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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part-II) (Semester - III) (Revised) Examination, April - 2018

APPLIED THERMODYNAMICS

Sub. Code : 63352

Day and Date : Thursday, 26 - 4 - 2018 **Total Marks : 100**

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

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicates full 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) Explain equivalence of Kelvin-Planck and Clausius statement of second law. **[8]**

OR

b) Explain Available energy, Unavailable energy and Dead state. **[8]**

c) State and prove Clausius Inequility. **[8]**

Q2) a) Draw P - V, T - V and P - T diagram for water - steam pure substance. **[8]**

OR

b) Write note on Reheat and Regenerative steam power cycles. **[8]**

c) A simple Rankine cycle steam power plant operates between temperatures of 260°C to 95°C. The steam is supplied to the turbine at a dry saturated condition. In the turbine, it expands in isentropic manner. Determine the efficiency of Rankine cycle, net work done and SSC. **[8]**

Q3) a) Classify boilers and compare between water tube and fire tube boilers. **[8]**

OR

b) Classify steam condensers and compare between surface and jet condensers. **[8]**

P.T.O.

Q5) a) Explain with the help neat sketch a single stage impulse turbine. Also explain the pressure and velocity variations along the axial direction. Draw combined velocity triangle of impulse turbine. **[9]**

b) A simple impulse turbine has one ring of moving blades running at 150 m/s. The absolute velocity of steam at exit from the stage is 85 m/s at an angle of 80° from the tangential direction. Blade velocity ci-efficient is 0182 and the rate of steam flowing through the stage is 2.5 kg/s. If the blades are equiangular, determine **[8]**

i) Blade angles

ii) Nozzle angle

iii) Axial thrust

iv) Absolute velocity of steam at inlet

Q6) a) Explain the term reheat factor why it's magnitude is always greater then unity? **[8]**

OR

Which are the different governing methods of steam turbine. Explain any one of them.

b) In a Parson's reaction turbine of 50% degree of reaction running at 1500 rpm, the available enthalpy drop for an expansion is 62.8 kJ/kg. If the mean diameter of the rotor is 1 m. Find number of rows of moving blades required. The blade outlet angle is 20° and speed ratio 0.7. Assume stage efficiency as 80%. **[8]**

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c) During a trial on a steam condenser, the following observations were made **[10]**

Condenser Vacuum	680 mm of Hg
Barometer reading	764 mm of Hg
Mean condenser temperature	36.2°C
Hot well temperature	30°C
Condensate formed per hour	1780 kg
Circulating cooling water inlet temperature	20°C
Circulating cooling water outlet temperature	32°C
Quablity of cooling water	1250 kg/min

Determine:

i) Condenser Vacuum corrected to standard barometer

ii) Vacuum Efficiency

iii) Under cooling of condensate

iv) Condenser efficiency

v) Condition as steam as it enters the condenser

Take the specific heat of water as 4.186 kJ/kgK

Q4) a) What is the effect of friction on the flow through a steam nozzle? Explain with the help of h - S diagram. **[8]**

OR

Derive an expression for mass of steam discharged through nozzle.

b) A convergent divergent nozzle is to be designed when pressure of entering steam is of 15 bar with dryness fraction of 0.97. The exit pressure is 0.2 bar. The mass flow rate is 9 kg/kw. hr. If the power developed is 220 kw determine: **[9]**

i) Throat pressure

ii) The number of nozzles required if each nozzle has a throat of rectangular C/S of 4 mm × 8 mm.

Take frictional heating as 78.96 kJ/kg.

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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) Examination, April - 2018

ELECTRICAL TECHNOLOGY

Sub. Code : 63351

Day and Date : Wednesday, 25 - 4 - 2018 **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) **Draw neat figures wherever necessary.**
4) **Assume suitable data, if missing. State it clearly.**

Q1) a) Explain the function of [1×8]

i) Field winding ii) Armature winding

iii) Commutator iv) Interpoles in a dc motor

OR

Differentiate between dc shunt motor and dc series motor about

i) Field winding design ii) Torque speed characteristics

iii) Starting torque iv) Applications

Answer any two of the following (b, c, d): [2×6]

b) Explain the principle of reversing rotation of dc motor. Draw appropriate circuit diagrams.

c) Explain the basic methods of speed control of dc series motor.

d) A DC shunt motor runs at 1200 rpm driving a constant torque load by taking 10 A armature current from 200 V supply. Now 5 ohm resistance is series with the armature winding. Find the new armature current and new speed. The armature resistance is 0.6 ohm.

P.T.O.

