le 2$.

Hence show that $\frac{\pi^2}{12}=\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\ldots.$ **[8]**

c) Find half range sine and cosine series for $f(x)=x(l-x)$, $0\le x\le l$. **[8]**

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S.E. (Mechanical) (Part - I) (Semester - III) (Revised) Examination, May -2019

METALLURGY

Sub. Code : 63353

Day and Date : Tuesday, 07 - 05 - 2019 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Solve any three questions from each section.**
2) **Draw neat sketches wherever necessary to support your answers.**
3) **Write our answers to the point and in order of preference.**
4) **Figures to the right indicate full marks.**

SECTION - I

Q1) Solve the following.

a) Classify Brasses and differentiate clearly between alpha and alpha-Beta brasses? [9]

b) Classify the steels ? Write down composition, properties and Applications of plain 'C' steels. [9]

Q2) Solve any four. [16]

a) Effect of Cr and Ni and C in stainless steel.

b) Effect of alloying element in tool steel.

c) Composition and properties of A1-4.5Cu alloy.

d) Properties and applications of Ti6A14V alloy.

e) Composition and properties of heating element alloys.

f) Explain in short different imperfections in crystal structures?

P.T.O.

3) Solve any four. [16]

a) Differentiate substitutional and interstitial solid solution?

b) Working principle and Steps in Brinell hardness testing.

c) Draw stress strain diagram for mild steel;

d) Dye penetrant method.

e) Pulse echo Ultrasonic method.

4) Write short notes on any four of the following. [16]

a) Nucleation and grain growth.

b) Lever arm principle.

c) Eutectic system with example.

d) Intermetallic compounds.

e) Dendritic structure and coring.

SECTION - II

5) Solve the following.

a) Draw Flowchart for manufacturing of self lubricating bearings? Explain why oil impreganation is must in this process? [9]

b) What you mean by quenching in heat treatment process, why it is needed? Mechanism of heat removal during quenching? [9]

6) Solve the following.

a) Explain precipitation hardening in Al- Cu alloy w.r.t. composition, aging temperature and time, hardness variations. [8]

b) Explain carburizing process? Why carburizing is followed by hardening? [8]

7) Differentiate clearly between any four of the following. [16]

a) Diffusion and shear transformation.

b) Compacting and sintering.

c) Upper and lower bainite

d) CCT and TTT diagram.

e) Flame and induction hardening.

f) Annealing and Normalizing.

8) Write short notes on any four of the following. [16]

a) Heat treatment defects

b) Sub-zero treatment

c) Austenite to Pearlite transformation

d) Different Powder manufacturing methods

e) Heat treatment furnaces

* * *

Q6) a) Define the term degree of reaction for steam turbine. Show it is 50% for parson's reaction turbine. [8]

b) The following data refers to a particular stage of Parson's reaction turbine. Find the isentropic enthalpy drop in the stage. [8]

Speed - 1500 rpm. Mean diameter of rotor - 1m.

Stage efficiency - 80% Speed ratio - 0.7 Blade outlet angle - 20°

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S.E. (Mechanical) (Part - II) (Semester - III) (Revised) Examination, May -2019

APPLIED THERMODYNAMICS

Sub. Code : 63352

Day and Date : Saturday, 4 - 05 - 2019 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Attempt all questions.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Make suitable assumptions if necessary and state it clearly.**
4) **Use of calculator, steam table and Mollier chart is allowed.**

Q1) a) State and prove Clausius inequality and hence define entropy. [8]

OR

Define and explain [8]

i) Energy

ii) Anergy

iii) Exergy

iv) Dead sate

b) 0.5 kg of perfect gas is heated from 100°C to 300°C at a constant pressure of 300 kN/m^2. It is then cooled at constant volume to initial temperature find the average change in entropy.

(Take c_p = 1.005 kJ/kg-K, c_v = 0.718 kJ/kg-K) [8]

Q2) a) What is meant by Reheat and regeneration steam power cycle? Explain with T-s diagram. [8]

OR

Which are the different properties of steam? Explain use of steam table and Mollier Chart. [8]

P.T.O.

b) In a Rankine cycle steam at inlet to turbine is saturated at a pressure 30 bar and exhaust pressure is 0.24 bar. Determine. [8]

i) Pump work

ii) Turbine power

iii) Rankine efficiency

iv) Condenser heat rejected.

Assume steam flow rate = 10 kg/sec and specific volume of water at 0.24 bar $v_w = 0.001019\ m^3/kg$.

3) a) Define thermal efficiency of steam boiler. Explain any one fire tube boiler with neat sketch. [8]

OR

What is function of condenser? Explain any one condenser with neat sketch.

b) In a condenser test, the following observations were made [10]

Vacuum – 71 cm of Hg

Barometer reading = 76.5 cm of Hg

Mean Temperature of condensation = 35°C

Temperature of hot well = 28°C.

