Seat No.	

Total No. of Pages : 3

S.E. (Mechanical) (Part - II) (Semester - IV) Examination, May - 2015

ANALYSIS OF MECHANICAL ELEMENTS

Sub. Code : 43592

Day and Date : Tuesday, 05 - 05 - 2015 Total Marks : 100

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

Instructions : 1) Solve any three questions from each section.
2) Assume suitable data wherever necessary & state it clearly.
3) Figures to the right indicates full marks.

SECTION - I

Q1) a) State the assumptions made in pure torsion. [4]

b) Two Copper rods & one steel rod, each of diameter 20mm jointly support a load of 100 kN as shown in figure 1.a. Calculate stresses in steel and copper rods. Also calculate the load shared by each rod.

$E_s = 200\ kN/mm^2$ & $E_c = 100\ kN/mm^2$. [12]

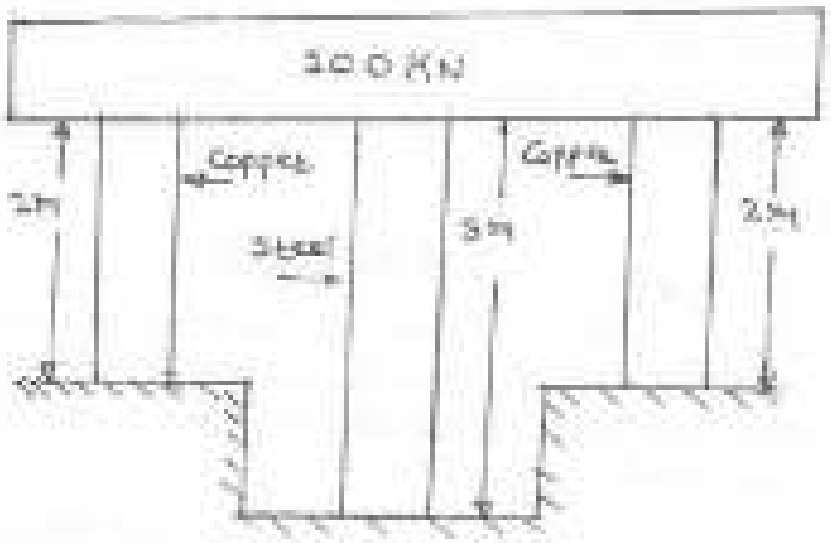

Fig. - 1.a

P.T.O.

Q2) Draw the shear force and bending moment diagrams for the beam shown in figure-2. Locate a point of max. bending moment and point of contraflexure in any. [18]

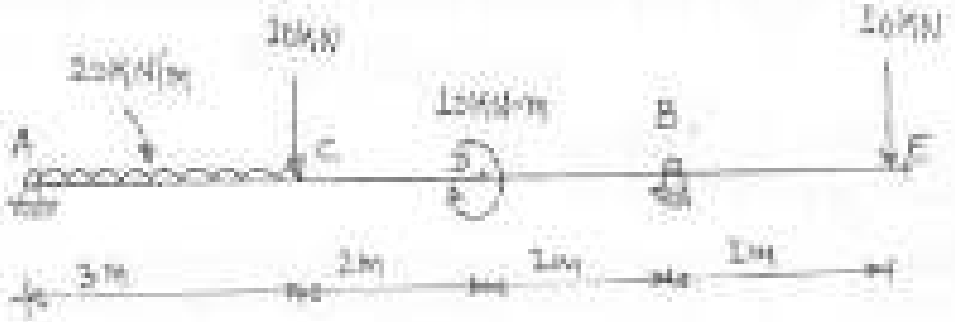

Fig. - 2

Q3) a) State the assumptions made in theory of simple bending. [4]

b) A cast iron beam of T-Section 8m long is simply supported at its ends. It carries a UDL of 1.5 kN/m over entire length. Determine the bending stresses and show it graphically. Flange dimensions are 100mm x 20mm & Web dimensions are 120mm x 20mm. [13]

Q4) 'I' - shaped cross section of a beam with flange dimensions 200mm x 50mm and web dimensions 200mm x 50mm is subjected to a shear force of 400 kN. Calculate shear stresses across the section and show it graphically. MI of the section about the horizontal neutral axis is 1.134×10^8 mm^4. [16]

SECTION - II

Q5) i) Rectangular bar is subjected to two direct stresses in two mutually perpendicular directions. Derive an expression for normal and tangential stress on an oblique plane which is inclined at an angle θ with plane of major stress. [8]

ii) At a point in a strained material the principal stresses are 100 N/mm^2 tensile and 60 N/mm^2 compressive. Determine normal, shear and resultant stress on a plane inclined at 50° to the axis of major principal stress. Also determine, the maximum shear stress at a point. [8]

Q6) a) An elemental cube is subjected to a tensile stresses of 38 N/mm² and 10 N/mm² acting on two mutually perpendicular planes and a shear stress of 16 N/mm² on these planes. Draw Mohr's circle and determine magnitude and direction of principal stresses and also maximum shear stress from Mohr's circle. [8]

b) Derive an expression for slope and deflection of a cantilever carrying UDL over entire span. [8]

Q7) a) A cantilever AB 2m long carrying load of 20kN at free end and 30 kN at 1m from free end. Find slope and deflection at the free end. Take E = 200 GPa and I = 150 x 10^6 mm⁴. [8]

b) Define equivalent length of column. Give the equivalent lengths for different end conditions of column. [6]

c) Give the limitations of Euler's equation of buckling load. [4]

Q8) a) A T-section having flange 150 x 20mm and web 100mm x 20mm is used as a strut of 4m long with hinges at both ends. Calculate Crippling load if young's modulus for material is 200 GPa. [8]

b) Derive an expression for strain energy stored in a body when load is applied gradually. [8]

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Total No. of Pages : 3

S.E. (Mechanical) (Part - II) (Semester - IV) (Revised)

Examination, May - 2015

ANALYSIS OF MECHANICAL ELEMENTS

Sub. Code : 63361

Day and Date : Thursday, 07 - 05 - 2015 Total Marks : 100

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

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

Q1) a) Two vertical rod one of steel and other of copper are rigidly fixed at the top and 50cm apart. Diameters and length of each rod are 2cm and 4m respectively. A cross bar fixed to the rods at lower end, carrying a load of 5000N such that cross bar remains horizontal even after loading. Find stress in each bar and position of load on the bar. [12]

Take E for steel = 2×10^5 N/mm^2

E for copper = 1×10^5 N/mm^2

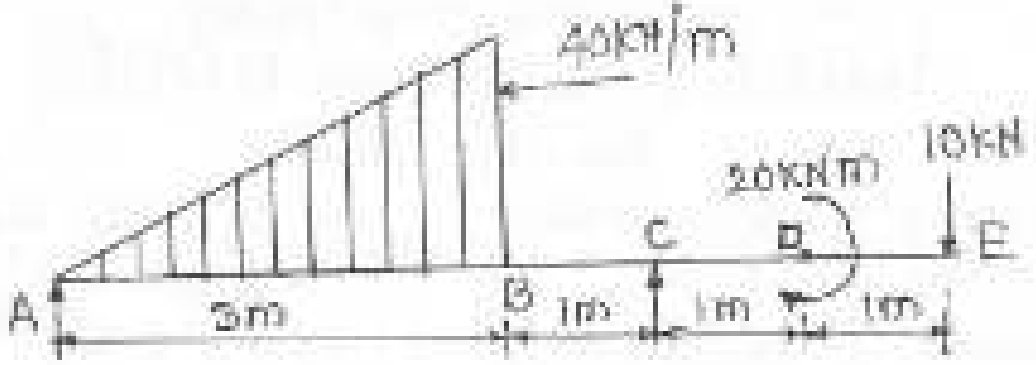
b) Define bulk modulus and derive relation between modulus of elasticity and bulk modulus. [6]

OR

b) A solid shaft of 80mm diameter is to be replaced by hollow shaft of external diameter 100mm. Determine the internal diameter of the hollow shaft if same power is to be transmitted by both shafts at same angular velocity and shear stress.

P.T.O.

Q2) Draw shear force and bending moment diagram for a beam as shown in fig. Also locate maximum bending moment and point of contraflexture if any. [16]



Q3) A cast iron beam is of I section having upper flange 80 x 20 mm, web 200 x 20 mm and lower flange 100 x 40mm. The beam is simply supported on a span of 5m. If the tensile stress is not to exceed 20N/mm². Find the safe UDL which beam can carry. Find also maximum compressive stress. [16]

Q4) a) Derive the expression for principal stresses and maximum shear stress for a member subjected to like direct stresses in mutually perpendicular directions. Also give the locations of principal planes and planes of maximum shear stress. [9]

b) A point in a strained material is subjected to stresses shown in Fig.1 Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. Check the answer analytically. [9]

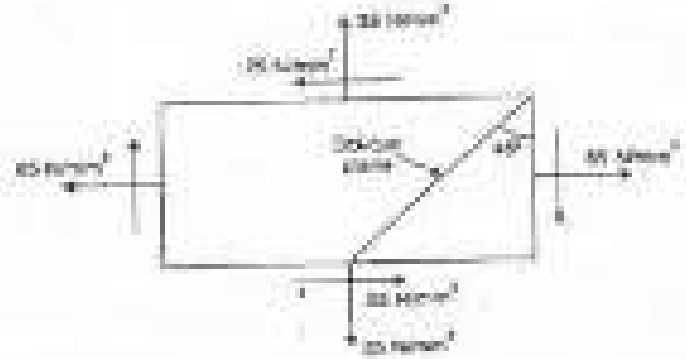


Fig 1

OR

b) An I-section beam 350 mm x 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. (Fig 2) If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section. Also sketch the shear stress distribution across the section.

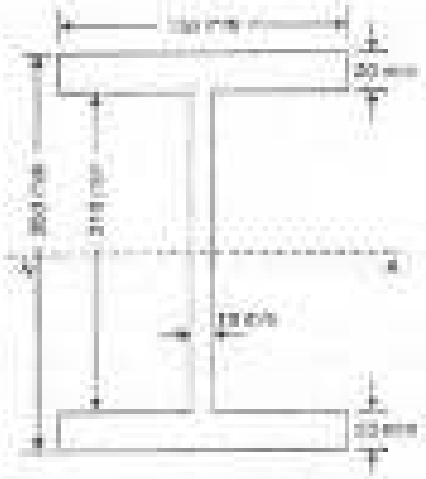


Fig 2

Q5) a) Derive the expression for slope and deflection of a simply supported beam subjected to an UDL for the whole span, using double integration method. [8]

b) A cantilever of length 2m carries a point load of 20 kN at the free end and another load of 20 kN at its centre. If $E = 10^5$ N/mm^2 and $I = 10^8$mm^4 for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end. [8]

OR

b) State the importance of theories of failure and explain the maximum shear stress theory (Guest's Theory).

Q6) a) State the assumptions made in Euler's column theory and derive its expression for the crippling load when both the ends of the column are hinged. [8]

b) A simply supported beam carries a point load P eccentrically on the span. Find the deflection under the load using energy theorem. Assume uniform flexural rigidity. [8]

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Total No. of Pages : 4

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S.E. (Mechanical Engineering) (Semester - IV)

Examination, May - 2015

APPLIED NUMERICAL METHODS

Sub. Code : 63360

Day and Date : Tuesday, 05- 05 - 2015 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 calculators is allowed.

Q1) a) Find the absolute error if the number X = 0.00545828 is [4]

i) Truncated to three decimal digits.

ii) Rounded off to three decimal digits.

b) Solve any two : [2 × 6 = 12]

i) Find the root of the equation using bisection method upto two decimal places $xe^x - (\cos x) = 0$

ii) Using Newton Raphson method find the real root of $e^x = x^3 + \cos 2\pi x$ which is near 4.5

iii) Use the method of false position, to find the fourth root of 32 correct to three decimal places.

Q2) a) Solve the following equations by Gauss-Jordon method. [6]

$2x - 3y + z = -1$

$x + 4y + 5z = 25$

$3x - 4y + z = 2$

b) Solve any two : [2 × 5 = 10]

i) Solve the system of equations using LU Decomposition.

$10x + y + 2z = 13$

$3x + 10y + z = 14$

$2x + 3y + 10z = 15$

P.T.O.

ii) An approximate solution of the equations

$x + 4y + 7z = 5$

$2x + 5y + 8z = 7$

$3x + 6y + 9.1z = 9.1$ is given by $x = 1.8, y = -1.2, z = 1$ Improve this solution.

iii) Solve the following equations by Gauss-Seidal method.

$2x - y + 6z = 9$

$8x + 3y - 2z = 13$

$x + 5y + z = 7$

Q3) a) Find f(x) as a polynomial in x for the following data by Newtons divided difference formula [6]

x :	–4	–1	0	2	5
f(x) :	1245	33	5	9	1335

b) Solve any two : [2 × 6 = 12]

i) The result of measurement of electric resistance R of a copper bar at various temperatures t°c are listed below.

t :	19	25	30	36	40	45	50
R :	76	77	79	80	82	83	85

ii) A controlled manufacturing process is 0.3% defective. What is the probability of taking 2 or more defectives from a lot of 100 pieces?

1) By using Binomial distribution
2) By poissions distribution

iii) Use Lagranges formula to find the form of f(x), Given

x :	0	2	3	6
f(x) :	648	704	729	792

Q4) Solve any three : [3 × 5 = 15]

a) Evaluate the integral $I = \int_{1}^{1.2} \ln x \, dx$ using Simpsons 1/3rd Rule. Taken n = 6.

b) Evaluate $\int_{0}^{1} (2x^3+1)dx$ by Gaussian Quadrature.

c) Use Rombergs method to evaluate $\int_{0}^{1} (dx/(1+x^2))$ take h = 0.5, 0.25, and 0.125

d) A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time 't' seconds. Find the velocity of the slider and its acceleration when t = 0.3 second.

t :	0	0.1	0.2	0.3	0.4	0.5	0.6
X :	30.13	31.62	32.87	33.64	33.95	33.81	33.24

Q5) Solve any three : [3 × 5 = 15]

a) Find y(0.2) and y(0.1) by Modified Euler's Method,

if $\frac{dy}{dx} = x^2 + y^2$; y(0) = 1

b) Solve the boundary value problem for x = 0.5

$\frac{d^2y}{dx^2} + y + 1 = 0$; y(0) = y(1) = 0. Take n = 4 using finite difference method.

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

d) Find the largest Eigen value and the corresponding Eigen vectors by power method

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

Q4) Solve any three : [3 × 5 = 15]

a) Evaluate the integral $I = \int_0^{0.2} \ln x\,dx$ using Simpsons 1/3rd Rule. Taken n=6

b) Evaluate $\int_0^1 (2x^2+1)dx$ by Gaussian Quadrature.

c) Use Romberg method to evaluate $\int_0^1 (dx/(1+x^2))$ take h = 0.5, 0.25, and 0.125

d) A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time 't' seconds. Find the velocity of the slider and its acceleration when t = 0.3 second.

t :	0	0.1	0.2	0.3	0.4	0.5	0.6
X :	30.13	31.62	32.87	33.64	33.95	33.81	33.24

Q5) Solve any three : [3 × 5 = 15]

a) Find y(0.2) and y(0.1) by Modified Euler's Method,

if $\frac{dy}{dx} = x^2 + y^2$; y(0) = 1

b) Solve the boundary value problem for x = 0.5

$\frac{d^2y}{dx^2} + y + 1 = 0$; y(0) = y(1) = 0. Take n = 4 using finite difference method.

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

d) Find the largest Eigen value and the corresponding Eigen vectors by power method

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

Q6) (a) is compulsory

Solve any two out of b), c) and d)

a) Solve $u_{xx} + u_{yy} = 0$ in the square region bounded by $x = 0$, $x = 4$, $y = 0$, $y = 4$ and with boundary conditions:

$u(0, y) = 0$

$u(4, y) = 8 - 2y$

$u(x, 0) = 0.5x^2$

$u(x, 4) = x^2$

take $\Delta x = 1$, $\Delta y = 1$. Perform two iterations. [10]

b) Classify the following partial differential equations [5]

i) $u_{xx} - 4u_{xy} + (x^2 + 4y^2)u_{yy} = \sin(x + y)$

ii) $(x + 1)u_{xx} - 2(x + 2)u_{xy} + (x + 3)u_{yy} = 0$

c) Write short note on Applications of Partial Differential Equation. [5]

d) Compare Explicit and Implicit method. [5]

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Total No. of Pages : 4

S.E. (Mech.) (Part - II) (Revised) Examination, May - 2015

FLUID AND TURBO MACHINERY

Sub. Code : 63362

Day and Date : Saturday, 09 - 05 - 2015 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) Assume suitable data, if necessary and indicate clearly.
4) Use of non-programmable calculator is allowed.

Q1) a) Define the hydraulic machines, turbines, pumps and also write classification of hydraulic turbines. [8]

b) A Pelton wheel produces 147 MW with a head of 1406m while running at 500 rpm. Assuming speed ratio as 0.46, overall efficiency 90%, jet ratio as 13, coefficient of velocity for nozzle as 0.98 calculate [8]

i) Diameter of jet.
ii) Mean diameter of wheel.
iii) No. of jet.
iv) Discharge of the turbine.

OR

c) A turbine running at 250 rpm gives 3700 kW under 12m head. It is proposed to use the same design, altered to a suitable scale for a turbine giving 2200 Kw under 7.5m head. [8]

Calculate:

i) The design speed.
ii) The scale ratio for the new machine.

Q2) a) Show that the hydraulic efficiency for a Francis turbine having velocity of flow through runner as constant is given by [8]

$$\eta_h = \frac{1}{1 + \frac{2}{\left(1 - \frac{\tan\alpha}{\tan\theta}\right)}}$$

P.T.O.

Where α = guide blade angle
θ = runner vane angle at inlet
The turbine is having radial discharge at outlet

b) A Francis turbine with an overall efficiency of 75% is required to produce 148.25 kW power. It is working under head of 7.62m. The peripheral velocity is $0.26\sqrt{2gh}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gh}$. The wheel runs at 150 rpm and hydraulic losses in turbine are 22% of available energy. Assuming radial discharge. Determine
   i) The guide blade angle.
   ii) The wheel vane angle at inlet.
   iii) Width of runner at inlet.

[8]

OR

c) The hub diameter of Kaplan turbine, working under a head of 12m is 0.35 times diameter of runner. The turbine is running at 100 rpm. If the vane angle of extreme edge of runner at outlet is 15° and flow ratio is 0.6 find
   i) Diameter of runner.
   ii) Diameter of boss.
   iii) Discharge through runner.

[8]

(3) a) Explain with neat sketch various heads in case of a centrifugal pump. [8]

b) Write short notes (any two): [10]
   i) Unit quantities.
   ii) Performance curves for pumps.
   iii) NPSH and MPSH.

OR

c) i) A centrifugal pump with 1.2m diameter runs at 200rpm and pumps 1.88 m³/s. The average lift being 6m. The angle which the vane makes at exit with the tangent to impeller is 26° and radial velocity is 2.5 m/s. Determine the manometric efficiency and least speed to start pump. If the inner diameter of impeller is 0.6m. [5]

   ii) Two geometrically similar pumps are running at the same speed of 1000 rpm. One pump has an impeller diameter of 0.30 m and lifts water at the rate of 20 lit/sec against a head of 15m. Determine the head and impeller diameter of the other pump to deliver half the discharge. [5]

Q4) a) Prove that the minimum work required for a two stage reciprocating air compressor with complete intercooling is [8]

$$W = 2n\frac{n}{n-1} \times p_1 v_1 \left[\left(\frac{p_2}{p_1} \right)^{\frac{n-1}{2n}} - 1 \right]$$

Where, p_1 = pressure of air entering the low pressure cylinder,
v_1 = volume of the Low pressure cylinder
p_2 = pressure of air leaving high pressure cylinder

b) Write short notes on any two: [10]

i) Classification of reciprocating compressors.

ii) Derive expression for workdone by reciprocating compressor with clearance volume.

iii) Diffirent efficiencies of reciprocating air compressor.