)2) Answer any TWO: [2×8]

a) Explain the working of 3 phase induction motor.

b) Compare two types of 3 phase induction motor with different rotor constructions.

c) Torque of 3 phase induction motor is given by $\frac{120sE_2^2R_2}{2\pi N_s\left(R_2^2+s^2X_2^2\right)}$ where E_2, R_2, X_2, s, N_s are rotor induced emf per phase at standstill, Rotor resistance per phase, Rotor reactance per phase at standstill, slip and synchronous speed respectively. Write the value of slip and expression for torque

i) At starting

ii) When the torque is maximum

iii) If rotor speed = Synchronus speed

)3) Answer any TWO: [2×8]

a) Why does induction motor draw large current at large slip? Explain basic methods of reducing starting current of induction motor.

b) Compare different methods of speed control of induction motor on the basis of

i) Effect on starting torque

ii) Suitability to different types of rotor

iii) Effect on current drawn while driving constant torque load

c) Explain the principle of rotation reversal of 3 phase induction motor. Draw necessary circuit diagrams.

)4) Answer any TWO: [2×8]

a) What is the difference between drive motor and servo motor? Describe methods of controlling dc servo motor.

b) Describe the construction and working of any one type of stepper motor.

c) Describe a linear induction motor. State its applications.

)5) Answer any TWO: [2×8]

a) State starting and braking requirements of following load and state one suitable motor for each.

i) Paper mill ii) Drilling machine

iii) Rolling mill iv) Conveyor

b) Explain with examples the terms - active load, passive load, multimotor drive.

c) Classify mechanical loads based on how the torque requirement changes with driving speed. Explain.

)6) Answer any TWO: [2×8]

a) Compare core type induction furnace with coreless induction furnace.

b) State basic principle of producing large heat for industrial use by using electric power. How is this principle adapted in resistance furnace, induction furnace, arc furnace.

c) Find the input power to a furnace required to melt 500 kg metal scrap per hour. The scrap is preheated to 100 deg. C. Efficiency of furnace 60%, latent heat constant of metal 270 J/kg, specific heat constant of metal 450 J/kg, melting point = 1500 deg. C.

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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical Engg.) (Semester - III) (Revised) Examination, April - 2018

ENGINEERING MATHEMATICS -III

Sub. Code :63350

Day and Date : Tuesday, 24- 04 - 2018 **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) **Use of non-programmable calculator is allowed.**
4) **Assume suitable data if necessary.**

SECTION - I

Q1) Attempt any Three of the following.

a) Solve $\left(D^2-4D+4\right)y=x^3+\cos 2x$ **[6]**

b) Solve $\left(D^3-7D^2+10D\right)y=e^{2x}\sin x$ **[6]**

c) Solve $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=\sin e^x$ **[6]**

d) Solve $x^2\frac{d^3y}{dx^3}+3x\frac{d^2y}{dx^2}+\frac{dy}{dx}+\frac{y}{x}=x^2\log x$ **[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 its centre and short bearing at both ends i.e. for $x=\pm l, y=\frac{d^2y}{dx^2}=0$ show that $y=\frac{g}{2\omega^2}\left[\frac{\cos mx}{\cos ml}+\frac{\cosh mx}{\cosh ml}-2\right]$, where $m^4=\frac{W\omega^2}{EIg}$ **[16]**

P.T.O.

b) A spring at the upper end supports a weight of 980 gm at its lower end. The spring stretches ½ cm under a load of 10 gm and the resistance (in gm wt.) to the motion of the weight is numerically equal to the 1/10 of the speed of weight in cm/sec. The weight is pulled down ¼ cm below its equilibrium position and then released. Find the expression for the distance of weight from its equilibrium position at time t during its first upward motion. **[16]**

3) Attempt any four of the following.

a) Show that $\vec{V} = 2xyz\vec{i} + (x^2z + 2y)\vec{j} + x^2y\vec{k}$ is irrotational and hence find a scalar potential function $u(x, y, z)$ such that $\vec{V} = \text{grad } u$ **[4]**

b) Find angle between surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at a point $(2, -1, 2)$ **[4]**

c) If $\vec{a}$ is a constant vector and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ then prove that

i) $div(\vec{a} \times \vec{r}) = 0$

ii) $curl(\vec{a} \times \vec{r}) = 2\vec{a}$ **[4]**

d) If $\vec{F} = (x+y+1)\vec{i} + \vec{j} - (x+y)k$, find the value of $\vec{F}$. curl $\vec{F}$ **[4]**

e) If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = \sqrt{x^2 + y^2 + z^2}$ then prove that $\nabla(r^2e^r) = (r+2)e^r\vec{r}$ **[4]**

SECTION - II

4) Attempt any three questions from the following.

a) Find Laplace transform of $\frac{1}{t}(\cos 6t - \sin 4t)$ **[6]**

b) Find Inverse Laplace transform of $\frac{3s+1}{(s-1)(s^2+1)}$ **[6]**

c) Solve using Laplace transform method $\frac{dy}{dt} + 3y + 2\int_0^t y\,dt = t$, given that $y(0) = 0$ **[6]**

d) Find the Laplace transform of $\frac{te^{3t}\sin t\cos t}{2}$ **[6]**

5) Attempt any two from the following.

a) Obtain Fourier series for $f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi \le x \le 0 \\ 1 - \frac{2x}{\pi}, & 0 < x \le \pi \end{cases}$ and hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$ **[8]**