Mass of cooling water = 60000 kg/hr.

Cooling water temperature temp. = 24°C

Mass of condensate collected = 2000 kg/hr

Find:

i) Corrected vacuum of standard barometer of 76 cm of Hg

ii) The quality of steam entering the condenser.

iii) Vacuum efficiency.

iv) Condenser efficiency.

v) Undercooling of the condenser.

Assume inlet temp of cooling water = 8°C.

4) a) What is the function of the nozzle? Describe types of steam nozzles with neat sketch. [8]

b) Stream enters a convergent-divergent nozzle of 2 MPa and 400°C with negligible velocity and mass-flow of 2.5 kg/s and it exits at a pressure of 300 kPa. The flow is isentropic between the nozzle entrance and throat and overall nozzle efficiency is 93 percent. [9]

Determine

i) Throat and

ii) Exit areas.

OR

Calculate the throat and exit diameters of a convergent-divergent nozzle, which will discharge 820 kg of steam per hour at a pressure of 8 bar and superheated to 220°C, into a chamber having a pressure of 1.5 bar. The friction loss in the divergent portion of the nozzle may be taken as 0.15 of the isentropic enthalpy drop in the divergent portion of the nozzle. [9]

5) a) How the steam turbines are classified? Differentiate between impulse and reaction turbine. [9]

OR

Explain the term reheat factor. Why its magnitude is always greater than unity? [9]

b) In an impulse turbine (with a single row wheel), the mean diameter of the blade is 1.05 m and speed is 3000 rpm. The nozzle angle is 18°. The ratio of blade speed to steam speed is 0.42 and ratio of relative velocity at outlet from the blades to that at inlet is 0.84. The outer angle of the blade is to be made 3° less than the inlet angle. The steam-flow rate is 10kg/s. Draw the velocity diagram for blades and derive the following. [8]

i) Tangential thrust on the blades.

ii) Power developed in the blades.

iii) Blanding efficiency.

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S.E. (Mechanical) (Semester - III) Examination, May - 2019

ELECTRICAL TECHNOLOGY

Sub. Code : 63351

Day and Date : Thursday, 02 - 05 - 2019. Total Marks : 100

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to right indicate full marks.
3) Draw neat labeled diagram wherever necessary.
4) In case of missing data, assume suitable value. State it clearly.

SECTION-I

Q1) a) Explain working principle of DC Motor. And state their applications. [8]

OR

Draw & explain characteristics of -

i) DC shunt motor

ii) DC series motor

iii) Cumulative compound motor.

Answer any two out of following sub questions b,c,d. [2×6]

b) Explain the flux control methods for DC series motor.

c) With a neat figure explain the working of 3 point Starter for dc shunt motor.

d) A 250v dc shunt motor with armature resistance of 0.5 ohm runs at 600 r.p.m. on full load and takes an armature current of 20A. If resistance of 1 ohm is placed in the armature circuit, find the speed at half full load.

Q2) Answer any two. [2×8]

a) Compare squirrel cage induction motor with slip ring induction motor.

b) Derive the expression for running torque of 3 phase induction motor. Hence explain how the torque varies with slip.

P.T.O.

c) A three phase induction motor has stator loss of 2 kw, rotor copper loss of 1kw and mechanical loss of 0.5 kw at a slip of 0.04 find.

i) Rotor input
ii) Stator input
iii) Rotor output
iv) Motor output.

3) Answer any two. [2×8]

a) Draw diagram and explain autotransformer starter.

b) Describe the stator side speed control methods of 3 phase induction motor.

c) With circuit diagram state the method of reversing rotation of 3 phase induction motor. Explain the reason behind the method.

SECTION-II

)4) Answer any two. [2×8]

a) State the types of stepper motor. Explain VR type stepper motor with its applications.

b) Explain construction and working principle of AC servomotor. State its applications.

c) Why BLDC motor is called as BLDC? Explain working principle and its applications.

25) Answer any two [2×8]

a) What factors to be considered for motor selection from electrical, mechanical and economical aspects?

b) State and explain types of mechanical loads. Give suitable example.

c) Suggest suitable motor for following applications. Also state their starting and running requirements.

i) Lift
ii) Lathe machine
iii) Electric traction
iv) Pumps

26) Answer any two. [2×8]

a) Explain construction, working and applications of core type induction furnace.

b) Compare direct and indirect Arc furnace in each aspect.

c) A high frequency induction furnace takes 20 min to melt 1.9 kg of aluminum, the input to the furnace being 3 kw and the initial temperature is 25°C, and then determines the efficiency of the furnace.

Melting point of aluminum = 660°C,

Specific heat = 0.212 kcal / kg °C,

Latent heat of 1 fusion of aluminum = 76.8 kcal/kg.