OR

c) Solve following two problems:

i) A single acting reciprocating air compressor sucks air at 1bar with temperature 27°C. After delivery stroke, pressure of compressed air is 8 bar when compressor runs with 100 rpm. The compressor has cylinder diameter of 20 cm and stroke length of 30 cm. Take R = 287 J/kgK.
Compare the indicated power of compressor when compressor follows: [5]

1) Polytropic compression with n = 1.25, and

2) Adiabatic compression.

ii) Calculate the minimum work required to compress 1 kg of air from 1 bar at 27°C to 16 bar in two stages, if the law of compression is $pv^{1.3} = C$ and assume intercooling is perfect. Take R = 287 J/kgK. [5]

Q5) a) Describe briefly with a neat sketch the axial flow compressor with its velocity diagram. Also define degree of reaction for axial flow compressor. [8]

b) A centrifugal Compressor delivers 60 kg of air per minute at a pressure of 2 bar and 100°C. The intake pressure and temperature of the air is 1 bar and 15°C. If no heat is lost to surrounding, find [8]

i) Index of compression.

ii) Power required, if the compression is isothermal

iii) Workdone by compressor, if the compression is isentropic

Take R = 287 J/kgK and Cp = 1kJ/kgK

OR

c) A centrifugal air compressor receives air at a pressure of 1 bar and 18°C and delivers it at a pressure of 6 bar. Determine workdone by the compressor per kg of air delivered and heat exchanged with the jacket water when compression is
   i) Isothermal.
   ii) Isentropic.
   iii) Follows law $pv^{1.3}$ = constant.
   Write comment on results. Take Cp = 1 kJ/kgK and R = 287 J/kgK. [8]

Q6) a) Which are the methods of improving the specific output and thermal efficiency of gas turbine? Explain Open cycle Gas turbine with Intercooling in details. [8]

b) In gas turbine plant, air enters the compressor at 100 kN/m² and 15°C. The pressure ration is 5:1. The temperature at the inlet of the turbine is 800°C. The mass flow rate is 10kg/s.
   Calculate
   i) The compressor power and turbine power.
   ii) The ratio of turbine work to compressor work.
   iii) The thermal efficiency.
   Take Cp = 1 kJ/KgK and γ = 1.4. [8]

OR

c) Closed cycle gas turbine using air as working medium is operating under following conditions:
   i) Atmospheric temperature = 26°C.
   ii) Maximum temperature = 870°C.
   iii) Initial Pressure of compressor = 1 bar.
   iv) Final Pressure of compressor = 5 bar.
   v) Turbine efficiency = 0.84.
   vi) Compressor efficiency = 0.8.
   vii) Calorific value of fuel = 41840 kJ/Kg of fuel.
   viii) Efficiency of heater = 0.9.
   ix) Cp = 1.005 kJ/kgK.
   x) γ = 1.4.

   Calculate: [8]
   1) Compressor work and Turbine Work.
   2) Heat Supplied.
   3) Fuel Air ratio.
   4) Thermal Efficiency.

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Total No. of Pages : 2

Seat No.	

S.E. Mech. (Semester - II) Examination, May - 2015

MACHINE TOOLS

Sub. Code : 43595

Day and Date : Tuesday, 12 - 05 - 2015 , Total Marks : 100

Time : 10.00 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 sketches wherever necessary.

SECTION - I

Q1) a) Draw block diagram of centre lathe. List and explain various operations on it. [8]

b) Explain in detail any one method of taper turning on lathe machine. [8]

Q2) a) Explain principle of metal cutting. Describe orthogonal and oblique cutting. [8]

b) Explain various turret tool holders with neat sketch. [8]

Q3) a) Classify drilling machines. Describe various operations carried out by drilling machine. [8]

b) Explain working of vertical boring machine with neat sketch. [8]

Q4) Write short notes (any three) [18]

a) Crank and slotted link quick return mechanism.

b) Hydraulic shaper

c) Turret indexing mechanism

d) Table drive and feed mechanism in planer

P.T.O.

SECTION - II

Q5) a) Explain with neat sketch different types of milling cutters. [8]

b) Describe various operations performed on milling machine. [8]

Q6) a) Explain following terms in grinding. [8]

i) Mounting ii) Glazing

iii) Loading iv) Truing

b) Explain various bonds and bonding processes for grinding wheels. [8]

Q7) a) Explain construction and working of CNC machines with block diagram. [8]

b) Describe various gear finishing processes. [8]

Q8) Write short notes (any three) [18]

a) Broaching operations

b) Centreless grinding

c) Gear shaping

d) CNC tooling

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Seat No.

Total No. of Pages : 2

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

May -2015

MACHINE TOOLS AND PROCESSES

Sub. Code : 63364

Day and Date : Thursday, 14 - 05 - 2015 Total Marks : 100

Time : 10.00 a.m. to 01.00 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) a) What are the steps involved in casting process? State its applications in various fields. [8]

b) Explain construction & working of hot chamber die casting process. [8]

OR

Describe with neat sketch investment casting process. [8]

Q2) a) Name different types of rolling mills and compare any two types of rolling mills with typical applications. [8]

b) Compare the following. [8]

1) Cold working and hot working.

2) Calendaring and thermo forming

OR

List different types of core making machines and explain any one of them with neat sketch. [8]

Q3) Write a short note on (Any Three) [18]

a) Continuous casting

b) Electric arc Furnace

c) Defects in Forging

d) Inspection of casting

P.T.O.

Q4) a) Calculate the gear train for cutting the 25 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. [3]

b) A lathe is provided with a change gear set from 30 to 125 teeth in steps of 5 teeth and an additional gear of 127 teeth. Find the gear train for cutting metric thread of 5.25 mm pitch on a lathe having lead screw pitch as 6 TPI. [5]

c) With neat sketch explain turret indexing Mechanism. [8]

OR

Compare turret lathe with centre lathe. [8]

Q5) a) What are various job holding devices on milling machine? [8]

b) Explain with neat sketch the quick return mechanism of shaper. [8]

OR

How are planers classified? State functions of principal parts of planer. [8]

Q6) Write a short note on: (Any Three) [18]

a) Gear Hobbing

b) Electro - chemical machining

c) Radial Drilling Machine

d) Various operations on milling machine

Seat No.	4593

Total No. of Pages : 2

S.E. (Mechanical) (Part - II) (Semester - IV) Examination, May - 2015

METALLURGY

Sub. Code : 43594

Day and Date : Saturday, 09 - 05 - 2015 Total Marks : 100

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

Instructions : 1) Attempt any three questions from each section.
2) Figures to the right indicate marks to that question.
3) Draw neat sketches wherever necessary.
4) Assume suitable data if necessary.

SECTION - I

Q1) Draw neat self-explanatory sketches of the following (any four): [16]
a) Microstructure of 0.4% carbon steel.
b) Eutectic system phase diagram.
c) Microstructure of Nodular cast iron.
d) Stress strain curve for mild steel and cast iron.
e) Dye penetrant test procedure.

Q2) a) Explain in detail Iron-Iron Carbide Equilibrium diagram, along with all the reactions, phases, and temperatures. [12]
b) Explain magnetic particle test in detail. [4]

Q3) a) Draw neat sketch of Cu-Zn equilibrium diagram and explain different types of brasses. [8]
b) Explain in detail the procedure to draw equilibrium diagram by thermal analysis method. [8]

Q4) Write short notes on (any four): [16]
a) Ni-based alloys.
b) Coring.
c) Gibb's phase rule.
d) S.G. iron.
e) Solid solution.

P.T.O.

SECTION - II

(Q5) a) Explain with neat sketch the transformation of Austenite to Pearlite. [8]

b) Explain tempering heat treatment along with the structural changes involved in it. [6]

c) Explain mechanism of quenching and quenching baths. [4]

(Q6) Compare the following (any four): [16]

a) Austempering and Martempering.

b) Bainite and Martensite.

c) Annealing and Normalizing.

d) Nitriding and Cyaniding.

e) Impregnation and Infiltration of powder compacts.

(Q7) a) What is annealing heat treatment? Mention the purposes of annealing. Explain any two types of annealing in detail. [8]

b) Explain the procedure to draw CCT diagram for 0.8% carbon steel. Compare CCT diagram with TTT diagram. [8]

(Q8) Write short notes on (any four): [16]

a) Methods of powder manufacturing.

b) Controlled atmosphere.

c) Salt-bath furnace.

d) Flow chart for manufacturing of diamond impregnated tools.

e) Heat treatment defects and remedies.

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Total No. of Pages : 3

S.E. (Mechanical) - IV Examination, May - 2015

NUMERICAL METHODS

Sub. Code : 43593

Day and Date : Thursday, 07 - 05 - 2015 Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) Attempt any three questions from each section.
2) Figures to the right indicates full marks.
3) Assume any additional data required and state it clearly.

SECTION - I

Q1) a) Apply method of Bisection to find the root of the equation $\cos x = xe^x$. Carry out six iterations. [8]

b) Find root of the equation $x \log_{10} x = 1.0$ correct up to three decimal places by Secant method. [8]

Q2) a) Apply factorization method to solve following equations [8]

$3x+2y+7z=4, 2x+3y+z=5, 3x+4y+z=7$.

b) Carry out six iterations to solve following equations [8]

$$10x_1 - 2x_2 - x_3 - x_4 = 3$$
$$-2x_1 + 10x_2 - x_3 - x_4 = 15$$
$$-x_1 - x_2 + 10x_3 - 2x_4 = 27$$
$$-x_1 - x_2 - 2x_3 + 10x_4 = -9$$

Use Gauss Seidal iteration method.

P.T.O.

Q3) a) The following values of x and y are supposed to follow the law $y = ax^2 + b \log_{10} x$. Find the most probable values of constants a & b using method of least square. [8]

x	2.85	3.88	4.66	5.69	6.65	7.77	8.63
y	16.7	26.4	35.3	47.5	60.6	77.5	93.4

b) Determine $f(x)$ as a polynomial in x for the following data and evaluate $f(9)$ using Newton's divided difference formula. [8]

x	-4	-1	0	2	5
$f(x)$	1245	33	5	9	1335

Q4) a) Calculate the mean and standard deviation for the following: [6]

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

b) What are applications of Binomial distribution and Poisson distribution? [6]

c) Box A contains 2 white and 4 black balls. Another box B contains 5 white and 7 black balls. A ball is transferred from box A to the box B. Then a ball is drawn from the box B. Find probability that it is white. [6]

SECTION – II

Q5) a) Evaluate $\int_{0.5}^{1.5} e^{-x^2} dx$ using the 3 point Gaussian quadrature formula. [8]

b) The velocity v of a particle at distance x from a point on its path is given by the table below. Estimate the time taken to travel 60ft by using Simpsons $1/3^{rd}$ rule. Compare the result with Simpsons $3/8^{th}$ rule. [8]

x (ft)	0	10	20	30	40	50	60
v (ft/sec)	47	58	64	65	61	52	38

Q6) a) Using Runge - Kutta method of fourth order, solve for y at $x = 1.2, 1.4$ from $\frac{dy}{dx} = \frac{2xy + e^x}{x^2 + xe^x}$. Take initial values of x and y as 1 and 0 respectively. [8]

b) Solve by Taylor series method of third order the equation $\frac{dy}{dx} = \frac{x^2 + xy^2}{e^x}$, $y(0) = 1$ for y at $x = 0.1$, $x = 0.2$ and $x = 0.3$. [8]

Q7) a) Classify the following equations: [6]

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) $x^2\frac{\partial^2 u}{\partial x^2} + (1 - y^2)\frac{\partial^2 u}{\partial y^2} = 0$, given that $-\infty < x < \infty, -1 < y < 1$.

iii) $(1 + x^2)\frac{\partial^2 u}{\partial x} + (5 + 2x^3)\frac{\partial^2 u}{\partial x \partial t} + (4 + x^2)\frac{\partial^2 u}{\partial t} = 0$.

b) Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units satisfying the following boundary conditions: $u(0, y) = 0$ for $0 \le y \le 4$, $u(4, y) = 12 + y$ for $0 \le y \le 4$; $u(x, 0) = 3x$ for $0 \le x \le 4$, $u(x, 4) = x^2$ for $0 \le x \le 4$. Carry out three iterations. [12]

Q8) Write short note on: [16]

a) Types of elements in FEM.

b) Crank Nicolson method.

c) Variational and Galerkin's method.

d) Implicit and Explicit method.

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Total No. of Pages : 4

S.E. (Mech.) (Part - II) (Revised) (Semester - IV) Examination, April - 2016

ANALYSIS OF MECHANICAL ELEMENTS

Sub. Code : 63361

Day and Date : Wednesday, 20 - 04 - 2016 Total Marks : 100

Time : 10.30 a.m. to 1.30 p.m.

Instructions : 1) Attempt all questions.

2) Figures to right indicate full marks.

3) Draw neat labaled sketch wherever necessary.

4) Assume suitable data, if necessary and state clearly.

5) Use of non-programmable calculator is allowed.

2) a) A compound tube consist of a steel tube 140 mm internal diameter and 160 mm external diameter and an outer brass tube 160 mm internal diameter and 180 mm external diameter. The two bars are of same length. The compound tube carries axial load of 900 kN. Find stresses and load carried by each tube and also deformation. The length of each tube is 140 mm.

Take : E for steel = 2×10^5 N/mm^2; E for brass = 1×10^5 N/mm^2. [12]

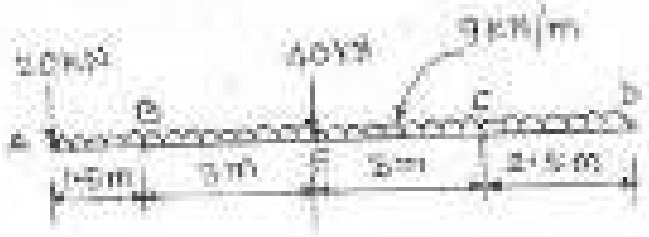
b) Explain important points of stress strain curve for ductile and brittle material with neat sketch. [8]

OR

b) Determine diameter of solid shaft which will transmit 90 kW at 160 rpm. Also determine length of shaft if the twist must not exceed 1° over entire length. The maximum shear stress is limited to 60 N/mm^2. Take modulus of rigidity as 8×10^4 N/mm^2.

P.T.O.

Q2) A beam ABCD is simply supported at point B and C as shown in fig. The beam carries UDL of 5 kN/m over its entire length. A anticlockwise load of 20 kN at A and concentrated load of 40 kN midway between B and C. Draw shear force and bending moment diagram. Also locate point of contraflexure if any. [16]



Q3) A beam has an I section with upper flange 80 × 40 mm, web 120 × 20 mm and lower flange 160 × 40 mm. If tensile stress is not to exceed 30 N/mm² and compressive stress is not to exceed 90 N/mm², what maximum UDL the beam can carry over a simply supported span of 6m. If larger flange is to be in tension. [16]

Q4) a) Derive the expression for principal stresses and maximum shear stress for a member subjected to like direct stresses at mutually perpendicular directions. Also give the locations of principal planes and planes of maximum shear stress. [9]

b) On a mild steel plate, a circle of diameter 50 mm is drawn before the plate is stressed as shown in Fig. 1. Find the lengths of the major and minor axes of an ellipse formed as a result of the deformation of the circle marked. Take E = 2 × 10⁵ N/mm² and 1/m = 0.25 [9]

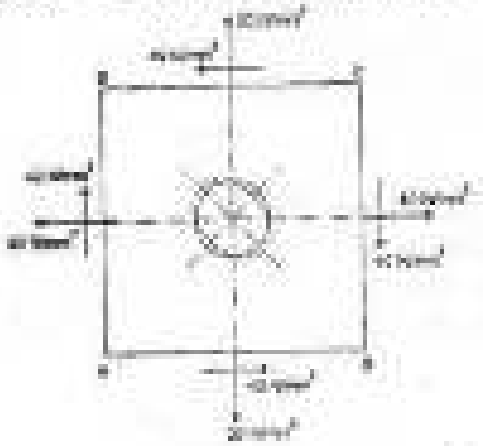


Fig 1

OR

b) An I section beam 350 mm × 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. (Fig 2). If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section. Also sketch the shear stress distribution across the section.

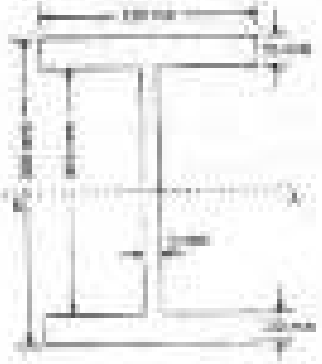


Fig 2

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

b) A cantilever AB 3 m long is subjected to a downward force of 60 kN and an anticlockwise couple of 108 kN-m at the free end as shown in Fig-3. Determine the slope and the deflection at B. Take EI = 9×10^5 kN/m^2. Use Moment area Method. [8

Fig 3

OR

b) State the importance of theories of failure and explain the maximum principal stress theory.

36) a) A straight both ends hinged column is 50 mm in diameter and 1250 mm long. Calculate

i) Euler's crippling load when loaded axially.

ii) The eccentricity which will cause failure at 75% of this load if the yield point stress of the material is 275 N/mm^2. [8]

Take E = 2×10^5 N/mm^2.

b) Find the deflection at the centre of a simply supported beam of span l carrying a UDL of w per unit run over the whole span, using energy theorem. Assume uniform flexural rigidity. [8]

* * *

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Total No. of Pages : 4

Seat No.

S.E. (Mech.) (Part - II) (Semester - IV) (Revised) Examination, April - 2016

FLUID AND TURBO MACHINERY

Sub. Code : 63362

Day and Date : Friday, 22 - 04 - 2016 Total Marks : 100

Time : 10.30 a.m. to 1.30 p.m.

Instructions : 1) All question are compulsory.
2) Figures to right indicate full marks.
3) Assume suitable data if necessary and indicate clearly.
4) Use of non-programmable calculator is allowed.

Q1) a) Derive Euler's equation for work done in rotodynamic machines. [8]

b) Design a Pelton wheel for following data [8]

i) Net head = 200m

ii) Power to be developed = 750 kW

iii) Speed = 360 rpm

iv) Overall efficiency = 80%

v) Coefficient of nozzle = 0.96

vi) Speed ratio = 0.47

OR

c) A turbine works under head of 200m and it develops 9000 kW at 200 rpm. The overall efficiency is 87%. Find its unit quantities. A model is to be built which is similar to above turbine in all respect having the scale 1:10 is is tested under a head of 20m. Find speed, discharge and specific speed of model. [8]

Q2) a) Draw a schematic diagram of Kaplan turbine and explain its working. [8]

b) 235 liters of water per sec is supplied to an inward flow reaction turbine. The head available is 11m. The wheel vanes are radial at inlet and inlet diameter is half the outer diameter. The velocity of flow is constant and is equal to 1.83 m/s. The runner makes 170 rpm. Find

P.T.O.

i) Guide vane angle
ii) Inlet and outlet diameter
iii) Width at inlet and outlet

Assume discharge is radial and neglect the thickness of vane. Take speed ratio (ϕ) = 0.7 [8]

OR

c) A turbine operate under head of 25m at 250 rpm and uses a discharge of 10m³/sec with overall efficiency 0.85. Find [8]
i) Power developed
ii) Specific speed
iii) Performance of turbine under head of 20m
iv) Type of turbine

Q5) a) Explain the concept of minimum starting speed of the centrifugal pump and also derive its formula [8]

b) Write short notes (any two) [10]
i) Mixed testing of centrifugal pump
ii) Priming of pumps
iii) Characteristics curves of pump

OR

c) i) A centrifugal pump having outer diameter of impeller equal to two times inner diameter and running at 1000 rpm, work against the total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back an angle of 40° at outlet. If the outer diameter of impeller is 500 mm and width at outlet is 50 mm, find [5]
1) Vane angle at inlet
2) Work done by impeller on water per sec
3) Manometric efficiency

ii) A single stage centrifugal pump with impeller diameter as 30 cm rotates at 200 rpm and lifts 3 m³ of water per sec to a height of 30 m with an efficiency of 75%. Find Number of stages and diameter of each impeller of a similar multistage pump to lift 5 m³ of water per sec to a height of 300 m when running at 1500 rpm. [5]

Q4) a) Explain the effect of clearance volume on reciprocating compressor with the help of P-V diagram and hence, define volumetric efficiency of compressor. Derive expression for work done by reciprocating compressor with clearance volume. [8]

b) Write short notes on any two: [10]

i) Construction and Working of vane blower.

ii) Difference between reciprocating compressor and rotary compressor

iii) Multistage reciprocating air compressor with and without intercooler

OR

c) Solve following two problems :

i) A single stage single acting compressor delivers 14m³ of free air per minute from 1 bar to 7 bar. The speed of compressor is 310 rpm. Assuming that compression and expansion follow the law $pv^{1.3}$ = constant and clearance is 5% of the swept volume, find Volumetric efficiency and Swept volume. Take L =1.5D. The temperature and pressure of air at the suction are same as atmospheric air. [5]

ii) A single stage reciprocating air compressor is required to compress air from 1 bar to 8 bar. The initial temperature is 27°C. Calculate work requirement in isothermal compression per unit mass of air. Take R = 287 J/kgK. Also define Isothermal efficiency of reciprocating compressor. [5]

Q5) a) Explain the construction of centrifugal compressor along with velocity triangles and write equations for work done by centrifugal compressor for different compression processes. [8]

b) 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. An enters the impeller blade radially at a speed of 15 m/s. Determine,

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 m³/kg and velocity of flow is constant.