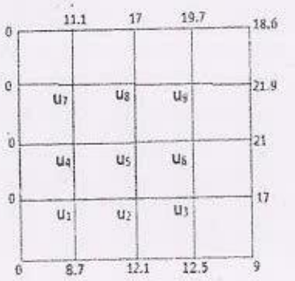
b) Obtain the Fourier series expansion for the function $f(x) = x + x^2$ in $(-1, 1)$. **[8]**

c) Find half range sine series for $f(x) = \begin{cases} x, & 0 < x < \pi/2 \\ \frac{\pi}{2}, & \pi/2 < x < \pi \end{cases}$. **[8]**

6) Attempt any one from the following.

a) An elastic string stretched between two fixed points at a distance 'l' apart. One end is taken at origin and at a distance $\frac{2l}{3}$ from this end the string is displaced a distance k transversely and is released from rest when in this position. Find $y(x, t)$ the vertical displacement, if y satisfies the equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ **[16]**

b) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for the following square mesh with boundary values as shown in figure by Gauss-Siedal iterative method by performing four iterations. **[16]**



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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) (Revised) Examination, April - 2018

FLUID MECHANICS

Sub. Code: 63354

Day and Date : Saturday, 28 - 04 - 2018 **Total Marks : 100**

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

Instructions :
1) **All questions 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) Define surface tension and show that the gauge pressure within a liquid droplet varies inversely with the diameter of the droplet. **[6]**

b) A U tube containing water has two limbs of internal diameters 3 mm and 8 mm respectively. The free surfaces of water are observed to be having approximately zero contact angles with the U tube surface. What is the approximate difference of water level between the two limbs? Surface tension coefficient and density of water are 0.073 N/m and 1000 Kg/m^3 respectively. **[6]**

c) Explain the terms stable, unstable and neutral equilibrium with reference to the floating bodies. **[4]**

Q2) a) The velocity field in a fluid flow is given by $V = x^2ti + 2xytj + 2yztk$ where x, y and z are given in metre and time t in seconds. Determine the velocity vector at a point $(2, -1, 1)$ at time $t = 1$ second. Also determine the magnitude of velocity and acceleration of the flow for the given location and time. **[8]**

b) Solve any one of the following : **[8]**

i) Define stream function and velocity potential. Show that the lines of constant stream function and velocity potential must intersect orthogonally.

P.T.O.

ii) Explain briefly the phenomenon of propagation of elastic waves in a compressible fluid and hence define zone of action and zone of silence.

3) a) i) Starting from steady flow energy equation show how Bernoulli's equation for an inviscid incompressible fluid can be obtained. **[4]**

ii) State the momentum equation. How will you apply momentum equation for determining the force exerted by a flowing fluid on a pipe bend? **[5]**

b) Solve any one of the following : **[9]**

i) Gasoline of specific gravity 0.8 is flowing upwards in a vertical pipeline which tapers from 30 cm to 15 cm diameter. A gasoline mercury differential manometer is connected between 30 cm and 15 cm pipe section to measure the rate of flow. The distance between the manometer tappings is 1 metre and gauge reading is 0.5 metre of mercury find

1) Differential gauge reading in terms of gasoline head.

2) Rate of flow. Neglect friction and other losses between tappings.

ii) A 300 mm × 150 mm venturimeter is to be replaced by an orificemeter both the meters are to give the same differential mercury manometer reading for a discharge of 100 lit/sec and the inlet diameter to remain as 300 mm. What should be the diameter of orifice? The coefficient of discharges of the venturimeter and orificemeter are 0.98 and 0.6 respectively. Assume the working fluid as water.

4) a) i) Explain why there is a need of defining correction factors for kinetic energy and momentum? And hence define kinetic energy correction factor and momentum correction factor. **[4]**

ii) Explain the concept of Total Energy Line and Hydraulic gradient Line. **[4]**

b) An oil of dynamic viscosity 20 centipoise and density 1200 Kg/m^3 flows through a 2.5 cm diameter pipe 250 metre long. What is the maximum flow in m^3/s that will ensure laminar flow? What would be the pressure drop for this flow? **[8]**

5) a) Show that the loss of head due to friction in a circular pipe can be expressed as $h_f = fLV^2/2gD$ where f is friction factor, L is length of pipe, V is average velocity and D is diameter of pipe. **[9]**

b) Solve any one of the following : **[9]**

i) Two pipelines of equal length and with diameters of 20 cm and 30 cm are in parallel and connect two reservoirs. The difference in water levels in the reservoirs is 4 metres. If the friction factors are assumed to be equal, find the ratio of the discharges due to the large diameter pipe to that of the smaller diameter pipe. Neglect all minor losses.

ii) Water is flowing through a horizontal pipe when the diameter of the pipe is suddenly enlarged from 20 cm to 40 cm, the hydraulic gradient line rises by 15 mm. Find the rate of flow of water.