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S.E. (Mechanical) (Semester - III) (Revised) Examination, May -2019

FLUID MECHANICS

Sub. Code : 63354

Day and Date : Thursday, 09 - 05 - 2019 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All question are compulsory.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the right indicate full marks.**
4) **Use of non programmable calculator is allowed.**
5) **Assume suitable data if necessary.**

Q1) a) State the characteristics of an ideal fluid. The general relation between shear stress and velocity gradient of a fluid can be written as $T = A[du/dy]^n+B$ where A, B and n are constants that depend upon the type of fluid and conditions imposed on the flow comment on the values of these constants so that the fluid may behave as **[6]**

i) An ideal fluid

ii) Newtonian fluid and

iii) Non Newtonian fluid

b) Five litres of oil weighs 61.8N Calculate **[6]**

i) Specific weight

ii) Specific mass

iii) Specific volume

iv) Relative density

c) Define Pascal's law and Hydrostatic law of pressure. **[4]**

Q2) a) In a two dimensional incompressible flow, the fluid velocity components are given by u=x-4y and v=-y-4x show that velocity potential exists and determine its form as well as stream function. **[8]**

P.T.O.

b) Solve any one of the following. [8]

i) Distinguish between Eulerian and Lagrangian methods of representing fluid flow, Steady and Unsteady flow, Pathline and Streamline and Convective and Local acceleration.

ii) With usual notations derive the equation for velocity of sound wave in fluid.

Q3) a) Explain why [9]

i) Coefficient of discharge for orifice meter is less than venturimeter.

ii) Length of divergent cone is greater than convergent cone in venturimeter.

iii) The convergent angle of venturimeter is around 21° and divergent angle around 5° to 7°.

b) Solve any one of the following [9]

i) Water is flowing vertically upwards through a pipeline having diameter 1 mt. and 0.5mt at the base and top respectively. The pressure at the lower end is 45cms of Hg. While the pressure at the upper end is 20KN/m² If the loss of head is 20% of difference in velocity head, calculate the discharge. The difference in elevation is 4mts.

ii) The drainage pump has tapered suction pipe. The pipe is running full of water. The pipe diameters at inlet and at the upper end are 1mt. and 0.5mt. respectively. The free water surface is 2mt. above the centre of the inlet and centre of upper end is 3mt. above the top of free water surface. The pressure at the tip end of the pipe is 25cms of mercury and it is known that loss of head by friction between top and bottom section is one tenth of the velocity hea[illegible]t the top section. Compute the discharge. Neglect loss of head at the entrance of the tapered pipe. Assume pressure head at the inlet is 76cms of mercury.

Q4) a) Derive an expression for the velocity distribution for viscous flow in a circular pipe and find the ratio of maximum velocity to average velocity. [8]

b) Water enters a reducing pipe horizontally and comes out vertically in the downward direction if the inlet velocity is 5m/s and pressure is 80Kpa and the diameters. at the entrance and exit sections are 30 cm and 20cm respectively. Calculate the components of the reaction acting on the pipe. [8]

Q5) a) i) Differentiate between major energy losses and minor energy losses in pipes. [4]

ii) With a neat sketch explain what is syphon Where it is used. [5]

b) Solve any one of the following [9]

i) Two pipes of diameters 40cm and 20cm are each 300mt. long. When the pipes are connected in series the discharge through the pipeline is 0.1m³/s find the loss of head incurred. What would be the loss of head in the system to pass the same total discharge when the pipes are connected in parallel? Take friction factor as 0.0075 for each pipe and head loss coefficient of contraction as 0.33.

ii) An oil of viscosity 0.096 Ns/m² and density 900 Kg/m³ is flowing through a horizontal pipe of 20cm. diameter and of length 20mt. If 90 Kg of oil is collected in a tank in one minute, check whether the flow is laminar or turbulent. If it is laminar find the difference of pressure at the two ends of the pipe.

Q6) a) Define Boundary layer thickness, displacement thickness, Momentum thickness and Energy thickness and write expressions of each. [8]

b) Solve any one of the following. [8]

i) The lift force F_L of an airfoil is found to depend on Mass density (ϱ), velocity of flow (V), characteristic depth d, angle of incidence (α) and coefficient of viscosity (μ) show by dimensional analysis $F_L = \varrho V^2 d^2 \phi[(\varrho Vd/\mu), \alpha]$

ii) In a fluid mechanics laboratory it was asked to conduct an experiment on a flat plate of 2mt long and 1.2mt wide in a wind tunnel with a wind velocity of 40 Km/hr when the plate is at 6° angle of attack the coefficients of lift and drag are computed as 0.7 and 0.18 respectively. Find the

1) Lift force
2) Drag force
3) Magnitude and direction of resultant force and
4) Power exerted by air on the plate. Assume density of air as 1.2 kg/m³.

* * *