Take Cp = 1.005 kJ/kg K and γ = 1.4. [8]

OR

c) An axial flow compressor with compression ratio as 5, draws air at 20° C delivers it at 30° C and rotate with blade velocity 100 m/s. Assuming 50% degree of reaction. Determine,
   i) Velocity of flow
   ii) Number of stages
   Take work factor is 0.85, $\alpha = 10°$, $\beta = 40°$, Cp=1 kJ/kg K [8]

Q6) a) Explain working of closed cycle gas turbine with reheating along with T-s diagram. [8]

b) In an oil gas turbine installation, air is taken at 1 bar and 30°C. The air is compressed to 4 bar and then heated by burning the oil to temperature of 500°C. If the air flows at the rate of 90 kg/min. find the power developed by plant. Take $\gamma = 1.4$ for air and Cp = 1kJ/kg K. If 2.4 kg of oil having calorific value of 40000 kJ/kg is burnt in the combustion chamber per minute, find net work done by turbine in kW. [8]

OR

c) In constant pressure open cycle gas turbine, air enters at 1 bar and 20°C and leaves the compressor at 5 bar. Using the following data:
   i) Temperature of gases entering the turbine = 680°C
   ii) Pressure loss in the combustion chamber = 0.1 bar
   iii) Compressor efficiency = 85%
   iv) Turbine efficiency =80%
   v) Combustion Chamber efficiency = 85 %
   vi) $\gamma = 1.4$
   vii) Cp = 1.034 kJ/kgK for air and gas

   Find the quantity of air circulation if the plant develops 1065 kW. Mass of fuel may be neglected. [8]

* * *

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Total No. of Pages : 3

Seat No.	

S.E. (Mech.) (Part - II) (Revised) (Semester - IV) Examination, April - 2016

THEORY OF MACHINES - I

Sub. Code : 63363

Day and Date : Sunday, 24 - 04 - 2016 Total Marks : 100

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

Instructions : 1) Attempt all questions.

2) Figures to 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) Explain the inversions of double slider crank chain with neat sketches. [8]

OR

The driving shaft of a Hooke's joint rotates at a uniform speed of 500 r.p.m. If the maximum variation in the speed of driven shaft is ±4% of the speed of driving shaft, determine the greatest permissible angle between the shafts. Also find the maximum and minimum speeds of the driven shaft. [8]

b) In a four-bar mechanism shown in fig 1.c, AB = 300 mm, BC = CD = 360 mm and AD = 600 mm. The crank AB rotates uniformly at 150 r.p.m. Locate all the instantaneous centers and find the angular velocity of link BC. [8]

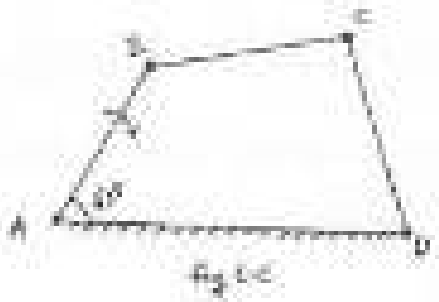

fig 1.c

P.T.O.

Q3) In a mechanism as shown in fig.2 the link AB rotates with uniform angular velocity of 30 rad/s. The lengths of various links are : AB = 200 mm, BC = 300 mm, BD = 150mm, DE = 350 mm, EF = 200 mm, DG = 185 mm. Determine the velocity and acceleration of slider at C and point G for the given configuration. [18]

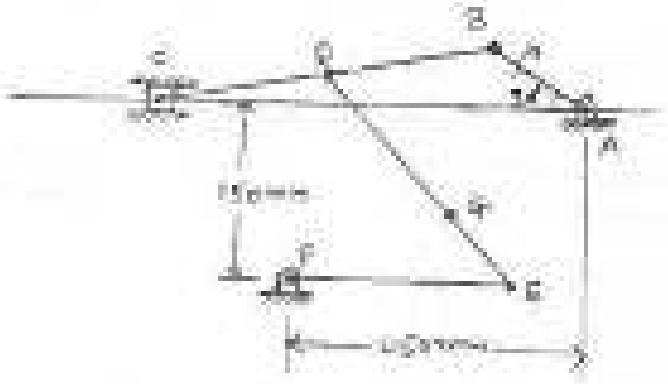

Fig. 2

Q3) a) Derive the equation for friction torque in case of flat pivot bearing assuming uniform wear with usual notations. [8]

OR

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

b) The thrust in the marine engine is taken up by multi-collared shaft and is equal to 150 kN. The speed of the shaft is 90 r.p.m. Assuming uniform pressure equal to 0.3 N/mm^2 and if the outer diameter is 1.5 times the inner diameter, find the internal and external diameters of the collar. Also find the number of collars required if the power lost in friction is not to exceed 15 kW. Take $\mu = 0.05$. [8]

Q4) a) With the help of sketch, define Trace point and Pressure angle in case of cam. [4]

b) Draw the profile of cam to give the following motion to the oscillating roller follower.

i) Follower to move outwards by an angular displacement of 30° during 120° of cam rotation.

ii) Follower to dwell for 30° of cam rotation at the end of outward stroke.

iii) Follower to return to the initial position during the 120° of cam rotation.

iv) Follower to dwell during next 90° of cam rotation.

The distance between pivot of oscillating follower and cam axis is 11 mm. The distance between pivot and roller follower center is 100 mm. Minimum radius of cam is 50 mm and roller radius is 10 mm. The ou stroke and return stroke is executed with SSSM. [14

Q5) a) An open belt drive transmits 2.5 kW power. The linear velocity of belt is 2.5 m/s. The angle of lap on smaller pulley is 165° and coefficient of friction is 0.3. Determine the effect on power transmission in the following cases : [10]

i) Initial tension in the belt is increased by 8%.

ii) Angle of lap is increased by 8% for the same speed and tension on the tight side.

iii) Coefficient of friction is increased by 8% by suitable dressing to the friction surface of the belt and initial tension is same.

b) Explain slip and creep of belt. [6]

OR

Explain rope brake dynamometer with neat sketch. [6]

Q6) a) In a spring loaded Hartnell type governor, the extreme radii of rotation of the balls are 80 mm and 120 mm. The ball arm and sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at the two extreme positions are 400 and 420 rpm, find the initial compression of the central spring and spring constant. Neglect weight of sleeve. [10]

b) Explain Effort and power of the governor. [6]

OR

Explain porter governor with the help of neat diagram. [6]

* * *

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Total No. of Pages : 2

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - IV) (Revised) Examination, April - 2016

MACHINE TOOLS AND PROCESSES

Sub. Code : 63364

Day and Date : Tuesday, 26 - 04 - 2016 Total Marks : 100

Time : 10.30 a.m. to 01.30 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) a) State the importance of casting in manufacturing process with its merits and demerits? [8]

b) Explain with neat sketch elements of gating system. [8]

OR

b) List different types of fuel fired melting furnaces and explain in detail Induction furnace.

Q2) a) With neat sketch explain open die forging & close die forging. [8]

b) Compare the following: [8]

i) Hot working & Cold working

ii) Direct extrusion & Indirect extrusion

OR

b) Explain in detail wire drawing process.

Q3) Write a short note on. (Any Three) [18]

a) Pressure die-casting

b) Crucible furnace

c) Defects in Extrusion

d) Directional Solidification

P.T.O.

Q4) a) Calculate the gear train for cutting the 8 TPI pitch on work piece if the lead screw of lathe is 4 TPI. [3]

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.

b) A lathe is provided with a change gear set from 20 to 120 teeth in steps of 5 teeth and an additional gear of 127 teeth. Find the gear train for cutting metric thread of 3.25 mm pitch on a lathe having lead screw pitch as 6 TPI. [5]

c) Draw block diagram of turret lathe. Name different parts & explain function of each part. [8]

OR

c) Draw block diagram of radial drilling machine and explain its working [8]

Q5) a) Describe the main features of the following milling machines. [9]

i) Horizontal milling machine.

ii) Vertical milling machine.

iii) Universal milling machine.

b) What is the difference between shaper and planner? [7]

OR

b) Describe standard accessories used for milling machine. [7]

Q6) Write a short note on. (Any Three) [18]

a) Gear Shaping

b) Water jet machining

c) Various operation of drilling machines

d) Hydraulic shaper

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Total No. of Pages : 4

Seat No.

S.E. (Mechanical Engineering) (Semester - IV) Examination, April - 2016

APPLIED NUMERICAL METHODS

Sub. Code : 63360

Day and Date : Sunday, 17-04-2016 Total Marks : 100

Time : 10.30 a.m. to 1.30 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 approximate error with an example. [5]

b) Solve any two [2 × 5 = 10]

i) Find an approximate root of the equation $x\log_{10} x = 1.2$ which lies between 2 and 3 using False position method.

ii) Find the root of the equation $x^3 + 2x^2 + 10x - 20 = 0$ using Muller's method.

(Take $x_0 = 0, x_1 = 1, x_2 = 2$).

iii) Evaluate $\sqrt{12}$ to four decimal places by Newton Raphson method.

Q2) a) Solve the following equations by Gauss - Elimination method. [5]

$2x + 3y - z = 5$

$4x + 4y - 3z = 3$

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

P.T.O.

[2 × 5 = 10]

b) Solve any two

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

$x+2y-3z=4$

$12x+4y-6z=18$

$x-2y+5z=4$

ii) Solve the system of equations using LU Decomposition.

$x+5y+z=14$

$2x+y+3z=13$

$3x+y+4z=17$

iii) Solve the following equations by Gauss - Seidal method.

$8x+15y+2z=72$

$x+y+34z=110$

$27x+6y-z=85$

[4 × 5 =20]

Q3) Solve any four:

a) The pressure and volume of gas are related by the equation $PV^{\gamma} = K$ (γ and K are constants). Fit this equation for the following data using principles of least squares

P	:	0.5	1	1.5	2.0	2.5	3.0
V	:	1.62	1.00	0.75	0.62	0.52	0.46

b) Using Lagrange's interpolation formula, find y(10) from the following table

x	:	5	6	9	11
y	:	12	13	14	16

c) Find the mean, median, mode and standard deviation of following:

15, 21, 21, 21, 25, 30, 35.

d) Using Newtons divided difference formula find f(5)

x	1	2	7	8
y	1	5	5	4

e) State and prove addition and multiplication law of probability.

Q4) Solve any three: [3 × 5 = 15]

a) Evaluate the integral $I = \int_{-1}^{1} x^4 \, dx$ using Simpsons 1/3rd Rule.

b) Use Romberg's method to evaluate $\int_0^{1/2} \frac{dx}{(1+x)}$ take $h = 0.6, 0.3$, and 0.15.

c) Evaluate $\int_{-2}^{+2} (3x^2 + 2x + 3) dx$ by Gaussian Quadrature.

d) A jet fighter position on an aircraft carriers runway was timed during landing

t(sec)	1.0	1.1	1.2	1.3	1.4	1.5	1.6
X(m)	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Where X is the distance from the end of the carrier. Estimate velocity and acceleration at t = 1.1 sec.

Q5) Solve any three: [3 × 5 = 15]

a) Using Runge Kutta method of fourth order find y at $x = 0.8$ if $y' = y - x$ Given $y(0.6) = 1.7379$ take $h = 0.1$.

b) Find the eigen values and corresponding eigen vectors of $\begin{bmatrix} 5 & -4 \\ 2 & 2 \end{bmatrix}$ by both power method and polynomial method.

c) Given the boundary value problem $\frac{d^2y}{dx^2} = 8x + 4$; $y(0) = 2$, $y(1) = 5$ obtain its solution in the range $0 \le x \le 1$ with $h = 0.25$ using finite difference method.

d) Solve $\frac{dy}{dx} = 1 + xy$; given $y(0) = 2$. Obtain the values of $y(0.1)$, $y(0.2)$ and $y(0.3)$ using Picard's method.

Q6) a) Solve $U_{xx} + U_{yy} = 0$ in the square region bounded by $x = 0$, $x = 4$, $y = 0$, $y = 4$ and with boundary conditions:

$u(0,y) = 0$; $u(4,y) = 12 + y$; $u(x,0) = 3x$; $u(x,4) = x^2$

by Liebmann's method. Take $\Delta x = 1$, $\Delta y = 1$. Perform two iterations. **[10]**

b) Classify the following partial differential equations: **[5]**

i) $U_{xx} - 2U_{xy} - U_{yy} = 0$.

ii) $xU_{xx} + yU_{yy} = 0$; $x > 0$, $y > 0$.

iii) $U_{xx} - 2U_{yy} = 0$.

c) Explain explicit method with a neat sketch. **[5]**

+ + +

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Total No. of Pages : 2

Seat No.

S.E. (Mechanical) (Part - II) (Semester - IV) (Old) (Pre-revised) Examination, April - 2016

MACHINE TOOLS

Sub. Code : 43595

Day and Date : Thursday, 28-04-2016 Total Marks : 100

Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) Answer any three questions from each section.
2) Figures to the right indicate full marks.
3) Assume suitable data, if necessary.
4) Use of Non-programmable Scientific Calculator is allowed.

SECTION - I

Q1) a) Draw block diagram of lathe. Name different parts. State the specification of lathe. [8]

b) Explain the following operations performed on lathe. [8]

i) Turning

ii) Facing

iii) Knurling

iv) Drilling

Q2) a) Explain bar feeding mechanism in capstan lathe with neat sketch. [8]

b) List various tool holding devices used on drilling machine. Describe any three in brief. [8]

Q3) a) Explain construction and working of jig boring machine with neat sketch. [8]

b) What is the difference between shaper and planner? [8]

P.T.O.

Q4) Write a short note on (Any Three). [18]

a) Classification of cutting tool.

b) Various Accessories used on drilling machine.

c) Arbors.

d) Table feed mechanism in shaper.

SECTION - II

Q5) a) Describe construction and working of vertical milling machine. [8]

b) Explain in detail gear cutting on milling machine. [8]

Q6) a) Draw neat sketch of milling cutters. State the application of each milling cutter. [8]

b) Explain the following terms in grinding. [8]

i) Wheel mounting.

ii) Wheel loading.

iii) Wheel truing.

iv) Wheel glazing.

Q7) a) Explain working of CNC machine with block diagram. [8]

b) Describe gear hobbing process with neat sketch. [8]

Q8) Write a short note on (Any Three) [18]

a) Tool and cutter grinder.

b) Gear rolling.

c) Types of CNC machines.

d) Various operation performed on broaching machine.

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Total No. of Pages : 4

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - IV) Examination, November - 2015

ANALYSIS OF MECHANICAL ELEMENTS

Sub. Code : 43592

Day and Date : Monday, 30 - 11 - 2015 Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

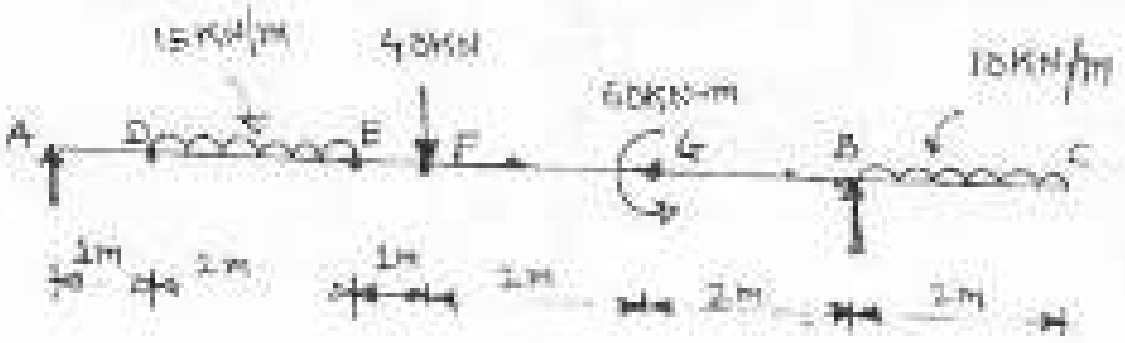
Instructions: 1) Solve any three questions from each section.
2) Assume suitable data wherever necessary & state it clearly.
3) Figures to the right indicates full marks.

SECTION - I

Q1) a) Draw stress - strain diagrams for ductile and brittle materials subjected to axial loading & explain the important points of the diagram. [6]

b) A steel bar 20mm in diameter is enclosed in a brass tube of 25mm external diameter and 2mm thick. Assuming $E_s/E_b = 2$ and initial lengths of both components are 400mm. Calculate stresses in steel and brass of the composite section which is subjected to an axial compressive force of 50 KN. Assume $E_s = 200$Gpa. Find also change in length of composite section. [10]

Q2) Draw the shear force and bending moment diagram for the beam shown in figure - 2. Locate the point of max. bending moment and point of contraflexure. [18]



P.T.O.

Q3) a) 500KW power has to be transmitted at 100rpm. Allowable shear stress is 75MPa for shaft material. [9]

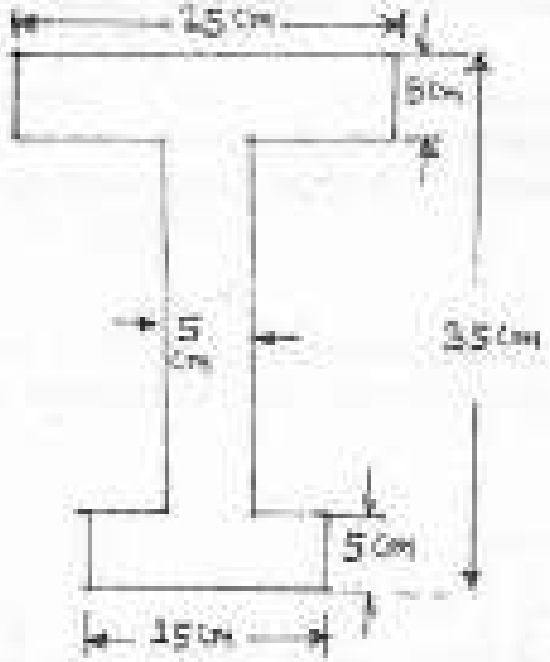
i) Determine the necessary diameter of solid shaft.

ii) Diameter of hollow shaft if the inside diameter is 0.8 times the outside diameter.

iii) Determine saving in material when hollow shaft is used.

b) The cross section of a simply supported beam is 'T' section with flange dimension 100mm × 50mm & web dimensions 100mm × 50mm. It is subjected under a bending moment of 3400N-m. Calculate the bending stresses in the beam & show it graphically. [7]

Q4) A cast iron bracket subjected to bending has a cross section of I-shape with unequal flanges as shown in fig - 4-1. If the tensile stress in top flange is not to exceed 17.5 MPa, what is the bending moment the section can take? If the section is subjected to a shear force of 100 KN. Calculate the shear stress across the section and show it graphically. [16]



SECTION - II

(Q5) a) Explain Maximum shear stress theory. [4]

b) At a point, within a body subjected to two mutually perpendicular directions, the stresses are 100N/mm^2 (tensile) and 75 N/mm^2 (tensile). Each of the above stressess, is accompained by shear stress of 75 N/mm^2. Determine normal, shear and resultant stress on an oblique plane inclined at 45° with the axis of minor tensile stress. [6]

c) At a certain point in a strained material the stresses on two planes at right angles to each other are 20N/mm^2 and 10N/mm^2 both tensile.They are accompained by a shear stress of magnitude 10N/mm^2. Find location of principal plane and evaluate principal stressess. [8]

(Q6) a) Derive an expression for slope and deflection for a simply supported beam carrying point load at center. [8]

b) A cantilever of length 2m carries a UDL of 25KN/m at free end to 75 KN/m at fixed end. If E = 1 x 10^{5}N/mm^2 and I = 10^8 mm^4 Determine the slope and deflection at free end. [8]

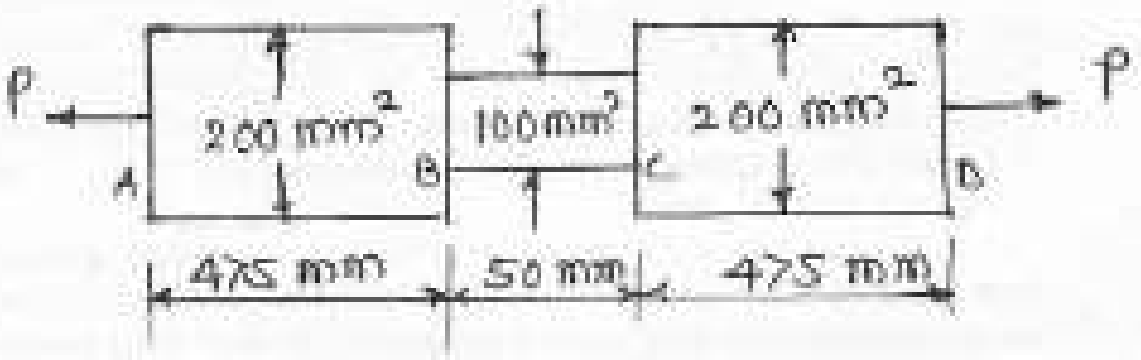
(Q7) a) Define equivalent length of column. Give equivalent length of columns for various end conditions. [4]

b) Define slenderness ratio and state the limitations of Eulers formula.[4]

c) A hollow alloy tube 5m long with external and internal diameters 40 mm and 25 mm respectively was found to extend 6.4 mm under tensile load of 60 KN. Find the buckling load for the tube when used as a column with both ends pinned. Also find the safe load for the tube, taking factor of safety = 4. [8]

(Q8) a) Derive an expression for strain energy stored in a body due to torsion. [8]

b) The maximum stress produced by a pull in a bar of length 1m is 150N/mm². The area of cross section and length are as shown in fig. Calculate strain energy stored in a bar if E = 2 × 10⁵ N/mm². [8]



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Total No. of Pages : 3

Seat No.