6) a) Explain the effect of pressure gradient on boundary layer separation. **[8]**

b) Solve any one of the following : **[8]**

i) The power P required to run a centrifugal pump depends on the impeller diameter D, the rotational speed N, the rate of discharge Q, density ρ and viscosity μ. Using Buckingham's π theorem obtain an expression for power of the form $P=\rho N^3D^5\Phi\left[\left(Q/ND^3\right),\left(\mu/\rho ND^2\right)\right]$.

ii) A truck having a projected area of 6.5 m^2 travelling at 70 Km/hr has a total resistance of 2000 N of this 20 percent is due to rolling friction and 10 percent due to surface friction. The rest is due to form drag. Make calculations for the coefficient of form drag. Take density of air as 1.22 Kg/m^3.

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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) (Revised) Examination, April -2018

METALLURGY

Sub. Code : 63353

Day and Date :Friday, 27 - 04 - 2018 **Total Marks : 100**

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

Instructions :
1) **Solve any three questions from each section.**
2) **Answer for both sections to be written in the same answer book.**
3) **Figures to the right indicate full marks.**
4) **Draw neat figures wherever necessary.**

SECTION - I

Q1) Answer any three of the following. Each question carries equal marks. **[18]**

a) What is Coring and Dendritic structure? Explain with neat sketches.

b) Explain what cooling curves are. Draw different types of cooling curves and evalute degree of freedom (DOF) of anyone using Gibbs phase rule.

c) What are Hume Ruthery rules for Substitutional Solid Solutions? Explain.

d) Explain what are Eutectic, Eutectoid and Peritectic transformations?

Q2) a) Draw Fe-Fe_3C equilibrium diagram. Indicate all the phases, Temperatures and Compositions. **[8]**

b) Suggest suitable materials for any four of the following and justify the same. **[8]**

i) Steel used in RCC

ii) Gears

iii) Machine tool Column

iv) Tools used in

v) Restaurant pots and pans

vi) Bearing material

P.T.O.

3) a) What are Malleable cast Irons? Explain the manufacturing process? Draw typical microstructure of Malleable and Gray cast iron and compare their properties. [7]

b) Draw self explanatory sketches of any three. [9]

i) Typical Microstructures of medium carbon steel and high carbon steels.

ii) Microstructures of White and gray cast irons.

iii) Microstructures of α & $\alpha + \beta$ brasses.

iv) Sn-Sb equilibrium diagram.

v) Substitutional and Interstitial solid solutions.

vi) Standard specimen for Charpy and Izod impact testing.

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

a) Water hardenables Tool steels.

b) Stainless steels.

c) Rockwell hardness testing.

d) Cast iron.

e) Ultra sonic Testing.

SECTION - II

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

b) Draw TTT diagram for hypo eutectoid and hyper eutectoid steels and explain why mild steel cannot be hardened by quenching? [9]

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

b) Elaborate case hardening processes, which steels are carburized and what is the significance of case depth? How it is measured? [8]

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

a) Hardening and softening processes.

b) Compacting and sintering.

c) Austempering and martempering.

d) Flame and induction hardening.

e) CCT and TTT diagram.

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

a) Oxidation and decarburization defects.

b) Austenitic grain size.

c) Austenite to Pearlite transformation.

d) Different Powder manufacturing methods.

e) Heat treatment furnaces.

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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical Engineering) (Semester - IV)
Examination, May - 2018
APPLIED NUMERICAL METHODS
Sub. Code : 63360

Day and Date : Friday, 04 - 05 - 2018 **Total Marks : 100**

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

Instructions :
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.**

Q1) a) Explain the different types of errors in numerical computations. **[4]**

b) Solve any two : **[2×6=12]**

i) Use bisection method to find the root correct to three decimal places of $f(x)=x^3-4x-8.95=0$.

ii) Using Newton's iterative method, find the real root of $x\log_{10}x=1.2$ correct to five decimal places.

iii) Use Muller's method to find a root of the equation $x^3-3x-7=0$, which lies between 2 and 3.

Q2) Solve any two : **[2×8=16]**

a) Solve the following equations by Gauss-Jordon method

$3x+4y+5z=18$

$2x-y+8z=13$

$5x-y+7z=20$

b) Solve the system of equations using LU Decomposition.

$3x+2y+7z=4$

$2x+3y+z=5$

$3x+4y+z=7$

P.T.O.

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

$15x+3y-2z=85$

$2x+10y+z=51$

$x-2y+8z=5$

Q3) a) Fit a polynomial of the second degree for the following data : [6]

x:	0	1	2	3	4
y:	1	0	3	10	21

Hence find y at $x=2.5$

b) Derive the equation of the interpolating polynomial by Newton's divided difference table for the following data : [6]

x:	0	1	2	3	4	5
y:	3	2	7	24	59	118

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

Size of item:	6	7	8	9	10	11	12
Frequency:	3	6	9	13	8	5	4

Q4) Solve any two : [2×8=16]

a) A slider in a machine moves along a fixed straight rod. Its distance $x(m)$ along the rod are given in the table for various values of time (sec). Find the velocity and acceleration of slider at t=0.3 seconds.

t(sec):	0	0.1	0.2	0.3	0.4	0.5	0.6
x(m):	30.13	31.62	32.87	33.64	33.95	33.81	33.24

b) Evaluate $\int_4^{5.2} \ln x\,dx$ using trapezoidal and Simpson's $1/3^{rd}$ rule n=6.

c) Use Romberg's method to evaluate $\int_0^{\pi} \sin x\,dx$.