S.E. (Mechanical) (Part - II) (Semester- IV) Examination, December - 2015

METALLURGY

Sub. Code : 43594

Day and Date : Wednesday,02- 12 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) Attempt any three questions from each section.
2) Figures to the right indicate marks to that question.
3) Draw neat sketches wherever necessary
4) Assume suitable data if necessary

SECTION-I

Q1) Draw neat self-explanatory sketches of the following (any four) [16]

a) Microstructure of 0.8 % carbon steel.

b) Isomorphus system phase diagram.

c) Microstructure of grey cast iron.

d) Creep fracture.

e) Ultrasonic test setup.

f) Partial eutectic system phase diagram.

Q2) a) Explain in detail Iron- Iron Carbide Equilibrium diagram along with all the reactions, phases, and temperatures. [12]

b) Explain fatigue test with neat sketch. [6]

Q3) a) Draw neat sketch of Al-Si equilibrium diagram. With reference to equilibrium diagram explain the modification treatment. [8]

b) Explain the procedure to draw equilibrium diagram from cooling curves.[8]

P.T.O.

Q4) Write short notes on (any four): [16]

a) Pb-Sn Alloys.

b) Imperfection in crystals.

c) Solidification by nucleation.

d) α-Brasses.

e) Standard Brinell Hardness test.

SECTION - II

Q5) a) Define Heat treatment. Explain the basic steps of heat treatment and mention the objectives of heat treatment. [6]

b) Explain in detail the transformation of Austenite to Martensite. [6]

c) Explain with neat sketch any one type of Heat treatment furnace. [6]

Q6) Compare the following (any four): [16]

a) Pearlitic and Bainitic transformation.

b) Austempering and Martempering.

c) TTT and CCT diagram.

d) Flame hardening and Induction hardening.

e) Sizing and Compacting.

Q7) a) Explain the mechanism of precipitation hardening with suitable example. Which are the different alloys that can be precipitation hardened. [8]

b) What is carburizing heat treatment? Explain in detail any one type, along with post carburizing heat treatment. [8]

Q8) Write short notes on (any four): [16]

a) Heat treatment defects and remedies.

b) Process annealing.

c) Quenching baths.

d) Methods of powder manufacturing.

e) Controlled atmosphere.

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Total No. of Pages : 4

Seat No.	

S.E. (Mechanical) (Part - II) (Semester- IV) Examination, December - 2015

THEORY OF MACHINES - I

Sub. Code : 43596

Day and Date : Friday, 04- 12 - 2015 Total Marks : 100

Time : 9.30 a.m. to 01.00 p.m.

Instructions :
1) Q.2 and Q.5 are compulsory. from the remaining questions of each section answer any two questions.
2) Figures to the right indicate full marks.
3) Draw neat labeled sketch wherever necessary.
4) Assume if necessary, suitable data and state clearly.
5) Use of Non programmable calculator is permitted.

SECTION-I

Q1) a) Sketch and explain the following with suitable examples: [4]

i) Lower pair and higher pair.

ii) Degree of freedom.

b) What do you mean by inversion of mechanism? Enlist the inversions of four bar chain, single slider crank chain and double slider crank chain. [6]

c) Define instantaneous centre of location. What are their types, explain how to locate them with the help of neat sketch. [6]

Q2) The dimensions of the Andreau differential stroke engine mechanism, as shown in Fig. 1 AB=80mm, CD=40mm, BE=DE=150mm, and EP=200mm. The links AB and CD are geared together. The speed of the smaller wheel is 1140 rpm. Determine the velocity and acceleration of the piston P for the given configuration. [18]

P.T.O.

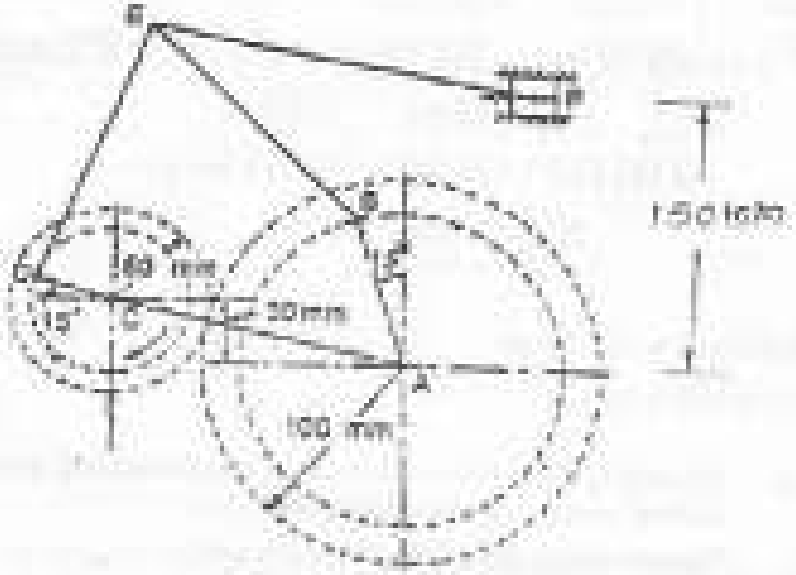

Fig. 1 (Not to scale)

Q3) a) Sketch and explain pantograph. Show that it can be used to plot the drawings at enlarged and reduced scale. [8]

b) Derive the condition for equal speeds of the driving and driven shafts connected by Hooke's joint. [8]

Q4) a) Explain different forces acting on the reciprocating parts of an engine in detail. [6]

b) A connecting rod of an I.C. engine has a mass of 2 kg and the distance between the centre of gudgeon pin and centre of crank pin is 250 mm. The C.G. falls at a point 160 mm from the gudgeon pin along the line of centres. The radius of gyration about an axis through the C.G. perpendicular to the plane of rotation is 110 mm. Find the equivalent dynamical system if only one of the masses is located at gudgeon pin.

If the connecting rod is replaced by two masses one at the gudgeon pin and the other at the crank pin and the angular acceleration of the rod is 23000 rad/s^2 clockwise, Determine the correction couple applied to the system to reduce it to a dynamically equivalent system. [10]

SECTION - II

(Q5) a) Derive the equation of maximum velocity and acceleration of follower moving with SHM. [4]

b) It is required to design the profile of a cam with oscillating follower for following motion;

i) Follower to move outward through an angular displacement of 20° during 90° of cam rotation

ii) Follower to dwell for 45° of cam rotation.

iii) Follower to return to its initial position in 75° of cam rotation; and

iv) Follower to dwell for remaining rotation of cam.

The distance between the pivot centre and the follower roller center is 70 mm and the roller diameter is 20 mm. The minimum radius of cam is such that follower arm is horizontal. The location of pivot point is 70 mm to the left and 60 mm above the cam centre. The motion of the follower is to take place with SHM during outward stroke and with uniform acceleration and retardation during return stroke. [14]

(Q6) a) Derive the equation for height of Porer governor. [6]

b) A thrust bearing of a propeller shaft consists of a number of collars. The shaft is of 400 mm diameter and rotates at a speed of 90 rpm. The thrust on the shaft is 300 KN. If the intensity of pressure is to be 200 KN/m^2 and coefficient of friction is 0.06, determine external diameter of the collars and the number of collars. The power lost in friction is 48 kW. [10]

(Q7) a) What are different types of dynamometers? With neat sketch explain belt transmission dynamometer. [6]

b) A Hartnell governor has rotating masses of 1.4 kg carried on right angled bell crank levers, in which weight arm is 60 mm and sleeve arm is 50 mm long. The sleeve has total movement of 25 mm and is in mid position sleeve arm is horizontal and masses rotates in circle of 80 mm radius. The maximum and minimum equilibrium speeds are 435 and 420 rpm respectively. Determine- **[10]**

i) Maximum and minimum radius of rotation

ii) The stiffness of spring

iii) Initial compression of spring

Q8) a) An open belt drive is used to connect two parallel shafts 4 m apart. The diameter of bigger pulley is 1.5 m and that of the smaller pulley is 0.5 m. The mass of the belt is 1 kg/m length. The maximum tension is not to exceed 1500 N. The coefficient of friction is 0.25. The bigger pulley which is the driver pulley also, rotates at 250 rpm. The speed of the driven pulley is 725 rpm. **[10]**

Calculate-

i) The power transmitted

ii) Power lost in friction

iii) Efficiency of the drive

b) Write note on friction circle. **[6]**

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Total No. of Pages :4

Seat No.

S.E. (Mechanical) (Part - II) (Semester - IV) Examination, December - 2015

ANALYSIS OF MECHANICAL ELEMENTS (Revised)

Sub. Code : 63361

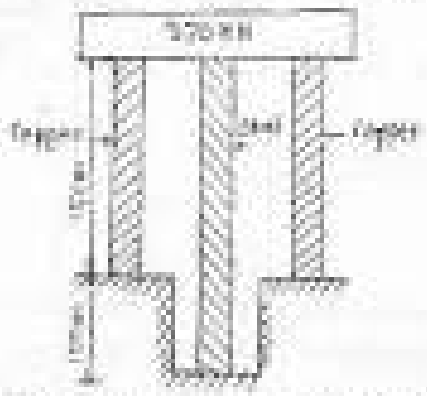
Day and Date : Tuesday, 01 - 12 - 2015 Total Marks :100

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) Attempt all questions.
2) Figures to the right indicate full marks to the question.
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) A steel rod and two copper rods together support a load of 370kN as shown in the Fig. The cross sectional area of steel rod is 2500mm^2 and of each copper rod is 1600mm^2. Find the stresses in rods.

Take : E for steel = 2×10^5N/mm^2; E for copper = 1×10^5N/mm^2 [12]



b) Define modulus of elasticity and modulus of rigidity. Also obtain relation between them. [6]

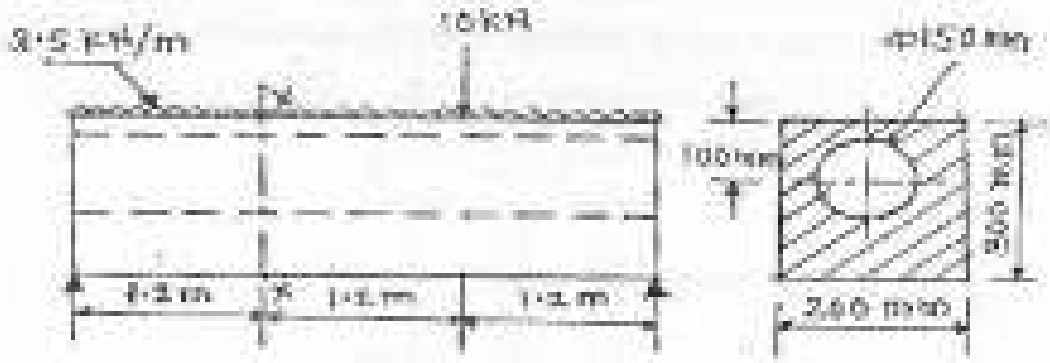
OR

b) A solid shaft of 60mm diameter is to be replaced by a hollow shaft of same material with internal diameter equal to half of the external diameter. Find diameters of hollow shaft and saving in material, if maximum allowable shear stress is same for both shafts. [6]

P.T.O.

(Q2) Draw shear force and bending moment diagram for a beam as shown in the fig. also locate maximum bending moment and point of contraflexure if any. [16]

(Q3) A simply supported beam and its cross section are as shown in the fig. The beam carries a load of 10kN as shown in fig. Its self weight is 3.5kN/m calculate maximum bending stress at XX. [16]



(Q4) a) Derive the expression for principle stresses and maximum shear stress for a member subjected to like direct stresses in mutually perpendicular directions. Also give the locations of principle planes and planes of maximum shear stress. [9]

b) The intensity of resultant stress on a plane AB shown in Fig 1 at a point in a material under stress is 800N/cm^2 and it is inclined at 30° to the normal to that plane. The normal component of that stress on another plane BC is 600 N/cm^2

Determine

i) the resultant stress on the plane BC.

ii) the principle stresses and their directions.

iii) The maximum shear stresses and their planes.

[9]

Fig 1

OR

b) An I-section beam 350mm x 150mm has a web thickness of 10mm and a flange thickness of 20mm. (fig 2) If the shear force acting on the section is 40kN, find the maximum shear stress developed in the I-section. Also sketch the shear stress distribution across the section. [9]

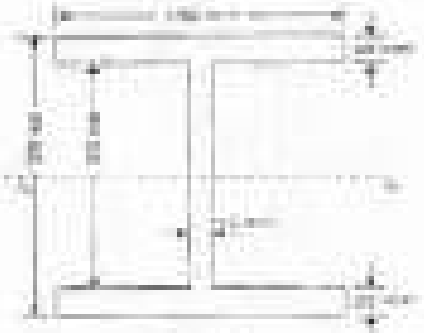


Fig 2

Q5) a) Derive the expression for slope and deflection of a cantilever subjected to uniformly varying load (UVL-maximum at fixed end and zero at free end) using double integration method. [8]

b) A cantilever of length 2 m carries a point load of 20 kN at the free end and another load of 20 kN at its centre. If $E = 10^5 N/mm^2$ and $I = 10^8 mm^4$ for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end. [8]

OR

b) State the importance of theories of failure and explain the maximum distortion energy theory (von Mises - Henky Theory) [8]

Q6) a) Explain the concept of equivalent length of the column and derive the expression for crippling stress in terms of effective length and radius of gyration. [8]

b) Find the deflection at the free end of a cantilever of length l carrying a uniformly distributed load of w per unit run over the whole span using energy theorem. Assume uniform flexural rigidity. [8]

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Total No. of Pages : 4

Seat No.	

S.E.(Mech.) (Part - II) (Revised) Examination, December - 2015
Fluid and Turbo Machinary
Sub. Code : 63362

Day and Date : Wednesday,02 - 12 - 2015 Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

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

Q1) a) Show that the maximum efficiency (hydraulic) of Pelton wheel given by $\eta_h = \frac{1+\cos\phi}{2}$ Where ϕ is bucket outlet angle. [8]

b) The following data relate to a Pelton wheel [8]
Head =72m
Speed of wheel =240rpm
Shaft power of wheel =115 kW
Speed ratio=0.45
Coefficient of velocity=0.98
Overall efficiency =85%
Design the Pelton wheel

OR

c) A turbine works under a head of 200m and it develops 6000kW power at 200rpm. The overall efficiency of turbine is 87% find its unit quantities. A model is to built which is similar to above turbine in all respect having the scale ratio1:10. It is tested under a head of 20m. Find the speed, discharge, power and specific speed of model having the same overall efficiency as turbine. [8]

Q2) a) Explain governing of Francis turbine with neat sketch. [8]

b) Determine the overall efficiency of Kaplan turbine developing 2450 kW under a head of 5.2m. it is provided with a draft tube with its inlet diameter 3m and set 1.8m above the tail race level. A vacuum gauge connect to the draft tube indicates a reading of 5.2m of water. Assume draft tube efficiency as 75%. [8]

P.T.O.

OR

c) The following data is given for Francis turbine; net head 60m, speed 700 rpm, shaft power 294.3KW, overall efficiency 84%, hydraulic efficiency 93%, flow ratio 0.2, breadth ratio 0.1. Outer diameter of runner is two times the inner diameter. The thickness of runner occupy 5% of circumferential area of runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Find [8]

i) Guide blade angel
ii) Diameter of runner at inlet and outlet
iii) Runner vane angles
iv) Width of wheel at outlet

Q3) a) Obtain expression for minimum starting speed of pump. [8]

b) Write short notes (any two) [10]

i) Types of impellers used in centrifugal pump
ii) Efficiencies of centrifugal pump
iii) Importance of multi staging of pump

OR

c) i) A centrifugal pump is to discharge 0.118 m³/s at a speed of 1450 rpm against a head of 25m. The impeller diameter is 250 mm, its width at outlet is 50mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller. [5]

ii) Two geometrically similar pumps are running at the same speeds of 1000 rpm.One pump has an impeller diameter of 300mm and lifts water at the rate of 0.02 m³/sec against a head of 15m. Determine the head and impeller diameter of the other pump to deliver half the discharge. [5]

Q4) a) Derive the expression for the workdone by single stage reciprocating compressor during [8]

i) Isothermal compression
ii) Polytropic compression
iii) Adiabatic compression

Discuss about which is the most efficient compression process for reciprocating compressor.

b) Write Short notes on any two [10]

i) Construction and Working of root blower
ii) Derive expression for workdone by reciprocating compressor with clearance volume
iii) Multistage reciprocating air compressor

OR

c) Solve following two problems [5]

i) Following data related to performance test of single acting reciprocating compressor

a) Suction pressure = 1 bar
b) Suction temperature = 20°C
c) Discharge pressure = 6 bar
d) Discharge temperature = 180 °C
e) Speed of compressor = 1200 rpm
f) Mass of air delivered = 1.7 kg/min

Calculate indicated power of compressor. Take R= 287 J/kgK

ii) A single stage double acting air compressor is required to deliver 14 m³ of air per minute measured at 1.013 bar and 15°C. The delivery pressure is 7 bar and the speed 300 rpm. Take the clearance volume as 5% of the swept volume with the compression and expansion index of n= 1.3, calculate Swept volume of cylinder [5]

Q5) a) Define degree of reaction for the axial flow compressor. Discuss effects of following cases [8]

i) 50% degree of reaction
ii) Low degree of reaction

b) A centrifugal compressor with 75% isentropic efficiency delivers 25 kg of air per minute at a pressure of 4 bar. If the compressor receives air at 20°C and at pressure of 1 bar. Find

i) Actual temperature of the air at exit
ii) Power required to run the compressor if mechanical efficiency is 95%

Take γ= 1.4 and Cp= 1 kJ/KgK [8]

OR

c) An axial flow compressor with compression ratio as 4, draws air at 20 °C delivers it at 197 °C and rotates with blade velocity 180 m/s. Assuming 50% degree of reaction. The mean blade speed and velocity are the constant throughout the compressor. Determine

i) Velocity of flow
ii) Number of stages

Take work factor is 0.82, α 12 °, β = 42 °, Cp 1.005 kJ/kgK. [8]

(Q6) a) Explain with neat sketch simple open cycle gas turbine along with P-V diagram. State advantages of open cycle gas turbine [8]

b) 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 0.80 and 0.82 respectively. Calculate the net power output in kW from turbine when the air enters the compressor at 15°C at the rate of 16 kg/s. Take Cp= 1.005 kJ/kgK and y= 1.4 for the compression process and take Cp =1.11 kJ/kgK and y= 1.333 for the expansion process. [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 turbine are 80 % and 85 % respectively. The air-fuel ratio used is 90: 1. If the flow rate of air is 3 kg/s, find

i) The compressor power and turbine power

ii) Net Power developed

Take Cp= 1.0 kj kgK and y =1.4 of air and gas. Calorific value of fuel = 41800kJ/kg. [8]

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S–2079

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part - II) (Revised) (Semester - IV) Examination, December - 2015

THEORY OF MACHINES - I

Sub. Code : 63363

Day and Date : Thursday, 03 - 12 - 2015 Total Marks : 100

Time : 9.00 a.m. to 01.00 p.m.

Instructions :
1) Attempt all questions.
2) Figures to the right indicate full marks to the question.
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. [8]

OR

a) Explain the inversions of four-bar chain with neat sketches. [8]

b) Locate all the instantaneous centers of the slider crank mechanism shown in fig.1.c. The lengths of crank OA and connecting rod AB are 90 mm and 360 mm respectively. If the crank rotates in clockwise direction with a speed of 150 r.p.m., find : [8]

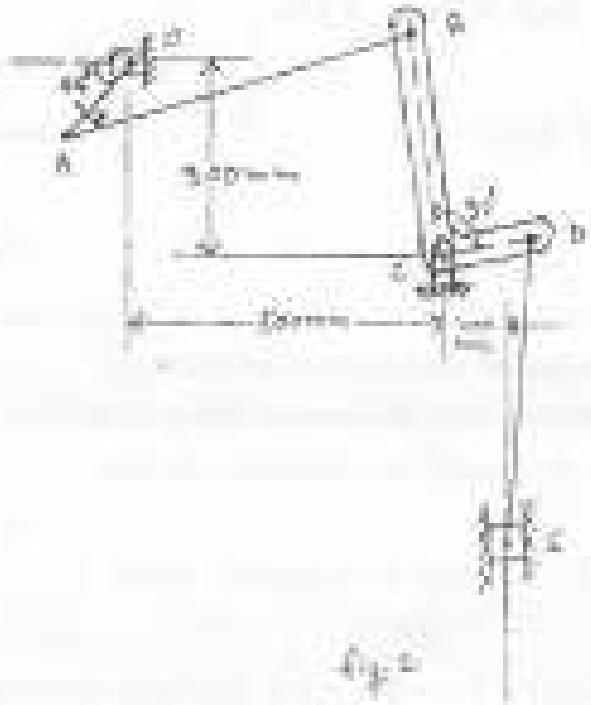
i) velocity of slider B and

ii) Angular velocity of the connecting rod AB.

fig.1.c

P.T.O.

Q2) The crank of a mechanism shown in fig.2 rotates in anticlockwise direction at a speed of 100 r.p.m. The dimensions of the various links are : OA = 150 mm, AB = 600 mm, DE = 500 mm. Link BCD is a bell-crank lever with angle BCD = 90°, BC = 350 mm, CD = 150 mm. Determine the velocity and acceleration of the slider at E. **[18]**



Q3) a) Derive the equation for friction torque in case of conical pivot bearing assuming uniform wear with usual notations. **[8]**

OR

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

b) A truncated conical pivot with angle of cone as 100° supports a load of 18kN. The external radius is 2.5 times the internal radius. The shaft rotates at 150 r.p.m. If the intensity of pressure is to be 300 kN/mm² and coefficient of friction is 0.05, determine the power lost in working against friction assuming uniform pressure. **[8]**

Q4) a) Draw neat sketches of different types of cams. **[4]**

b) The following data relate to cam profile in which the follower moves with uniform acceleration and deceleration during ascent and descent.

Minimum radius of cam = 25 mm
Roller Diameter = 8 mm
Lift of follower = 30 mm
Offset of follower axis = 12 mm towards right
Angle of ascent = 60°
Angle of descent 90°
Angle of dwell between ascent and descent = 45°
Speed of cam = 200 rpm
Draw the profile of the cam and determine the maximum velocity and the uniform acceleration of the follower during the outstroke. [14]

Q5) a) An open belt of rectangular cross section of 100 mm × 10 mm connects two pulleys 1250 mm and 500 mm diameter, on parallel shafts 5 m apart. The mass of belt per meter length is 1 kg/m. Maximum tension is not to exceed 2000 N and coefficient of friction is 0.3. The bigger pulley is the driver and runs at 250 rpm and driven shaft runs at 600 rpm. Calculate the power transmitted and torque exerted on each shaft considering centrifugal tension. [10]

b) Derive an equation for centrifugal tension in belt. [6]

OR

b) With neat sketches explain different types of belt drives. [6]

Q6) a) The lengths of the upper and lower arms of a Porter governor are 200 mm and 250 mm respectively. Both the arms are pivoted at the axis of rotation. The central sleeve load is 150 N, the weight of each ball is 20 N and the friction of the sleeve is equivalent to 30 N. If the limiting inclinations of the upper arms to the vertical are 30° and 40°, determine the range of speed of the governor. [10]

b) By means of controlling force curves explain stable governor, unstable governor and Isochronous governor. [6]

OR

b) Define sensitiveness, hunting and Isochronism of governor. [6]

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S - 2080

Total No. of Pages : 2

Seat No.	

S.E.(Mechanical) (Revised) (Part - II) (Semester - IV) Examination, December - 2015

Machine Tools and Processes

Sub. Code : 63364

Day and Date : Friday,04 - 12 - 2015 Total Marks : 100

Time : 10.30 a.m. to 01.00 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) a) State the function different elements of gating system with neat sketch. [8]

b) Explain in brief construction & working of cold chamber die casting process. [8]

OR

b) What is meant by continuous casting? Explain its merits, demerits and applications. [8]

Q2) a) Explain construction and working of hydraulic extrusion. Also write defects in extrusion . [8]

b) Draw block diagram of lathe and explain in brief principal parts of lathe. [8]

OR

b) Describe the method of injection moulding for high production rates? [8]

Q3) Write a short note on (Any Three) [18]

a) Centrifugal casting.

b) Induction Furnace

c) Defects in Rolling

d) Calendaring and thermo forming

P.T.O.

Q4) a) Calculate the gear train for cutting the 12 TPI pitch on work piece if the lead screw of lathe is 4 TPI. [3]

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.

b) A lathe is provided with a change gear set from 20 to 120 teeth in steps of 5 teeth and an additional gear of 127 teeth. Find the gear train for cutting metric thread of 4.25 mm pitch on a lathe having lead screw pitch as 6 TPI. [5]

c) Enumerate various turret tool holding device with neat sketch. [8]

OR

c) Describe construction, working & operations of vertical boring machine with neat sketch. [8]

Q5) a) Explain with neat sketch vertical milling attachment for Horizontal milling machine. [8]

b) How are the shapers classified? State the purpose of the following parts in a shaper [8]

i) Column

ii) Cross-rail

iii) Table

iv) Shaper head

OR

b) List various gear manufacturing processes. Explain gear hobbing process with neat sketch. [8]

Q6) Write a short note on (Any Three) [18]

a) Gear Shaving

b) Electric discharge machining

c) Jig Boring machine

d) Laser beam machining

S-2437

Total No. of Pages : 4

Seat No.	

S.E. (Mechanical Engineering) (Semester - IV)
Examination, November - 2015
APPLIED NUMERICAL METHODS
Sub. Code : 63360

Day and Date : Monday, 30 - 11 - 2015 Total Marks : 100

Time : 10.00 a.m. to 01.00 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 accuracy and precision with the help of a neat sketch. [5]

b) Solve any two: [2 × 5 = 10]

i) Find the root of the equation $x^3 - 4x - 9 = 0$ using false position method up to two decimal places.

ii) Using Newton Raphson method, find the real root of $3x - \cos x - 1 = 0$.

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

Q2) a) Solve the following equations by Gauss-Jordan method. [5]

$2x - 6y + z = 7$

$x - 2y - z = -1$

$5x - 7y - 4z = 9$

P.T.O.

b) Solve any two: [2 × 5 = 10]

i) Solve the system of equations using LU Decomposition.

$2x - 3y + z = 9$

$x + 2y + 3z = 6$

$3x + y + 2z = 8$

ii) Solve by Gauss Elimination method.

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

$2x - y + 8z = 13$

$5x - 2y + 7z = 20$

iii) Solve the following equations by Gauss-Seidal method.

$8x + 2y - 2z = 8$

$x - 8y + 3z = -4$

$2x + y + 9z = 12$

Q3) a) Find $f(x)$ as a polynomial in x and hence $f(6)$ for the following data by Newton's divided difference formula. [5]

x	:	1	2	7	8
$f(x)$	:	1	5	5	4

b) Solve any two: [2 × 5 = 10]

i) The following table gives experimental data for force (N) and velocity (m/s) for an object suspended in a wind tunnel.

Velocity (m/s)	:	10	20	30	40	50	60	70	80
Force (N)	:	20	68	378	552	608	1218	831	1452

Use the linear least-squares regression to determine the coefficients a and b in the function $y = a + bx$ that best fits the data.

ii) Fit a normal curve to the following data:

Length of line cm :	8.60	8.59	8.58	8.57	8.56	8.55	8.54	8.53	8.52
Frequency :	2	3	4	9	10	8	4	1	1

iii) Use Lagrange's formula to find $y(10)$, Given

x :	5	6	9	11
y :	12	13	14	16

Q4) Solve any three: [3 × 5 = 15]

a) Evaluate the integral $I=\int_0^1 1/(1+x)dx$ using Simpsons 3/8th Rule. Take $n=6$.

b) Evaluate $\int_0^1 (1/(x^2+1))dx$ by Gaussian Quadrature

c) Use Romberg's method to evaluate $\int_0^1 (dx/(1+x))$ take $h = 0.5, 0.25$ and 0.125.

d) A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various values of time 't' (seconds). Calculate the angular velocity of the rod at $t = 0.6$ second

t	0	0.2	0.4	0.6	0.8	1.0
θ	0	0.12	0.49	1.12	2.02	3.20

Q5) Solve any three: [3 × 5 = 15]

a) Given $\frac{dy}{dx}=\frac{y-x}{y+x}$

with $y(0) = 1$. Find $y(0.1)$ using modified Euler's method.

b) Using Euler's method, find an approximate value of y when $x = 1$, in five steps given that:

$$\frac{dy}{dx}=x+y$$

$$y(0) = 1$$

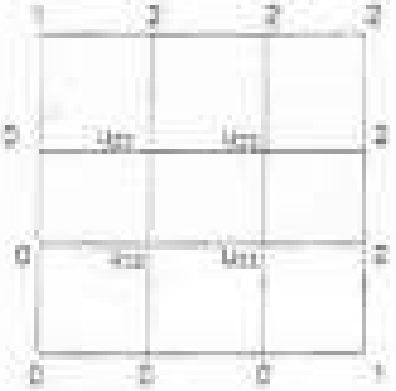
c) Solve the equation $\frac{dy}{dx} = x + y + y$

Given $y(0) = 1$. Obtain the values of $y(0.1)$ using Picard's method.

d) Find the largest Eigen value and the corresponding Eigen vectors of

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

Q6) a) Solve $U_{xx} + U_{yy} = 0$ in the square region with boundary values as shown in figure. [10]



Perform two iterations.

b) Classify the following partial differential equations: [5]

i) $\Phi_{xx} + \Phi_{yy} = 0$

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

c) Use explicit method to solve for the temperature distribution of a long thin rod with a length of 10 cm and following values $\Delta x = 2$cm, $\Delta t = 0.1$ second, and $\lambda = 0.0203$ at time $t = 0.1$ second, 0.2second at $t = 0$ the temperature of rod is zero and the boundary condition are fixed for all times at $T(0) = 100°C$ and $T(10) = 50°C$. [5]

d) Explain Crank Nicholson method. [5]

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Total No. of Pages : 3

Seat No.	

S.E. (Mech.) (Part - II) (Pre-Revised) Examination, December - 2015

FLUID AND TURBOMACHINERY

Sub. Code : 43597

Day and Date : Saturday, 05 - 12 - 2015 Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) Attempt any three questions from each section.
2) Figures to the right indicate full marks.
3) Assume suitable data if necessary.
4) Use of nonprogrammable calculator is allowed.
5) Draw neat sketch wherever necessary.

SECTION - I

Q1) a) What are unit quantities? Define the unit quantities for a turbine. Why are they important? [8]

b) A Pelton wheel 2.5 m diameter operates under the following conditions: [8]

Net available head = 300 m Speed = 300 rpm

Blade angle at outlet = 165° C_v of the jet = 0.98

Blade friction coefficient = 0.95 Jet diameter = 20 cm.

Mechanical efficiency = 95 %

Determine:

i) Power developed

ii) Specific speed

iii) Hydraulic efficiency.

Q2) a) Draw a schematic diagram of Kaplan turbine and explain function of each part of Kaplan turbine. [7]

b) An inward flow reaction turbine develops 1200 kW power having the vane velocity at inlet as 30 m/s and the corresponding whirl velocity of 24 m/s. The ratio of outer to inner diameter is 2. The velocity of flow remains at 6 m/s throughout and discharge at exit is radial. The head available on wheel is 75 m. Find: [9]

i) Vane angles

ii) Power developed

iii) Discharge in m³/s

iv) Hydraulic efficiency

P.T.O.

Q3) a) Explain the working of single stage centrifugal pump with sketch. [4]

b) Define cavitation. Give necessary precautions to avoid the cavitation. [4]

c) A centrifugal pump delivers 1.27 m³ of water per minute at 1200 rpm. The impeller diameter is 350 mm and breadth at outlet is 12.7 mm. The pressure difference between inlet and outlet of pump casing is 272 kN/m². Assuming manometric efficiency as 63%, calculate the impeller exit blade angle. [8]

Q4) Write short notes on any three. [18]

a) Pelton wheel buckets.

b) MPSH & NPSH

c) Priming of Pumps

d) Various efficiencies of turbine.

e) Multi staging of pumps.

SECTION - II

Q5) a) Derive the expression for minimum work required for two stage reciprocating compressor with inter cooler. [8]

b) A single stage single acting reciprocating air compressor delivers 0.6 kg/min of air at 6 bar. The temperature and pressure at the suction stroke are 30°C and 1 bar respectively. The bore and stroke are 100 mm and 150mm respectively. The clearance volume is 5% of the swept volume and index of expansion and compression is 1.3. [8]

Determine,

i) the volumetric efficiency of compressor.

ii) the power required, if mechanical efficiency is 85%.

Q6) a) Explain the losses and isentropic efficiency in centrifugal compressor. [8]

b) An axial flow compressor having 10 stages works with 50% degree of reaction. It compresses air with a pressure ratio of 5. The inlet conditions of air are 27°C and 100 kPa. The air enters the compressor with a velocity of 110 m/s. The mean speed of the rotor blade is 220 m/s. The isentropic efficiency of the compressor is 85%. Calculate the work input per kg of air and blade angles. [8]

Q7) a) Draw the schematic diagram of closed cycle gas turbine power plant. State merits and demerits. [8]

b) Air enters the compressor of a gas turbine plant operating on air standard cycle at 100 kPa and 300K with a volumetric flow rate of 5 m³/s. The compressor pressure ratio is 10. The turbine inlet temperature is 1400K. The turbine and compressor each has an isentropic efficiency of 80%.[8] Calculate,

i) The thermal efficiency of the cycle

ii) The back work ratio

iii) The net power developed in kW.

Q8) Write short notes on any three. [18]

a) Roots blower and Vane blower.

b) Applications of compressed air.

c) Slip factor and pressure.

d) Classification of compressor.

e) Degree of reaction.

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Seat No.

S.E. (Mechanical) (Pre-revised) (Part - II) (Semester - IV) Examination, December - 2015

MACHINE TOOLS

Sub. Code : 43595

Day and Date : Thursday, 03 - 12 - 2015 Total Marks : 100

Time :10.00 a.m. to 01.00 p.m.

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

SECTION - I

Q1) a) Draw block diagram of lathe. Name different parts of lathe and state the function of each. [8]

b) Explain various accessories used on lathe. [8]

Q2) a) Compare turret lathe and capstan lathe. [8]

b) Explain with neat sketch bar feeding mechanism in capstan lathe. [8]

Q3) a) Describe with neat sketch, construction and working of vertical boring machine. [8]

b) State classification of drilling machine and explain various operations performed by drilling machine. [8]

Q4) Write a short note on (Any Three) [18]

a) Turret Indexing Mechanism

b) Crank and slotted link quick return mechanism in shaper

c) Classification of planning machine

d) Jig Boring Machine

P.T.O.

SECTION - II

(Q5) a) Explain with neat sketch working of column and knee type milling machine. [8]

b) Describe with neat sketch vertical milling attachment for horizontal milling. [8]

(Q6) a) How are grinding machine classified? Explain any one with neat sketch. [8]

b) State specifications of grinding wheel and explain its meaning. [8]

(Q7) a) List various gear manufacturing processes. Explain gear hobbing process in detail. [8]

b) Explain Construction and working of CNC Machine with Block Diagram. [8]

(Q8) Write a short note on (Any Three) [18]

a) Wheel truing and Wheel loading of Grinding wheel

b) Up milling and Down milling

c) Gear finishing processes

d) Types of CNC machines

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Total No. of Pages : 3

Seat No.	

S.E. (Mech.) (Semester - IV) Examination, November - 2019

APPLIED NUMERICAL METHODS

Sub. Code : 63360

Day and Date : Wednesday, 13 - 11 - 2019 **Total Marks : 100**

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

Instructions: 1) All questions are compulsory.
2) Use of non programmable calculator is allowed.
3) Assume additional data if required and mention it clearly.

Q1) Solve any two: [16]

a) Perform two iterations of Newton Raphson Method to Solve:

$x^2 + xy + y^2 = 7, x^2 + y^2 = 9$

Take initial approximations $X_0 = 1.5, Y_0 = 0.5$.

b) Define errors? Explain Approximation error with an example.

c) Find root of equation $x^3 - 4x - 9 = 0$ using bisection method, correct to three decimal places.

Q2) Solve any two: [16]

a) Solve following equations by Gauss Seidal method.

$2x + y + 6z = 9, 8x + 3y + 2z = 13, x + 5y + z = 7.$

b) Solve following equations using LU-decomposition method

$10x + y + 2z = 13, 3x + 10y + z = 14, 2x + 3y + 10z = 15.$

c) Solve by Jacobi Iteration Method

$8x - 3y + 2z = 20, 6x + 3y + 12z = 35, 4x + 11 - z = 33$

P.T.O.

Q3) Solve any three: [18]

a) What are the applications of binomial distribution and normal distribution.

b) Find Mean and Median

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of Students	12	18	27	20	17	6

c) Find missing term in the following table using Lagrange's interpolation formula.

X	0	1	2	3	4
Y	1	3	7	31	81

d) Find f(x) as a polynomial in x and f(6) for the following data by Newton's divided difference formula

x	1	2	7	8
$f(x)$	1	5	3	4

Q4) Solve any three: [3×6=18]

a) Evaluate the integral $I = \int_0^{\pi} \sin x \, dx$ using Trapezoidal and Simpsons 1/3rd Rule.

Take $n = 10$.

b) Use Romberg's method to evaluate $\int_0^1 \frac{x}{\sin x} dx$ take h = 0.5, 0.25, and 0.125.

c) Evaluate $\int_0^{\pi/2} (\sin x) dx$ by two point Gaussian Quadrature formula.

d) Find the value of cos(1.74) from the following table

x:	1.7	1.74	1.78	1.82	1.86
Sin(x)	0.9916	0.9857	0.9781	0.9691	0.9584

Q5) Solve any three [3×6=18]

a) Solve

$\frac{dy}{dx} = x^2 + y^2$; given $y(0) = 1$. Obtain the values of $y(0.1)$ using Picard's method.

b) Apply the fourth order Runge Kutta method to find $y(0.2)$ given

$\frac{dy}{dx} = y + x$; $y(0) = 1$ take $h = 0.1$

c) Find $y(0.2)$ and $y(0.1)$ by Euler's Method,

If $\frac{dy}{dx} = x^2 + y^2$; $y(0) = 1$

d) Find the largest Eigen value and the corresponding Eigen vectors by power method.

$$\begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$$

Q6) a) Solve $u_{xx} + u_{yy} = 0$ in the square region bounded by $x = 0$, $x = 4$, $y = 0$, $y = 4$ and with boundary conditions: [10]

$u(0, y) = 0$

$u(4, y) = 12 + y$

$u(x, 0) = 3x$

$u(x, 4) = x^2$

take $\Delta x = 1$, $\Delta y = 1$. Perform two iterations

b) Classify the following partial differential equations $U_{xx} = 8U_x + U_{yy}$ [4]

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Total No. of Pages : 3

Seat No.	

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

Day and Date : Thursday, 14 - 11 - 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) A steel bar 20 mm in diameter is enclosed in a brass tube of 25 mm external diameter and 2 mm thick. Assuming Es/Eb = 2 and initial length of both the components is 400 mm, calculate stresses in steel and brass of the composite section which is subjected to an axial compressive force of 50 KN. Assume Es = 200 GPa. Find also change in length of composite section. [12]

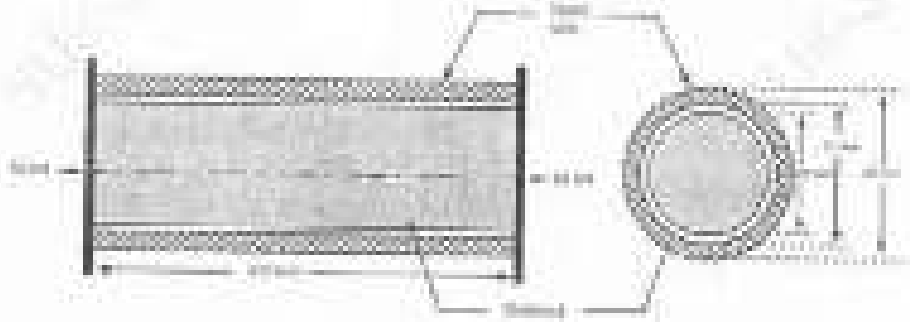

Fig. 1

b) Draw stress-strain diagram of ductile and brittle material subjected to axial loading and explain the important points of diagram [6]

OR

A hollow steel shaft is to transmit 300 KW power at 80 rpm. If the shear stress is not to exceed 60 N/mm² and internal diameter is 0.6 of the external diameter. Find external and internal diameters, assuming that maximum torque is 1.4 times the mean torque. [6]

P.T.O.