Q5) Solve any two : [2×8=16]

a) Compute $y(0.2)$ correct to four decimal places, for $\frac{dy}{dx}+y+xy^2=0$ with $y(0)=1$, take $h=0.1$. Use RungeKutta fourth order method.

b) Given the boundary value problem $\frac{d^2y}{dx^2}=6x+4$ $y(0)=2, y(1)=5$ obtain its solution in the range $0\le x\le 1$ with $h=0.25$ using Finite Difference method.

c) Solve the equation $\frac{dy}{dx}=x+y$. Given $y(0)=1$. Obtain the values of $y(0.1), y(0.2)$ using Picard's method.

Q6) a) Classify the following partial differential equations : [6]

i) $\frac{\partial^2 y}{\partial t^2}=\alpha^2\frac{\partial^2 y}{\partial x^2}$

ii) $xU_{xx}+yU_{yy}+4y^2U_x=0$

iii) $\frac{\partial u}{\partial t}=k\frac{\partial^2 u}{\partial x^2}$

b) Solve $U_{xx}+U_{yy}=0$ in the square mesh of side 4 units satisfying the following conditions. [12]

i) $u(0,y)=0$ for $0\le y\le 4$

ii) $u(4,y)=12+y$ for $0\le y\le 4$

iii) $u(x,0)=3x$ for $0\le x\le 4$

iv) $u(x,4)=x^2$ for $0\le x\le 4$

Perform two iterations

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) a) Explain the concept of Equivalent Length and slenderness ratio of the column. Discuss the limitation of the Euler's Formula. [8]

b) A tension bar 5 m long (Fig. 5) is made up of two parts, 3m of its length has a cross sectional area of 10 cm² while the remaining 2 m has an cross sectional area of 20 cm². An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar of the same length and having the same volume when under the same load. Take $E = 2 \times 10^5$ N/mm². [8]

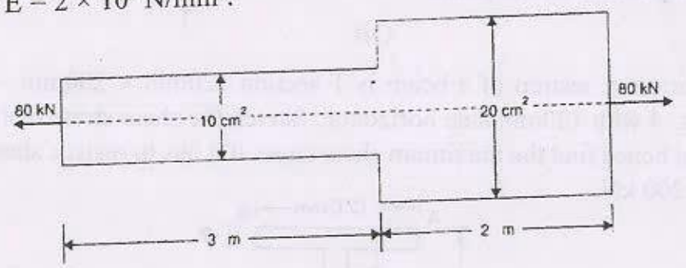

Fig. 5

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Total No. of Pages : 4

Seat No.

S.E. (Mechanical) (Semester - IV) Examination, May - 2018
ANALYSIS OF MECHANICAL ELEMENTS
Sub. Code: 63361

)ay and Date : Monday, 07 - 05 - 2018 Total Marks : 100

'ime :10.00 a.m. to 1.00 p.m.

nstructions :
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.

)1) a) Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 50 cm apart as shown in Fig. 1. Diameters and lengths of each rod are 2 cm and 4 m respectively. A cross a bar fixed to the rods at the lower ends carries a load of 5000 N such that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar. Take E for steel = 2×10^5 N/mm² and E for copper 1×10^5 N/mm². [12]

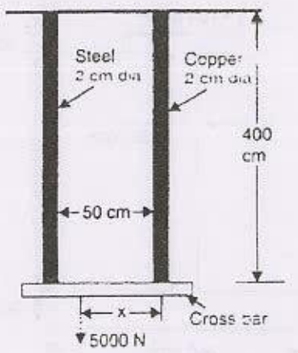

Fig. 1

P.T.O.

b) Explain the stress strain curve for ductile and brittle material with the help of neat sketch. [6]

OR

b) Find the angle of twist per meter length of hollow shaft of 100 mm external and 60 mm internal diameter. If the shear stress is not to exceed 35 N/mm². Take modulus of rigidity as 85×10^3 N/mm². [6]

Q2) Draw SFD and BMD for loading condition shown in fig 2. Locate point of inflection if any. [16]

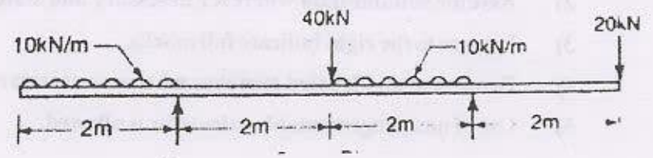

Fig. 2

Q3) The tension flange of a cast iron I section beam is 240 mm wide and 50 mm deep, the compression flange is 100 mm wide and 20 mm deep whereas web is 300 mm × 30 mm as shown in fig. 3. Find the load per meter run which can be carried over a 4m span by a simply supported beam, if the maximum permissible stresses are 90 N/mm² in compression and 24 N/mm² in tension. [16]

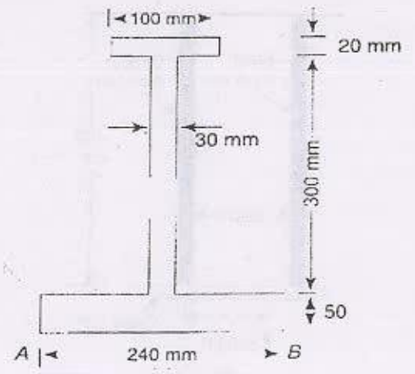

Fig. 3

Q4) a) Derive the expression for the principal stresses and the maximum shear stress for a member subjected to like direct stresses in mutually prependicular directions. Show the locations of Principal Planes and Planes of Maximum shear stress. [9]

b) The stresses on the two perpendicular planes through a point are 120 MPa (tensile), 80 MPa (Compressive), 60 MPa (Shear). Determine the normal and shear stress components on a plane at 60° to that of the 120 MPa stress and also the resultant and its inclination with normal components on the plane. [9]

OR

b) The cross section of a beam is T section 120mm × 200mm × 12mm Fig. 4 with 120mm side horizontal. Sketch the shear stress distribution and hence find the maximum shear stress if it has to resist a shear force of 200 kN. [9]

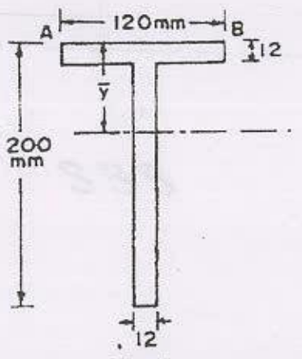

Fig.4

Q5) a) Derive the expression for slope and deflection of a cantilever subjected to uniformly distributed load (UDL) over whole length using double integration method. [8]

b) A cantilever beam of span 4 m carries a point load of 20 kN at a distance of 3 m from the fixed end. Determine, by moment area method the slope and deflection at the free end of the cantilever Assume $EI = 9 \times 10^{12}$ N mm². [8]

OR

b) State the importance of theories of failure and explain the maximum strain energy theory. [8]

c) An axial flow compressor having eight stages with 50% reaction design compresses air in the pressure ratio of 4:1. The air enters the compressor at 20°C and flows at a constant speed of 90 m/s. The rotating blades of compressor rotate with a mean speed of 180 m/s. Isentropic efficiency of the compressor taken as 82%. Calculate,

i) Work done by machine

ii) Blade angles

Take $\gamma = 1.4$ and $c_p = 1.005$ kJ/kg K. **[8]**

Q6) a) Compare gas turbine with reheating and intercooling. **[8]**

d) A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 610°C. The isentropic efficiencies of the compressor and turbine are 80% and 82% respectively. Calculate the power output in kW of an electric generator geared to the turbine when air enters the compressor at 15°C at the rate of 16 kg/s.

Take $\gamma = 1.4$ and $c_p = 1.005$ kJ/kg K for the compression process and $\gamma = 1.333$ and cp = 1.11 kJ/kg K for the expansion process. **[8]**

OR

c) In an oil-gas turbine installation, it is taken at pressure of 1 bar and 27°C and compressed to a pressure of 4 bar. The oil with calorific value of 42000 kJ/kg is burnt in the combustion chamber to raise the temperature of air 550°C. If the air flows at the rate of 1.2 kg/s, find the net power of installation and air fuel ratio. **[8]**

Take $c_p = 1.05$ kJ/kg K and $c_v = 0.714$ kJ/kg K.

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Total No. of Pages : 4

Seat No.

S.E. (Mechanical Engineering) (Part - II) (Semester - IV) (Revised) Examination, May - 2018

FLUID AND TURBO MACHINERY

Sub. Code: 63362

Day and Date : Friday, 11 - 05 - 2018 **Total Marks : 100**

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

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right side indicate full marks.**
3) **Assume suitable data, if necessary and indicate clearly.**
4) **Use non programmable calcualtor is allowed.**

Q1) a) Explain different efficiencies of hydraulic turbine. **[8]**

b) A Pelton wheel is to be designed for following specifications **[8]**

i) Shaft Power = 13250 kW

ii) Head = 800 m

iii) Speed = 600 rpm

iv) Peripheral velocity = $0.46\sqrt{2gH}$

v) Overall efficiency = 85%

vi) The diameter of the jet is not exceeding one sixteenth the wheel diameter.

Take coefficient of velocity 0.97 and determine,

1) Discharge through turbine
2) Diameter of wheel
3) Diameter of jet
4) Number of jet required

OR

c) A Pelton wheel is revolving at a speed of 190 rpm and develops 5150.25 kW when working under head of 220 m with an overall efficiency of 80%. The speed ratio for turbine is given as 0.47. Determine unit speed, unit discharge and unit power. Also find speed when this turbine is working under a head of 140 m. **[8]**

P.T.O.