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

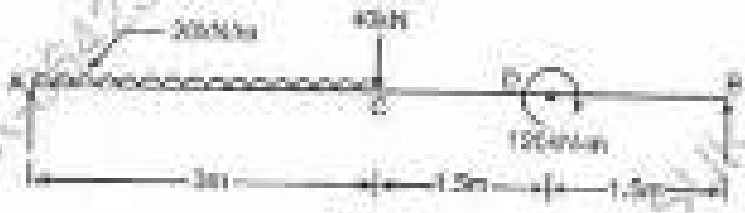

Fig. 2

Q3) A cast iron beam is of 'I' section as shown fig. 3. The beam is simply supported on a span of 8 m. the beam carries UDL of 1.5 KN/m on the entire span. Determine maximum tensile and maximum compressive strength. [16]

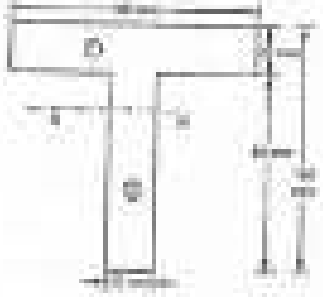

Fig. 3

Q4) a) Derive the expression for the normal stresses and tangential stress when a member subjected to like direct stresses in mutually perpendicular directions. Show the locations of principal planes and planes of maximum shear [9]

b) The dimensions of an I beam shown in figure are: Top flange 300 mm × 20 mm, Bottom flange 220 mm × 20 mm and web 20 mm × 300 mm. Sketch the shear stress distribution across the section showing all values if it has to resist a shear force of 200 kN. [9]

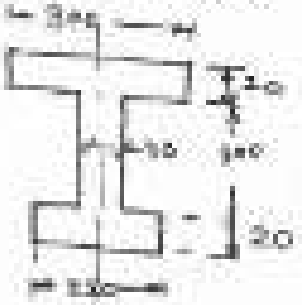

Fig. 4b-1

OR

Figure shows normal and tangential stresses on two planes. Determine the principal stress.

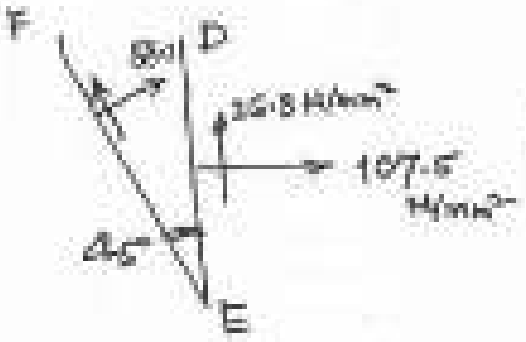

Fig. 4b-2

Q5) a) Derive the equation of slope and deflection of a simply supported beam of length L carring point load at the center. Use double integration method. [8]

b) A cantilever beam of span 3 m is carrying a point load of 20 kN at the free end and 50 kN at 1 m from the free end. Find the slope and deflection of cantilever at the free end. Take EI = 3000 kN/m². [8]

OR

State the importance of theories of failure and explain the maximum principal stress theory. [8]

Q6) a) A straight both ends hinged column is 50 mm in diameter and 1250 long. Calculate:

i) Euler's crippling load when loaded axially and

ii) The eccentricity which will cause failure at 75% of this load if the yield point stress of the material is 275 N/mm². Take E = 200 N/mm². [8]

b) Find the deflection at the center of a simply supported beam of span 'l' carrying a UDL of 'w' per unit run over the whole span, using energy theorem. Assume uniform flexural rigidity. [8]

■ ■ ■

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Total No. of Pages : 4

Seat No.	

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

FLUID AND TURBO MACHINERY

Sub. Code : 63362

Day and Date : Friday, 15 - 11 - 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 side indicate full marks.
3) Assume suitable data if necessary and indicate clearly.
4) Use of non programmable calculator is allowed.

Q1) a) Explain governing of peltonturbine with neat sketch. [8]

b) A pelton wheel has a mean bucket speed of 12 m/s and is supplied water at a rate of 750 litres per second under a head of 35m. If the bucket deflects the jet through angle of 160°, find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine if the mechanical efficiency is 80%. [8]

OR

c) A pelton wheel working under a head of 500 meters has an overall efficiency of 85% and runs at 430 rpm developing 6980 KW of shaft power. Taking the bucket speed at 0.47 times the jet speed and assuming, Cv = 0.97, find (i) the wheel diameter & (ii) jet diameter. [8]

Q2) a) Explain the construction & working of francis turbine by drawing a neat sketch. [8]

b) A reaction turbine works at 450 rpm under a head of 120 meters. Its diameter at inlet is 1.20m and the flow area is 0.4m². The angles made by the absolute & relative velocities at inlet are 20° & 60° respectively with the tangential velocity. Determine
i) Volume flow rate,
ii) Power developed
iii) Hydraulic efficiency
Assume whirl at outlet to be zero. [8]

OR

P.T.O.

c) Particulars of a reaction turbine are given below: Head on turbine = 180mm; Inlet diameter = 4.25m; outlet diameter = 2.75m; Inlet vane angle = 120°; velocity of flow at outlet = 16 m/s; Hydraulic efficiency = 92% width of wheel is same at inlet & outlet. Discharge at outlet is entirely radial. Calculate the speed of the turbine. [8]

Q3) a) Draw neat sketch of centrifugal pump & explain different heads associated with it. [8]

b) A centrifugal pump discharging 370 litres of water per second has to develop a head of 12 meters, the speed of rotation of impeller being 750 rpm. The manometric efficiency is 80% and loss of head in the pump due to friction is $0.326\ V_1^2$ meters of water where 'V_1' is the velocity with which the water leaves the impeller. Assume that the velocity of flow through the impeller is constant at 2.7 meters per second & that there is no velocity of whirl at inlet. Determine : [10]

i) Diameter of the impeller,

ii) Outlet area,

iii) Vane angle at the outlet edge of the impeller.

OR

c) A centrifugal pump having an overall efficiency of 75% delivers 1820 litres of water per minute to a height of 18 metres through a pipe of 100 mm diameter and 90 meters length. Taking $f = 0.012$, find power required to drive the pump. [10]

Q4) a) Explain the working of two stage reciprocating compressor with help of P-V diagram and derive equation for work done by compressor. [8]

b) Write short note on any two [10]

i) Different efficiencies of reciprocating compressor.

ii) Work done during the Polytropic compression (PV^n = constant) in single stage reciprocating compressor.

iii) Working and Construction of root blower.

OR

c) Solve following two questions [10]

i) Single stage single acting reciprocating air compressor has a bore of 200 mm and stroke of 300 mm. It receives air at 1 bar and 20°C and delivers it at 5.5 bars. If the compression follows the law $PV^{1.2}$ = constant and clearance volume is 5 % of stroke volume, determine the power required to drive the compressor if it runs at 500 rpm.

ii) A compressor draws 42.5 m^3 of air per minute into the cylinder at a pressure of 1.05 bar. It is compressed polytropically ($PV^{1.3}$ = constant) to a pressure of 4.2 bar before being delivered to receiver. Assuming a mechanical efficiency of 80% find

1) Indicated power

2) Shaft power

3) Overall isothermal efficiency

Q5) a) Explain following terms used in working of axial flow compressor [8]

i) Surging

ii) Choking

iii) Stalling

b) Define degree of reaction of axial flow compressor and comments on following case of degree of reaction [8]

i) Low degree of reaction stage

ii) 50% degree of reaction stage

iii) High degree of reaction stage

OR

c) A rotary air compressor receives air at pressure of 1 bar and 17°C and delivers it at a pressure of 6 bar. Determine per kg of air delivered, work done by the compressor and heat exchanged with the jacket water when the compression is isothermal, isentropic and by the relation $PV^{1.4}$ = Constant. [8]

Q6) a) Give different methods to improve the efficiency and specific output of simple gas turbine cycle. Explain any one with neat sketch. [8]

b) Following particulars refers to closed cycle gas turbine using air as working medium.

Atmospheric temperature = 26°C

Maximum temperature = 870°C

Initial pressure in compressor = 1bar

Final pressure of compressor = 5 bar

Turbine efficiency = 0.84

Compressor efficiency = 0.8

Calorific value of fuel = 41840 KJ/kg

Cp = 1.005 kJ/Kg K

γ = 1.4

Determine the compressor work, turbine work, net work done and thermal efficiency of gas turbine. [8]

OR

c) A simple gas turbine takes air in at atmospheric pressure at 15°C and compresses the air in the compressor up to 6 bar. Then air enters the combustion chamber and is heated to maximum temperature of 750°C. Then it enters the turbine and expands to atmospheric pressure if isentropic efficiency of compressor and turbine is 0.8, Cp for both air and gases 1.005 kJ/kgK, γ= 1.4. Determine mass flow rate of air and gases through turbine to develop net power of 1100 kW. [8]

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SC-62

Total No. of Pages : 4

Seat No.

S.E. (Mechanical) (Part-II) (Semester - IV)

Examination, November - 2019

THEORY OF MACHINES-I

Sub. Code : 63363

Day and Date : Tuesday, 19- 11 - 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) Draw neat labeled sketches wherever necessary.
4) Assume if necessary suitable data & state clearly.
5) Use of Non-programmable calculator is permissed.

Q1) a) What is inversion of mechanism? Explain inversions of double slider-crank chain with neat sketches. [8]

OR

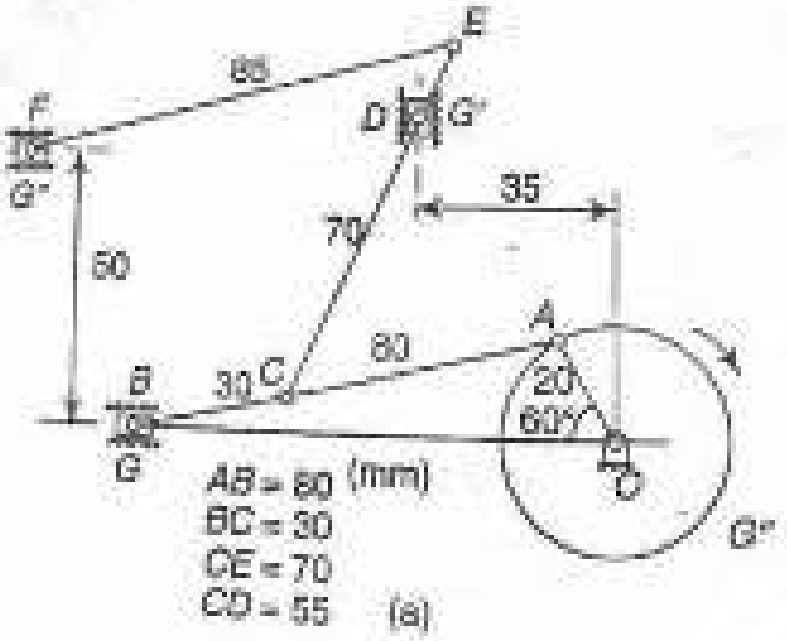
Explain condition of correct steering. Also differentiate Ackerman steering gear mechanism and Davis Steering gear mechanism. [8]

b) In a slider crank mechanism, the lengths of the crank and connecting rod are 200 mm and 800 mm respectively. Locate all I-centers of the mechanism for the position of the crank when it has turned 30° from the inner dead center. Also find the velocity of the slider and the angular velocity of the connecting rod if the crank rotates at 40 rad/s. [8]

Q2) In the mechanism shown in following figure, the crank OA rotates at 210 rpm clockwise. For the given configuration, determine the velocities and accelerations of sliders B,D and F. The various link lengths are,

P.T.O.

AB=80 mm, BC=30 mm, CD=55 mm and CE= 70 mm, OA= 20 mm, EF=85 mm. **[18]**



Q3) a) Derive the equation for force required to lift the load in square threaded screw jack using inclined plane theory. **[8]**

OR

a) Derive the equation for torque required to overcome the friction in collar pivot bearing using uniform wear theory. **[8]**

b) A 150 mm diameter valve, against which a steam pressure of 2 MN/m2 is acting, is closed by means of a square threaded screw 50 mm in external diameter with6 mm pitch. If the coefficient of friction is 0.12, find torque required to turn the handle. **[8]**

Q4) a) Draw the displacement, velocity and acceleration diagrams for a follower when it moves with simple harmonic motion and uniform acceleration and retardation. **[6]**

b) Draw a cam profile to drive an oscillating roller follower to the specifications given below:

i) Follower to move outwards through an angular displacement of 20° during the first 120° rotation of the cam;

ii) Follower to return to its initial position during next 120° rotation of the cam;

iii) Follower to dwell during the next 120° of cam rotation.

The distance between pivot centre and roller centre=120 mm; distance between pivot centre and cam axis=130 mm; minimum radius of cam =40 mm; radius of roller=10 mm; forward and outward strokes take place with simple harmonic motion. **[12]**

Q5) a) Explain what is dynamometer. What are different types of dynamometers? Explain any one in detail **[6]**

OR

a) Derive the equation of belt tensions on tight and slack side of belts $(T1/T2)=e^{\mu\theta}$ **[6]**

b) A belt drive transmits 8 Kw power from shaft rotating at 240 rpm to another shaft rotating at 160 rpm. The diameter of smaller pulley is 600 mm and the two shafts are 5m apart. The coefficient of friction is 0.25 if the maximum stress in belt is limited to 3 N/mm^2 and thickness of belt is 8 mm find the width of belt for open belt drive. **[10]**

Q6) a) Define and explain the following terms relating to governors: Stability, Sensitiveness, and Isochronism **[6]**

OR

a) Explain with sketch the working of centrifugal governor. How it differs from flywheel. **[6]**

b) In a spring loaded governor of the Hartnell type, the mass of each ball is 5 kg, length of vertical arm of the bell crank lever is 100 mm and that of the horizontal arm is 50 mm. The distance of fulcrum of each bell crank lever is 80 mm from the axis of rotation of the governor, the extreme radii of rotation of the balls are 75 mm and 112.5 mm. The maximum equilibrium speed is 5 per cent greater than the minimum equilibrium speed which is 360 r.p.m. Find, neglecting obliquity of arms, initial compression of the spring and equilibrium speed corresponding to the radius of rotation of 100 mm. [10]

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Total No. of Pages : 2

Seat No.	

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

MACHINE TOOLS & PROCESSES

Sub. Code : 63364

Day and Date : Wednesday, 20 - 11 - 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 two

a) Describe in brief different types of sand used to prepare mold in sand casting process. State the desirable properties of molding sand. [8]

b) Explain with neat sketch centrifugal casting process. State the application of Centrifugal casting. [8]

c) State types of induction furnaces used in foundry for melting of CI. Explain in brief working of any of induction furnace with neat sketch. [8]

Q2) Attempt any two

a) Define rolling process. Explain with neat sketch tandem rolling mill. [8]

b) Explain the following with neat sketch [8]

i) Operations performed in forging.

ii) Tube drawing process

c) Describe with neat sketch indirect extrusion process. State the applications of direct & indirect extrusion process. [8]

Q3) Write a short note on Any Three :

a) Applications and advantages of Injection molding & Blow molding [6]

b) Thermoforming process [6]

c) Defects in forging [6]

d) Casting defects [6]

P.T.O.

Q4) Attempt any two

a) Describe thread cutting mechanism on lathe? [4]

If a lathe is provided with a change gear set from 20 to 125 teeth in steps of 5 teeth and an additional gear of 127 teeth. Find the gear train for cutting metric thread of 6.25 mm pitch on a lathe having lead screw pitch as 6 TPI. [4]

b) What is the purpose of bar feeding mechanism? Explain with neat sketch working of the same. [8]

c) Explain with neat sketch construction & working of radial drilling machine. [8]

Q5) Attempt any two

a) Name the different types of milling cutters used. State its applications. Also draw neat sketch of the milling cutters. [8]

b) How does crank & slotted link quick return mechanism work in shaper? State various operations performed on shaper. [8]

c) State gear manufacturing processes. Explain with neat sketch gear shaping process. [8]

Q6) Write a short note on Any Three

a) Jig Boring Machine. [6]

b) Process parameters of Abrasive Jet Machining and its limitations. [6]

c) Set up of Electro-Chemical machining and its applications. [6]

d) Process parameters of Ultrasonic machining and its advantages. [6]

♦ ♦ ♦

Seat No.

S.E. (Mechanical Engineering) (Semester - IV) Examination, November - 2018

APPLIED NUMERICAL METHODS

Sub. Code : 63360

Day and Date : Monday, 12 - 11 - 2018 Total Marks : 100

Time : 10.00 a.m. to 01.00 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) Solve any two [2 × 8 = 16]

a) Use bisection method to find the root correct to four decimal places of $f(x) = x^3 - 10x^2 + 5 = 0$ that lies in the interval (0, 1).

b) Determine the points of intersection between the circle $x^2 + y^2 = 3$ and the hyperbola $xy = 1$. Take initial value as $x_0 = 0.5$, $y_0 = 1.5$.

c) Use Muller's method to find a root of the equation $x^3 - 7x^2 + 6x + 5 = 0$, using $x_0 = 0$, $x_1 = 1$ and $x_2 = 2$ as approximations.

Q2) Solve any two [2 × 8 = 16]

a) Solve the following equations by Gauss-Jordan method.

$x + 2y + z = 3$

$2x + 3y + 3z = 10$

$3x - y + 2z = 13$

b) Solve the system of equations using LU Decomposition.

$x + y + 5z = 14$

$2x + 3y + z = 11$

$4x + y - z = 4$

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

$5x - 2y + z = -4$

$x + 6y - 2z = -1$

$3x + y - 5z = 13$

P.T.O.

Q3) Solve any three: [3 × 6 = 18]

a) Find the equation $y = f(x)$ of least degree and passing through the points $(-1,-2)$, $(1,15)$, $(2,12)$, $(3,3)$ by Newton's divided difference formula. Also find y at $x = 0$.

b) The following table gives experimental data for force (N) and velocity (m/s) for an object suspended in a wind tunnel

Velocity(m/s):	10	20	30	40	50	60	70	80
Force (N):	24	58	378	552	608	1238	851	1451

Use the linear least-squares regression to determine the coefficients a and b in the function $y = a + bx$ that best fits the data

c) Fit a normal curve to the following data:

Length of line cm:	8.60	8.59	8.58	8.57	8.56	8.55	8.54	8.53	8.52
Frequency:	2	3	4	9	10	8	4	2	1

d) Use Lagrange's formula to find $y(10)$, Given

x:	5	6	9	11
y:	12	13	14	16

Q4) Solve any three: [3 × 6 = 18]

a) Evaluate the integral $I = \int_{20}^{28} y(x)dx$ using Simpsons 1/3rd Rule for the following data

x:	20	21	22	23	24	25	26
y:	95.9	96.85	97.77	98.68	99.56	100.41	101.24

b) Evaluate $\int_{-1}^{1} (\sin x)\,dx$ by two point Gaussian Quadrature formula.

c) Use Romberg's method to evaluate $\int_0^1 dx/(x+x+4)$ take h=1.0, 0.5, and 0.25.

d) A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various values of time 't' (seconds). Calculate the angular velocity of the rod at t=0.6 second.

t	0	0.2	0.4	0.6	0.8	1.0
θ	0	0.12	0.49	1.12	2.02	3.20

(25) Solve any three [3 × 6 = 18]

a) Given

$$\frac{dy}{dx} = \frac{y-x}{y+x}$$

with y(0) = 1. Find y(0.1) using modified Euler's method.

b) Using Euler's method, find an approximate value of y when x = 1, in five steps given that

$$\frac{dy}{dx} = x+y$$

y(0) = 1.

c) Solve the equation

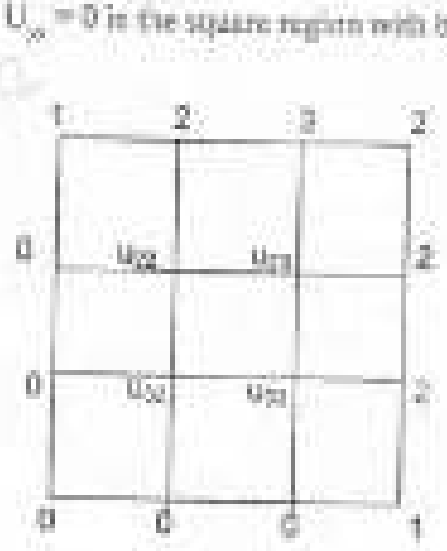
$$\frac{dy}{dx} = x^2+y^2$$

Given y(0)=1. Obtain the values of y(0.1) using Picard's method.

d) Find the largest Eigen value and the corresponding Eigen vectors of

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

Q6) a) Solve $U_{xx} + U_{yy} = 0$ in the square region with boundary values as shown in figure. [



Perform two iterations.

Solve any one out of b) and c) [1 × 6 = 6

b) Classify the following partial differential equations

i) $\phi_{xx} + \phi_{yy} = 0$

ii) $u U_{xx} + 3U_{xy} + 4y^2 U_{yy} = 0$

c) Use explicit method to solve for the temperature distribution of a long thin rod with a length of 10 cm and following values $\Delta x = 2$ cm, $\Delta t = 0.1$ second, and $\lambda = 0.001$ at time t=0.1 second, 0.2 second. At t=0, the temperature of rod is zero and the boundary conditions are fixed for all times at T(0) = 100° C and T(10) = 50° C.

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Total No. of Pages : 4

Seat No.	