Q2) a) State working principle of Reaction turbine and explain working of any one reaction turbine. [8]

b) A Francis turbine with overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity = $0.26\sqrt{2gH}$ and radial velocity of flow at inlet is $0.96\sqrt{2gH}$. The wheels runs at 150 rpm and hydraulic losses in turbine are 22% of available energy. Assuming radial discharge. [8]

Derermine:

i) Guide blade angle,

ii) Wheel vane angle,

iii) Diameter of wheel,

iv) Width of wheel at inlet.

OR

c) A conical draft tube having diameter at the top as 2 m and pressure head of 7 m of water (vacuum), discharges water at the outlet with a velocity of 1.2 m/s at the rate of 25 m^3/s. If atmospheric pressure head is 10.3 m of water and losses between the inlet and outlet of the draft tube are negligible, find the length of draft tube immersed in water. Total lenght of tube is 5m. [8]

Q3) a) Explain construction of centrifugal pump and define different heads available for pump. [8]

b) Write a short note (any two): [10]

i) Explain multistage of pump.

ii) What is Cavitation and also comments on effects, precaution

iii) Explain performance curves of pump.

OR

c) Solve following problems. [10]

i) A centrifugal pump is used to discharge 0.118 m^3/s of water at a speed of 1450 rpm against a head of 25m. 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.

ii) Find the number of pumps required to take water from a deep well under a total head of 89m. All pumps are identical and are running at 800 rpm. The specific speed of each pump is given as 25 rpm while the rated capacity of each pump is 0.16 m^3/s.

Q4) a) Why the clearance volume is provided in reciprocating air compressor. Explain its effect on the work required to drive the compressor. [8]

b) Write a short note (any two): [10]

i) Explain root blower and vane blower compressor.

ii) Different efficiencies of reciprocating air compressor.

ii) Different applications of compressed air.

OR

c) Solve following problems. [10]

i) A two stage single acting reciprocating air compressor draws in air at a pressure of 1 bar and 17°C and compresses it to a pressure of 60 bar. After compression in the low pressure cylinder, the air is cooled at constant pressure of 8 bar to a temperature of 37°C. The low pressure cylinder has a diameter of 150 mm and both cylinders have 200 mm stroke. If law of compression is PV^{135}= constant, find the power of the compressor, when it runs at 200 rpm. Take R = 287 J/kg K.

ii) A single stage reciprocating air compressor takes in 7.5 m^3/min of air at 1 bar and 30°C and delivers it at 5 bar. The clearance is 5 percent of the stroke. The expansion and compression follows $PV^{1.3}$ = constant. Calculate Temperature of delivered air volumetric efficiency & power of the compressor.

Q5) a) Explain terms Surging, Chocking, and Stalling for centrigual air compressor. [8]

b) A centrifugal compressor running at 10000 rpm delivers 660 m^3/min of free air. The air is compressed from 1 bar and 20°C to pressure ratio of 4 with isentropic efficiency of 82%. Blades are radial at outlet of impeller and flow velocity of 62 m/s may be assumed throughout constant. The outer radius of impeller is twice the inner and the slip factor may be assumed as 0.9. The blade area co-efficient may be assumed 0.9 at inlet. Calculate:

i) Theoretical power

ii) Impeller diameters at inlet and outlet. Also find breadth of impeller at inlet. [8]

OR

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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - IV) (Revised) Examination, May - 2018

THEORY OF MACHINES - I

Sub. Code: 63363

Day and Date : Monday, 14 - 05 - 2018 **Total Marks : 100**

Time :9.30 a.m. to 1.30 p.m.

Instructions :
1) **Attempt all questions.**
2) **Figures to the right indicate full marks.**
3) **Draw neat labeled sketch wherever necessary.**
4) **Assume suitable data, if necessary and state clearly.**
5) **Use of non-programmable calculator is allowed.**

Q1) a) Write a note on different types of kinematic pairs with the help of neat sketches. **[8]**

OR

A Hooke's joint connects two shafts having an angle of 15° between them. The driving shaft rotates at 1200 r.p.m. The driven shaft has a flywheel of mass 7 kg and radius of gyration 90 mm. Find the maximum angular acceleration of the driven shaft and the maximum torque required. **[8]**

b) A four bar mechanism is as shown in fig. 1. b. Lengths of various links are: OA = 225 mm, AB = 375 mm, BC = 350 mm and OC = 650 mm. Crank OA rotates at 320 r.p.m. Locate all the instantaneous centres and find: **[8]**

i) velocity of B and

ii) angular velocities of AB and BC.

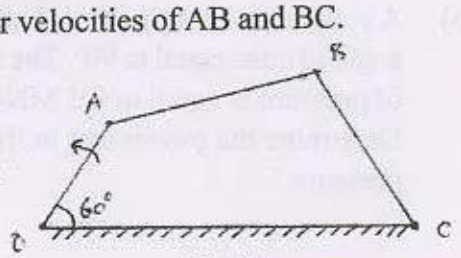

fig. 1.b

P.T.O.

Q2) The dimensions of the various links of a mechanism shown in fig. 2 are: OA = 30 mm, AB = 80 mm, BC = 45 mm and BD = 120 mm. **[18]**

The crank OA rotates uniformly in clockwise direction at 120 r.p.m. For the given configuration, find

a) velocity of D,

b) acceleration of D and

c) angular acceleration of link BD.

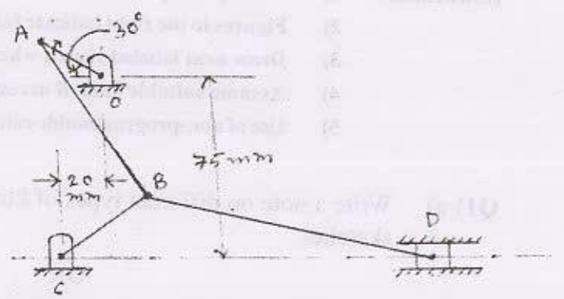

fig. 2

Q3)a) Derive the equation for friction torque in case of flat collar pivot bearing assuming the condition of uniform pressure. **[8]**

OR

Derive the equation for friction torque in case of conical pivot bearing assuming uniform wear with usual notations. **[8]**

b) A conical pivot supports a shaft having an axial load of 15 kN and has an angle of cone equal to 90°. The shaft is rotating at 150 r.p.m. The intensity of pressure is equal to 0.3 MN/m² and the coefficient of friction is 0.05. Determine the power lost in friction assuming the condition of uniform pressure. **[8]**

Q4) a) With neat sketches write classification of followers. **[4]**

b) Construct the cam profile for the following specifications;

Least radius of cam = 25 mm; Diameter of roller = 25 mm; Angle of rise 120°; Angle of fall = 150°; Angle of dwell in between = 45°; Lift of follower = 40 mm;

During the lift follower moves with SHM and during the fall it moves with uniform acceleration and deceleration. The line of stroke of follower is off set by 12.5 mm towards right of centre of cam. **[14]**

Q5) a) Explain law of belting: **[6]**

OR

Explain initial tension in belt drive. **[6]**

b) An open belt drive connects two pulleys 1200 mm and 500 mm diameters, on parallel shafts 4 m apart. The maximum tension in the belt is 1855.3 N. The coefficient of friction is 0.3. The driver pulley of 1200 mm diameter rotates at 200 rpm. Calculate the power transmitted by the drive and torque on each pulley. **[10]**

Q6) a) Derive the equation for relation between speed and height of Porter governor. **[6]**

OR

Explain effort and power of governor. **[6]**

b) In a spring loaded Hartnell governor, the extreme radii of rotation of balls are 80 mm and 120 mm. The weight arm and sleeve arm of bell crank lever are equal in length. Mass of each ball is 2 kg. The speeds at the two extreme positions are 400 and 420 rpm. Determine spring stiffness and initial compression of spring. Neglet the sleeve mass. **[10]**

EEE

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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part-II) (Semester-IV) (Revised) Examination, May - 2018

MACHINE TOOLS AND PROCESSES

Sub. Code : 63364

Day and Date : Wednesday, 16 - 05 - 2018 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 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 (4 marks each):

a) Explain the properties of core sand. Suggest the methods to measure the same. [4]

b) Briefly explain the function of runners and gates in the gating system. [4]

c) What are the steps involved in pressure die casting. [4]

d) Draw neat sketch of arc furnace and label all the parts. [4]

e) State the defects related to melting process? Explain any two of them. [4]

Q2) Attempt any four (4 marks each):

a) How does cold rolling differ from hot rolling in terms of the process and product? [4]

b) List the different stages in drop forging process in production of a component such as spanner. [4]

c) Show by schematic sketches the process of forward extrusion. Give two examples of components produced by extrusion. [4]

d) What is the difference between a wire drawing operation and extrusion? [4]

e) Why is the strength of rolled part is better that a cast piece. [4]

P.T.O.

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

a) Advantages and limitations of centrifugal casting process. **[6]**

b) Defects in extrusion. **[6]**

c) Blow molding. **[6]**

d) Calendaring process for plastic. **[6]**

Q4) Attempt any four (4 marks each):

a) Calculate the gear train for cutting following threads on a lathe having lead screw 4 TPI.

i) 6 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) Describe the various work holding devices used on turret lathe. **[4]**

c) Discuss in brief methods of classification of boring machines. **[4]**

d) Draw a neat sketch of radial drilling machine and label all the parts. **[4]**

e) Where would you propose use of face plate on a lathe? Justify your answer. **[4]**

Q5) Attempt any four (4 marks each):

a) What is meant by the term 'speed' & 'feed' of a planer. **[4]**

b) Explain with neat sketch working principle of shaper. **[4]**

c) Describe the function of any four parts of milling machines. **[4]**

d) Sketch and describe the following operations on milling machine: **[4]**

i) Angular milling.

ii) Keyway milling.

e) Which method of manufacturing of a gear is best suitable for helical gears? Give reasons. **[4]**

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

a) Various operations performed on drilling machine. **[6]**

b) Electrical Discharge machining advantages and limitations. **[6]**

c) Applications of Laser beam machining process with sketch. **[6]**

d) Ultrasonic machining process. **[6]**

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