S.E. (Mechanical) (Semester - IV) Examination, November-2018

ANALYSIS OF MECHANICAL ELEMENTS

Sub. Code : 63361

Day and Date : Tuesday, 13 - 11 - 2018 Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

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

Q1) a) Three pillars two of copper and one of steel support a rigid platform of 250 kN as shown in the fig.1. If area of each copper pillar is 1000 mm^2 and that of steel pillar is 1000mm^2, find the stresses developed in each pillar. Length of steel rod is 210 mm, length of copper rod is 140 mm. Take $E_s = 1 \times 10^5$ N/mm^2 and $E_c = 2 \times 10^5$ N/mm^2. [12]

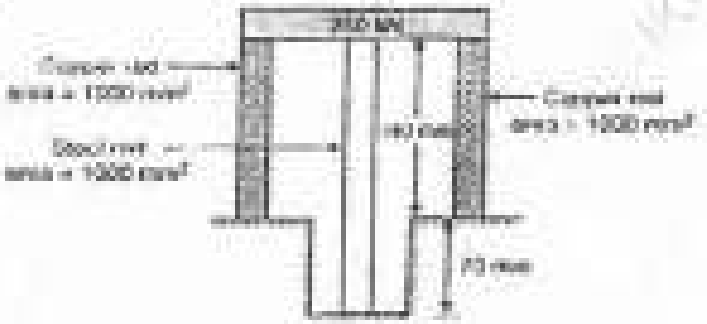

Fig.1

b) A rectangular bar having cross sectional area 50 mm × 20 mm is subjected to axial forces as shown in fig. 2. Find Total change in length of the bar Take E = 1.05 × 10^5 N/mm^2. [6]

Fig. 2

P.T.O

OR

Determine diameter of solid shaft which will transmit 90 KW at 160 rpm. Also determine the length of shaft if twist must not exceed 1° over entire length. Take maximum shear stress as 60 N/mm² and modulus of rigidity 8×10^4 N/mm².

Q2) Draw SFD and BMD for loading condition shown in fig 3. Locate point of contraflexure and maximum bending moment if any. [16]

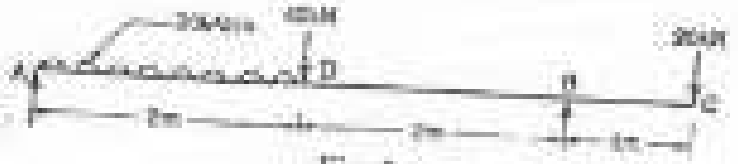

Fig. 3

Q3) A cast iron beam has I section with top flange 80 mm × 20 mm, web 200 mm × 20 mm and bottom flange 160 mm × 40 mm, as shown in Fig. 4 if tensile stress is not to exceed 20 N/mm² what is the maximum UDL the beam can carry over a simply supported span of 5 m, if larger flange is in tension. Find also the maximum compressive stress. [16]

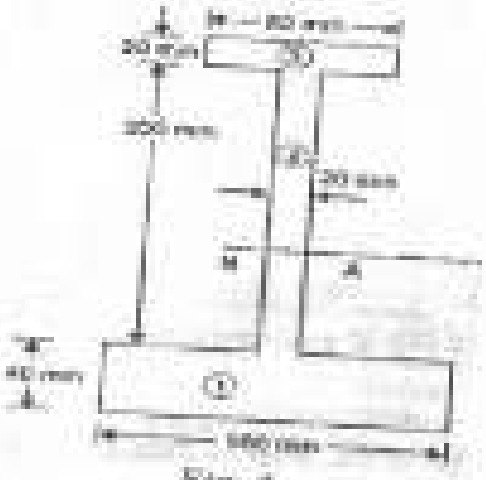

Fig. 4

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

b) The beam section shown in figure 4b .1 is 120 mm × 132 mm × 12 mm T section. Find the stresses and show the shear stress distribution if it has to resist a shear force of 20 kN. [9]

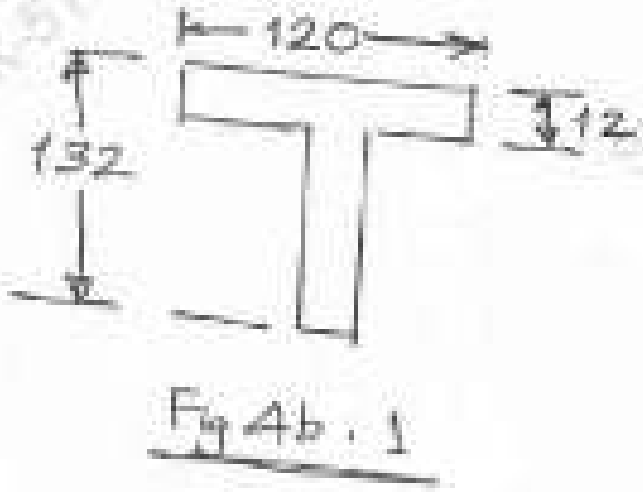

Fig 4b . 1

OR

A point in a stressed material is subjected to stresses as shown in figure 4b.2. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. Also check the answer analytically.

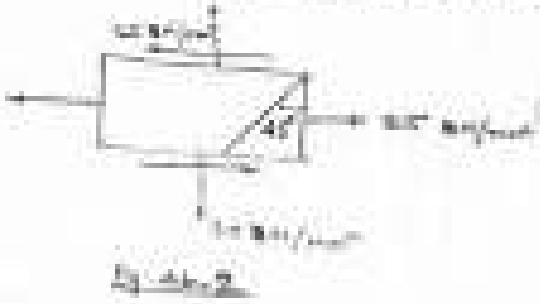

Fig 4b.2

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

b) A cantilever beam of span 3 m is carrying a point load of W kN at the free end. If the moment of inertia of the beam is 1×10^8 mm^4 and the modulus of elasticity is 21×10^4 N/mm^2, find the slope of cantilever at the free end if deflection at the free end is 10.71 mm. [8]

OR

State the importance of theories of failure and explain the maximum strain energy theory.

Q6/ a) State the importance of mode in Euler's column theory and derive an expression for the crippling load when both the ends of the column are hinged. [8]

b) Derive the expression for strain energy stored in a solid shaft due to pure torsion. [8]

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Total No. of Pages : 4

Seat No.

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

FLUID AND TURBO MACHINERY (Revised)

Sub. Code : 63362

Day and Date : Wednesday, 14 - 11 - 2018 Total Marks : 100

Time : 10.00 a.m. to 01.00 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 calculator is allowed.

Q1) a) Explain the terms : Hydraulic efficiency, Mechanical efficiency, volumetric efficiency and overall efficiency for hydraulic turbines. [8]

b) A pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at a rate of 750 litres per second under a head of 35m. If the bucket deflects the jet through an angle of 160°, find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine if its mechanical efficiency is 80%. [8]

OR

c) The following data were obtained from a test on a pelton wheel : [8]

i) Head at the base of the nozzle = 32m

ii) Discharge of the nozzle = 0.18m³/s.

iii) Area of the jet = 7500 sq.mm.

iv) Power available at the shaft = 44kw.

v) Mechanical efficiency = 94%.

Calculate the power lost

i) in the nozzle,

ii) in the runner

iii) in mechanical friction

Q4) a) What is a draft tube? Why it is used in reaction turbine? Describe with neat sketch the different types of draft tube. [8]

b) An inward flow reaction turbine discharges radially and the velocity of flow is constant and equal to the velocity of discharge from the turbine. Show that the hydraulic efficiency can be given by -

$$\eta_h = \frac{1}{1 + \frac{1}{2\cos^2\alpha}}$$

Where 'α' & 'θ' are guide vane angle & wheel vane angle at inlet. [8]

OR

c) Determine the efficiency of a Kaplan turbine developing 3000 kw under a net head of 8m. It is provided with a draft tube with its inlet (diameter 3m) set 1.6m above the tail race level. A vacuum gage connected to the draft tube indicates a reading of 5m of water. Assume draft tube efficiency as 78%. [8]

Q5) a) What is minimum starting speed of pump? Derive the equation for the same. [8]

b) Write short notes (any two) [10]

i) priming devices

ii) VPSH

iii) Cavitation in pumps.

OR

c) A centrifugal pump has an impeller 0.5m outer diameter and when running at 600 rpm discharges water at the rate of 8000 litre/min against a head of 8.5m. The water enters the impeller without whirl and shock. The inner diameter is 0.25m, and the vanes are set back at outlet at an angle of 45° and the area of flow which is constant from inlet to outlet of the impeller is 0.05m². Determine [10]

i) the manometric efficiency of the pump,

ii) the vane angle at inlet &

iii) the least speed at which the pump commences to work.

Q4) a) Explain the working of Reciprocating Compressor and Derive equation for work input required for single stage compressor with adiabatic compression [8]

b) Write Short notes on any two [10]

i) Importance of Multi staging of reciprocating compressors and how it reduces the required work to run the compressor.

ii) Derive expression for workdone by reciprocating compressor with clearance volume.

iii) Write the difference between Reciprocating compressor and Rotary Compressor.

OR

c) Solve following two problems

i) In single stage air compressor the index of compression and expansion may be taken as 1.2. The clearance volume is 1/10th of the swept volume. A compressor of this type is required capable of compressing 7.6 cubic meter free air per minute from 100 kPa to 900 kPa. It runs at 240 rpm with a mean piston speed 220 m/min. Find Volumetric efficiency and Diameter of piston. [5]

ii) The Cylinders of two stage air compressor have the same stroke and the ratio of their diameters is 3.4 to 1. The delivery pressure is 34 bar and the air supply to the compressor is 1 bar and 17 °C. If the temperature of the air leaving the intercooler is 40°C, find the work done per cubic meter of free air delivered when the compression in each cylinder is adiabatic. [5]

Q5) a) Explain the phenomenon of surging, choking and Stalling in centrifugal compressor [8]

b) A rotary compressor working between 1 bar and 3.5 bar has internal and external diameters of impeller as 300 mm and 600 mm 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. [8]

OR

c) A centrifugal air compressor receives air at a pressure of 1 bar and 18 °C, and delivers it at a pressure of 6 bar. Determine workdone by the compressor per kg of air delivered and heat exchanged with the jacket water when compression is

i) Isothermal

ii) Isentropic

iii) Follows law $pv^{1.3}$ = constant

Write comment on results. Take Cp = 1 kJ/kgK and R = 287 J/kgK. [8]

Q9) a) Explain working of Open cycle Gas turbine with help of Brayton cycle [8]

b) In an oil gas turbine installation, air is taken at 1 bar and 30 °C. The air is compressed to 4 bar and then heated by burning the oil to a temperature of 505 °C. If air flows at rate of 90 kg/min. Find the power developed by the plant. Takes γ for air as 1.4 and Cp as 1.05kJ/kgK.

If 2.4 kg of oil having calorific value of 40000 kJ/kg is burnt in the combustion chamber per minute, find the overall efficiency of the plant.[8]

OR

c) A simple gas turbine takes in air at atmospheric pressure at 15°C and compresses the air in the compressor up to 6 bar. This air enters the combustion chamber and is heated to maximum temperature of 750°C. Then it enters the turbine and expands to atmospheric pressure if the isentropic efficiency of compressor and turbine is 0.8, combustion efficiency 0.9, fall of pressure through the combustion system 0.1 bar, Cp for both air and gases 1.005 KJ/kg, γ = 1.4. Determine the flow of air and gases for net power of 1100 kW developed. [8]

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Seat No.

S.E. (Mechanical) (Part - II) (Semester - IV) (Revised) Examination, November - 2018
THEORY OF MACHINES - I
Sub. Code : 63363

Day and Date : Thursday, 15 - 11 - 2018 Total Marks : 100

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

Instructions : 1) Attempt all questions.
2) Figures to the right indicate full marks to the question.
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) Explain the inversions of four-bar chain with neat sketches. [8]

OR

a) Two shafts with an angle of 18° between their axes are connected by Hooke's joint. The driving shaft runs at 1400 r.p.m. The driven shaft has a flywheel of mass 10 kg and radius of gyration 130 mm. Find the maximum angular acceleration of the driven shaft and the maximum torque required.

b) The crank of an I.C. engine is rotating at 500 r.p.m. as shown in fig. 1.b. Crank OC is 60 mm and connecting rod CP is 180 mm in length. Find velocity and acceleration of the piston by using Klein's construction method. [8]

Fig 1.b

P.T.O.

Q2) In a mechanism as shown in fig.2, the crank OA is 100 mm long and rotates in clockwise direction at a speed of 100 r.p.m. The straight link BCD is pinned at C and the lengths BC and CD are each 300 mm and the link AB is 300 mm long. The link DE is 250 mm long and drives slider E. Find the velocity and acceleration of slider E. [18]

Fig. 2

Q3) a) Derive the equation for friction torque in case of flat collar pivot bearing assuming uniform wear with usual notations. [8]

OR

a) Derive the equation for friction torque in case of truncated conical pivot bearing assuming uniform pressure with usual notations.

b) The mean diameter of a square treaded screw jack is 50 mm. The pitch of the thread is 10 mm. The coefficient of friction is 0.15. Determine the force required at the end of a 0.7 m long lever, which is perpendicular to the longitudinal axis of the screw, to raise a load of 20 kN, neglecting collar friction. [8]

Q4) a) Define following with neat diagram: [6]

i) Base Circle
ii) Pressure Angle
iii) Pitch curve
iv) Prime Circle

b) From the following data draw the profile of cam in which follower moves with SHM during ascent and with uniform acceleration and retardation during descent:

Minimum radius of cam = 50 mm, Angle of ascent = 48°, Angle of Dwell = 42°, Angle of Descent = 60°, Lift of follower = 40 mm, Roller Diameter = 30 mm Distance between line of action of the follower and axis of cam = 10 mm. [12]

Q5) a) Explain Slip and Creep phenomenon in Belt. [6]

OR

a) Derive condition for maximum power transmission in Belt Drive

b) In an open belt drive, the diameter of the larger and the smaller pulleys are 1.5 m and 0.8 m respectively. The smaller pulley rotates at 320 rpm. The center distance between the shafts is 4 m. When stationary, the initial tension in the belt is 2.8 kN. The mass of the belt is 1.8 Kg/m and coefficient of friction between the belt and pulley is 0.25. Determine power transmitted by belt considering centrifugal tension. [10]

Q6) a) Explain the terms sensitiveness, stability, isochronism and hunting related with governors. [6]

OR

a) derive the equation for height of Porter governor

b) Each arm of Porter governor is 200 mm long and is pivoted on the axis of the governor. The radii of rotation of the balls at minimum and maximum speeds are 120 and 160 mm respectively. The mass of the sleeve is 24 kg and each ball is 4 kg. Find the range of speed of governor. Also determine the range of speed if the friction at sleeve is 18 N. [10]

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SE - 805

Total No. of Pages : 2

Seat No.	

S.E. (Mechanical) (Revised) (Part - II) (Semester - IV)

Examination, November - 2018

MACHINE TOOLS AND PROCESSES

Sub. Code : 63364

Day and Date : Friday, 16 - 11 - 2018 Total Marks : 100

Time : 10.30 a.m. to 01.00 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 of the following :

a) State advantages and limitations of metal casting processes. [4]

b) Draw a neat sketch of gating system. [4]

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

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

e) What are the different methods used for cleaning of casting? [4]

Q2) Attempt any four of the following :

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

b) Define Extrusion and Explain with neat sketch tube extrusion process. [4]

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

d) State types of rolling mill. Draw a neat sketch of any one of them. [4]

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

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

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

b) Thermoforming [6]

c) Application of forging [6]

d) Cupola furnace [6]

P.T.O.

Q4) Attempt any four of the following :

a) Calculate the gear train for cutting the 8 TPI pitch on work piece if the lead screw of lathe is 6 TPI. [4]

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.

b) Compare turret lathe & capstan lathe. [4]

c) State principal parts of lathe & explain its function. [4]

d) State tool holding devices on drilling machine. Draw sketch of any two. [4]

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

Q5) Attempt any four of the following :

a) Draw neat sketch of operations performed on planning machine. [4]

b) State various operations performed on shaping machine. [4]

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

d) Describe vertical milling attachment on horizontal milling machine. [4]

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

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

a) Laser beam machining [6]

b) Electro-chemical machining [6]

c) Jig boring machine [6]

d) Types of milling cutters [6]

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Total No. of Pages : 4

Seat No.	

S.E. (Mechanical Engineering) (Semester - IV) Examination, November - 2017

APPLIED NUMERICAL METHODS

Sub. Code : 63360

Day and Date : Wednesday, 01 - 11 - 2017 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 types of errors. [5]

b) Solve any two : [2 × 5 = 10]

i) Using bisection method, find the negative root of $x^3 - 4x + 9 = 0$.

ii) Use Newton Raphson Method to evaluate the $\sqrt{21}$.

iii) Find root of the equation $x - e^{-x} = 0$ using secant method with four iterations.

Q2) a) Solve the following equations by Gauss Elimination method [5]

$3x + y - z = 3$

$2x - 8y + z = -5$

$x - 2y + 9z = 8$

b) Solve any two [2 × 5 = 10]

i) Solve the following equations by Gauss Jordan method

$2x + y + z = 10$

$3x + 2y + 3z = 18$

$x + 4y + 9z = 16$

P.T.O.

h) Solve the following equations by matrix inversion method

$3x + y - 2z = 3$

$2x - 3y - z = -3$

$x + 2y + z = 4$

i) Solve the following equations by Gauss-Seidel method

$2x + y + 6z = 9$

$8x + 3y + 2z = 13$

$x + 5y - z = 7$

Q5) Solve any four [4 × 5 = 20]

a) Fit a least square curve $y = ax^b$ to the following data

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

b) Find the missing term in the following table using Lagrange's interpolation formula.

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

c) Using Newton's divided difference formula, evaluate $f(9)$

x	−4	−1	0	2	5
$f(x)$	1245	33	5	9	1335

d) Find the mean and median

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of Students	12	18	27	20	17	6

e) What are the applications of Binomial distribution and normal distribution?

Q4) a) Evaluate $\int_1^3 (1/x)\,dx$ by Simpson's $\frac{1}{3}^{rd}$ rule with 4 strips. [4]

b) Solve any two :

i) Compute the integral $I=\int_1^3 xe^x dx$ by Gaussian Quadrature. [6]

ii) Evaluate the integral $\int_0^{\pi/2} (x/\sin x)\,dx$ using Romberg's method, correct to three decimal places. [6]

iii) The population of a certain town is shown in the following table : [6]

Year (x)	1931	1941	1951	1961	1971
Population in lakhs (y) :	40.62	60.80	79.95	103.56	132.65

Find the rate of growth of population in 1961.

Q5) a) Solve $\frac{dy}{dx}=y^2+x$, $y(0)=1$ using Taylor's series method and compute $y(0.1)$ and $y(0.2)$. [6]

b) Solve any two

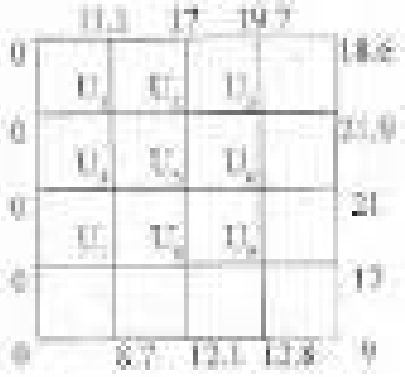
i) Using modified Euler's method, find $y(0.2)$ and $y(0.4)$ given $y'=y+e^x$, $y(0)=0$. [5]

ii) Apply Runge-Kutta method to find approximate value of y for $x=0.2$, in steps of 0.1, if $\frac{dy}{dx}=x+y^2$ given that $y=1$ where $x=0$. [5]

iii) Find the largest Eigen value and the associated Eigen vector.

$$A=\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$ by power method. [5]

Q6) a) Solve the equation $u_{xx} + u_{yy} = 0$ for the following square mesh with shown boundary values. [10]



b) Solve any two :

i) Classify the following partial differential equations. [4]

1) $x^2 u_{xx} - 2y\, u_{xy} + u_{yy} - u_x = 8x$

2) $y^2 u_{xx} - 2xy\, u_{xy} + x^2 u_{yy} + 2u_y - 3x = 0$

ii) Explain Crank Nicolson method. [4]

iii) Explain Bender-Schmidt method. [4]

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Total No. of Pages :4

Seat No.	

S.E. (Mechanical) (Semester - IV) Examination, November - 2017
ANALYSIS OF MECHANICAL ELEMENTS
Sub. Code:63361

Day and Date : Thursday, 02 - 11 - 2017 Total Marks : 100

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

Instructions : 1) All questions are compulsory.

2) Assume suitable data wherever necessary and state it clearly.

3) Figures to the right indicate full marks.

4) Draw neat and labeled sketches wherever necessary.

5) Use of non programmable calculator is allowed.

Q1) a) Three pillars two of aluminum and one of steel support a rigid platform of 200 kN as shown in the fig 1. If area of each aluminum pillar is 1000 mm^2 and that of steel pillar is 800mm^2, find the stresses developed in each pillar.

Take $E_s = 1 \times 10^5$ N/mm^2 and $E_a = 2 \times 10^5$ N/mm^2. What additional load P, can it take, if working stresses are 65N/mm^2 in aluminum and 150N/mm^2 in steel? [12]

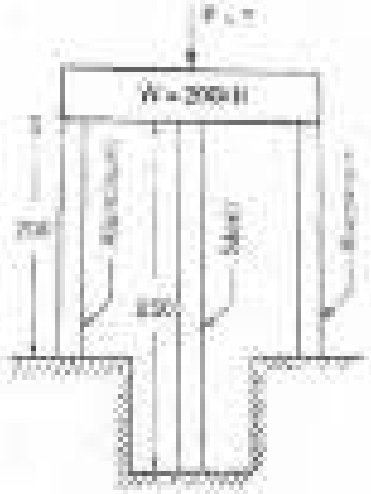

Fig 1

b) Explain thermal stresses and hence derive the expression for thermal stress induced in a bar with its ends fixed by rigid support. [6]

OR

b) A hollow circular shaft 200 mm external diameter and thickness 35mm is transmitting power at 200 rpm. The angle of twist over the length of 3m was found to be 6.9°. Calculate the power transmitted and the maximum shear stress induced in the shaft. Take modulus of rigidity as 84 kN/mm² [6]

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

Fig. 2

Q3) A cast iron beam has I section with top flange 80 mm ×40 mm, web 120 mm ×20mm and bottom flange 160 mm×40 mm, as shown in Fig 3 if tensile stress is not to exceed 30 N/mm² and compressive stress 90N/mm²,what is the maximum UDL the beam can carry over a simply supported span of 6m, if larger flange is in tension [16]

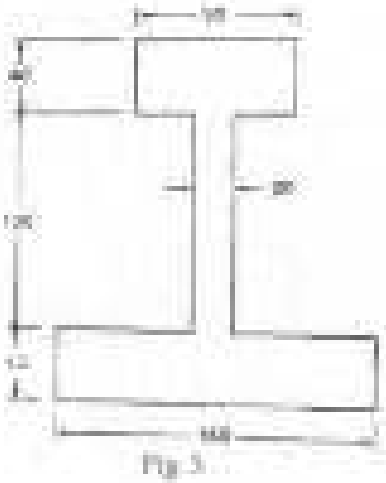

Fig. 3

Q4(a) Derive the expression for the principal stresses and the maximum shear stress for a member subjected to simple shear stress. Show the locations of Principal Planes and Planes of Maximum shear stress. [9]

b) At a point in a strained material the principal stresses are 140N/mm² (tensile) and 60 N/mm² (compressive). Determine the normal stress, shear stress and the resultant stress on a plane inclined at 45° to axis of major Principal stress. What is the intensity of maximum shear stress at the point? [9]

OR

b) An I-section beam 350mm × 150mm has a web thickness of 15mm and a flange thickness of 20mm (Fig 4) If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section. Also sketch the shear stress distribution across the section. [9]

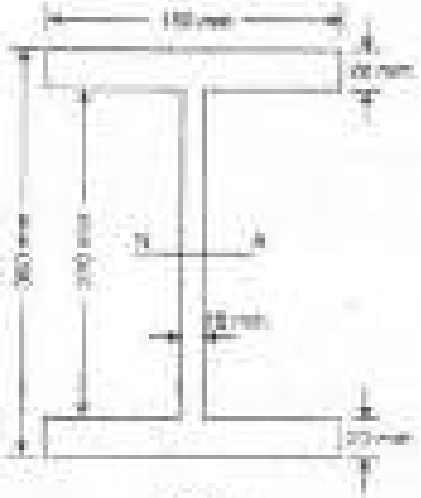

Fig 4

Q5) a) Derive the expression for slope and deflection of a simply supported beam subjected to an UDL for the whole span, using double integration method. [8]

b) A cantilever of length 2 m carries a UDL of 2 kN/m over a length of 1 m from the free end and a point load of 1 kN at the free end. Find the slope and deflection at the free end if $E=2.1\times10^5$ N/mm^2 and $I=6.667\times10^6$ mm^4 [8]

OR

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

Q6) a) State the assumptions made in Euler's column theory and derive its expression for the crippling load when both the ends of the column are hinged. [8]

b) The maximum stress produced by pull in bar of length 1 m is 130 N/mm^2. The area of cross sections and lengths are as shown in fig 5. Calculate the strain energy stored in a bar if $E=2\times10^5$ N/mm^2 [8]

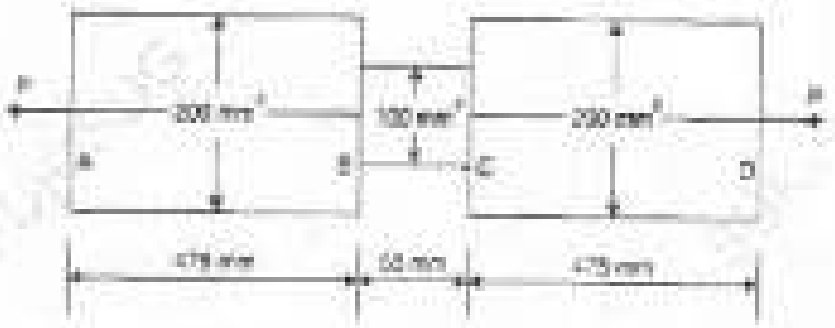

Fig. 5

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S.E. (Mechanical) (Part - II) (Semester - IV) (Revised) Examination, November - 2017

FLUID AND TURBO MACHINERY

Sub. Code: 63362

Day and Date : Friday, 03 - 11 - 2017 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 calculator is allowed.

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

b) The following data were obtained from a test on a Pelton wheel [8]

i) Head at the base of nozzle = 32m

ii) Discharge through nozzle = 0.18 m³/s

iii) Area of the jet = 7500 mm²

iv) Power available at the shaft = 44 kW

v) Mechanical efficiency = 94%

Calculate the power lost

1) In the nozzle

2) In the runner

3) In mechanical friction

OR

c) A turbine work under a head of 200 m and it develops 6000 kW at 200 rpm. The overall efficiencies 87%. Find its unit quantities. A model is to built which is similar to above turbine in all respect having the scale 1:10, it is tested under a head of 20m. find the speed, discharge and specific speed of model having the same overall efficiency as turbine. [8]

P.T.O.

Q2) a) What is governing of turbine? Explain governing of Francis turbine with neat sketch. [8]

b) An inward flow reaction turbine has outer diameter of 1m and inner diameter 0.5m. The vanes are radial at the inlet and discharge is radial at the outlet. Water enters vane at an angle of 10°. Assuming velocity of flow to be constant at 3m/sec. Find speed of the wheel and vane angle at outlet. [8]

OR

c) A Kaplan turbine works under head of 16m. Runner diameter is 2.5 times diameter of hub, speed of turbine is 105 rpm. Angle of vane tip at outlet extreme edge is 20° and K_v=0.6.

Assume radial discharge. [8]

Calculate i) Runner diameter

ii) Hub diameter

iii) Discharge through turbine

Q3) a) Define specific speed of pump and obtain expression of it. What is significance of it? [8]

b) Write short notes (any two) [10]

i) Priming and its necessity

ii) NPSH

iii) Derive expression for minimum starting speed of centrifugal pump.

OR

c) i) A centrifugal pump is running at 1000 rpm. The outlet vane angle of impeller is 45° and velocity of flow at out 2.5 m/sec. Discharge through pumps is 200 lit/sec working against total head of 20m. If manometric efficiency is 80%, find impeller diameter and width of impeller at outlet. [5]

ii) Centrifugal pump of impeller diameter 0.30m discharging 0.03 m³/s water against a total head of 15 m and the pump is running at 1000 rpm. Find the discharge, head and ratio of power of a geometrically similar pump of diameter 0.15 m when it is running at 2300 rpm. [5]

Q4) a) Prove that the expression for volumetric efficiency in reciprocating compressor with effect of clearance volume is

$$\eta_v = 1 - \frac{V_c}{V_s}\left[\left(\frac{P_2}{P_1}\right)^{\frac{1}{n}} - 1\right]$$

Where,

V_c is Clearance volume, V_s is swept volume and P_2/P_1 is the pressure ratio. Also discuss the effect of Clearance ratio on the volumetric efficiency of the compressor. [8]

b) Write short notes on any two: [10]

i) Requirement of multistage of reciprocating compressors.

ii) Workdone by reciprocating compressor during adiabatic and isothermal compressions.

iii) Classification of reciprocating compressors.

OR

b) i) A single acting single stage compressor is belt driven from an electric motor at 400 rpm. The cylinder diameter is 15cm and the stroke 17.5 cm. The air is compressed from 1 bar to 7 bar and the law of compression $PV^{1.3}$ = Constant. Find the power of the motor, if transmission efficiency is 97% and the mechanical efficiency of compressor is 90%. Neglect clearance effect. [5]

ii) The pressure in the mains of compressor air service is to be 8 bar and a supply of 28 m³/hr at 15°C and that pressure is to be maintained. The air is compressed from an initial pressure 1 bar by a two stage compressor in which the compression is adiabatic. The air is cooled to an initial temperature of 15°C in the inter cooler. What is the minimum power required to compress the air? Take R = 287 J/kgK. [5]

Q5) a) Explain the concept of Slip factor and Power input factor. [8]

b) A Centrifugal compressor delivers 40 kg of air per minute at a pressure of 3 bar and 120° C. The intake pressure and temperature of the air is 1 bar and 25°C. If no heat loss to the surrounding, find

i) Index of compression

ii) Power required, if the compression is isothermal

(Take R = 287 J/kgK and C_p = 1.005 J/kgK) [8]

OR

b) An axial flow compressor with compression ratio 6, draws air at 25°C, delivers it at 60°C. Assuming 50% degree of reaction, find the velocity of flow if the blade velocity is 100 m/sec and also find the number of stages. Take work factor = 0.85, $\alpha_1 = 10°$ & $\beta_1 = 40°$, $C_p = 1$ kJ/kgK. [8]

Q6) a) Give the methods of improving the specific output and thermal efficiency of gas turbine and explain gas turbine with intercooling arrangement. [8]

b) An open gas turbine plant works between the fixed absolute temperature limits 350 K, 1550 K, the absolute pressure limits being 1 bar and 14 bar. The isentropic efficiency of compressor is 0.85 and that of turbine 0.86. Estimate the net work done by the turbine. The calorific value of the fuel is 4200 kJ/kg.

Assume

Efficiency of combustion chamber is 0.99,

Mechanical efficiency of whole assembly is 0.98,

Efficiency of generator is 0.985

Fuel air ratio = 1 : 54.06 and m_a = 500 kg/s. Take Cp = 1.005 kJ/kgK for air and gas. [8]

OR

b) Operating conditions of the Gas turbine unit are given below

i) The isentropic efficiency of compressor = 0.85

ii) The isentropic efficiency of turbine = 0.82

iii) A turbine unit has a pressure ratio 7:1

iv) Maximum cycle temperature is 620°C

v) The air enters the compressor at 15°C at the rate of 20 kg/s

Then calculate the workdone by turbine, compressor work and total work.

Take Cp = 1.005 kJ/kgK and γ = 1.4 for the compression and Cp=1.11 kJ/ kgK and γ = 1.35 for the expansion. [8]

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Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part - II) (Semester-IV) (Revised) Examination, November - 2017

THEORY OF MACHINES - I

Sub. Code : 63363

Day and Date : Monday, 06-11-2017 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.

SECTION-I

Q1) a) Write a note on Grubler's criterion for planar mechanism. [8]

OR

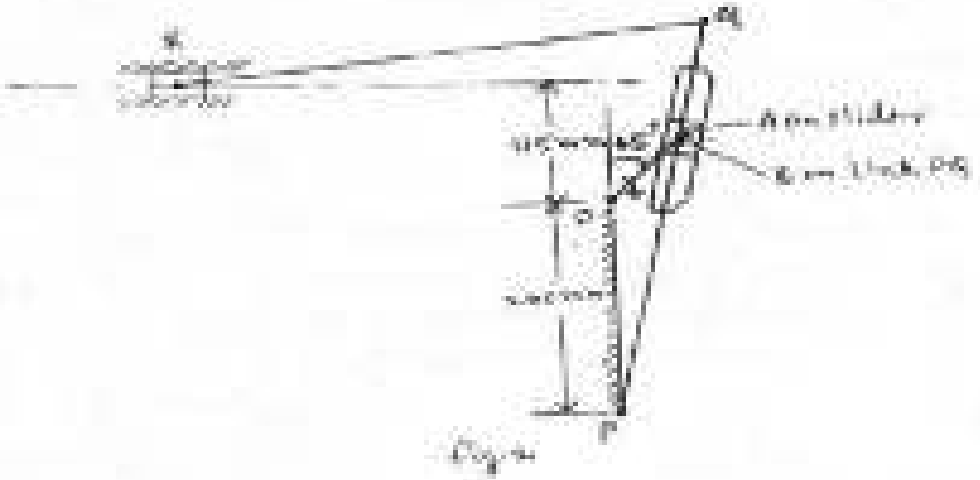
a) Explain the inversions of single-slider crank chain with neat sketches. [8]

b) A reciprocating engine mechanism is shown in fig 1-b. Crank OC is 60 mm long and connecting rod CP is having length of 180mm. By using Klein's construction method, find the velocity and acceleration of the piston if the crank is rotating at 180 r.p.m. [8]

Fig 1-b

P.T.O.

Q2) Crank OA of the quick return mechanism shown in fig. 2 revolves at a uniform speed of 250 r.p.m. in clockwise direction. The dimensions of various links are: OA = 75 mm, PQ = 375 mm, and QR = 400 mm. Crank makes 45° with vertical line PO. Find: i) velocity of R, ii) acceleration of R and iii) angular acceleration of QR. [18]



Q3) a) Derive the equation for friction torque in case of conical pivot bearing assuming uniform pressure with usual notations. [8]

OR

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

b) A screw jack has square threaded screw with mean diameter of 40 mm. The pitch of the thread is 6 mm and the coefficient of friction at the screw is 0.16. The load to be lifted is 25 kN and is supported by a collar having mean diameter of 50 mm and the coefficient of friction at the collar is 0.18. Determine the length of the tommy bar required if an effort of 200 N is applied to lift the load. [8]

Q4) a) Draw displacement, velocity and acceleration diagram for Uniform acceleration and retardation motion program of follower. [4]

b) A cam is operating an oscillating roller follower having SHM during outward and return stroke. Draw the cam profile for the following given data:

Distance of roller centre from cam centre at the start of ascent = 60 mm;

Follower arm length = 80 mm; Distance of pivot point from cam centre = 180 mm;

Angle of ascent = 60°; Angle of descent = 90°; Angle of dwell inbetween = 45°

Angle of oscillation of follower arm during ascent and descent = 15° **[14]**

Q5) a) Derive the equation of ratios of belt tensions in case of flat belt drive. **[6]**

OR

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

b) An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3m apart and transmits 4 kW from smaller pulley that rotates at 300 rpm. Coefficient of friction between the belt and pulley is 0.3 and safe working tension is 10N per mm width. Determine minimum width of belt, initial tension in belt. **[10]**

Q6) a) Explain controlling force and controlling curve. **[6]**

OR

a) Explain the terms height of governor, Isochronism and stability related to governor. **[6]**

b) In a porter governor, each of the four arms is 400 mm long. The upper arms are pivoted on the axis of rotation whereas the lower arms are attached to the sleeve at a distance of 45 mm from the axis of rotation. Each ball has a mass of 8 kg and the load on the sleeve is 80 kg. What will be the equilibrium speeds for the two extreme radii of 250 mm and 300 mm of rotation of governor balls? **[10]**

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Total No. of Pages : 2

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - IV) (Old) (Pre-revised)
Examination, November - 2017
MACHINE TOOLS
Sub. Code : 43595

Day and Date : Wednesday, 01 - 11 - 2017 Total Marks : 100

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

Instructions: 1) Answer any three questions from each Section.
2) Figures to the right indicate full marks.
3) Assume suitable data, if necessary.
4) Use of Non-programmable Scientific Calculator is allowed.

SECTION - I

Q1) a) State and explain various operations performed on lathe? [8]

b) Describe with neat sketch any two attachments used on lathe. [8]

Q2) a) What are principal parts of Radial drilling machine? State the function of each. [8]

b) Explain construction and working of horizontal boring machine? [8]

Q3) a) With the help of neat sketch explain turret indexing mechanism. [8]

b) Sketch various types of tools used on boring machine. [8]

Q4) Write a short note on (Any Three) : [18]

a) Various accessories used on lathe.

b) Table drive and feed mechanism in planer.

c) Hydraulic shaper.

d) Characteristics of machine tools.

P.T.O.

SECTION - II

Q5) a) Explain vertical milling attachment for horizontal milling machine. [8]

b) Sketch and describe the functions of the following milling cutters [8]

i) side milling cutter.

ii) Angular cutter.

iii) End mill cutter.

iv) T-slot cutter.

Q6) a) What are the commonly used shapes and sizes of grinding wheel? [8]

b) Describe the working principle of tool and cutter grinder. What are its uses? [8]

Q7) a) List gear finishing processes. Explain gear shaving process. [8]

b) Explain construction of CNC machine with block diagram. [8]

Q8) Write a short note on (Any Three) : [18]

a) Cylindrical grinder.

b) Classification of milling Machine.

c) Gear shaping.

d) Advantages and limitations of broaching.

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Total No. of Pages : 3

S.E. (Mechanical) (Part - II) (Semester - IV) (Revised) Examination, November - 2017

MACHINE TOOLS & PROCESSES

Sub. Code : 63364

Day and Date : Tuesday, 07 - 11 - 2017

Time : 10.00 a.m. to 01.00 p.m. Total Marks : 100

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 molding sand. Suggest the methods to measure the same. [4]

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

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

d) Draw neat sketch of cupola furnace and name the parts. [4]

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

Q2) Attempt any four (4 marks each) :

a) Briefly explain principle of rolling with neat sketch. [4]

b) Distinguish between open and closed die forging processes. [4]

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

d) Why is lubrication difficult in wire drawing process? State the methods generally employed in it. [4]

e) Indicate by means of flow diagram the different stages in manufacture of 50 mm diameter rod from a steel ingot. [4]

P.T.O.

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

a) Advantages and Limitations of sand casting process [6]

b) Defects in forging [6]

c) Injection molding [6]

d) Thermoforming process for plastic [6]

Q4) Attempt any four (4 marks each)

a) A lathe is provided with a change gear set from 20 to 125 teeth in steps of 5 teeth and an additional gear of 127 teeth. Find the gear train for cutting metric thread of 3 mm pitch on a lathe having lead screw pitch as 6 TPI. [4]

b) How are a capstan and turret lathe headstock classified? Describe any one of them. [4]

c) Describe in brief working principle of boring machine. [4]

d) Draw neat sketch of following operations performed on drilling machine. [4]

i) Countersinking

ii) Counterboring

e) Give the specification of lathe. [4]

Q5) Attempt any four (4 marks each) :

a) Explain the method of carrying out an operation on shaper. [4]

b) Outline the procedure of planning vertical surfaces. [4]

c) Make a neat sketch of Universal milling machine. State its advantages. [4]

d) What are various tool holding devices used on milling machine? [4]

e) Compare the gear shaving with gear rolling. [4]

Q8) Write a short note on (Any Three) :

a) Abrasive Jet Machining advantages & limitations [6]

b) Application of Electro- Chemical machining with neat sketch [6]

c) Water jet machining process [6]

d) Various operations performed on milling machine [6]

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Total No. of Pages : 4

Seat No.

S.E. (Mechanical Engineering) (Semester - IV) Examination, November - 2016

APPLIED NUMERICAL METHODS

Sub. Code : 63360

Day and Date : Monday, 07-11-2016 Total Marks : 100

Time : 2.30 p.m. to 5.30 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) If the length of a bridge and a rivet measured by you are 9999 cm and 9 cm respectively, while the true values are 10000 cm and 10 cm respectively, compute

i) the true error and

ii) true percent relative error for each case [5]

b) Solve any two [2×5=10]

i) Use the method of false position to find the fourth root of 32 correct to three decimal places.

ii) Using Muller's method find the root of equation $f(x) = 2x - \sin x = 0$ (Take $x_0 = 1.5$, $x_1 = 1.2$, $x_2 = 1.4$)

iii) Find the real root of $xe^x - 2 = 0$ using Newton Raphson method.

Q2) a) Solve the system of equations using LU Decomposition method. [5]

$7x - 2y - 5z = -18$

$x - 6y - 3z = 49$

$2x - y - 9z = 26$

P.T.O.

b) Solve any two [2×5=10]

i) Solve the following equations by Gauss Seidal method.

$2x_1 + 4x_2 - x_3 = 12$

$x_1 - 3x_2 + 10x_3 = 24$

$2x_1 - 17x_2 + 4x_3 = 35$

ii) Solve the following equations by matrix inversion method.

$x + y + z = 3$

$x + 2y + 3z = 4$

$x + 4y + 6z = 8$

iii) Solve the following equations by Gauss Elimination method.

$3x + y + 2z = 3$

$2x - 3y + z = -1$

$x - 2y + z = 4$

Q3) Solve any four [4×5=20]

a) Obtain a relation of the form $y = ax^n$ for the following data by the method of least squares.

x	1	2	3	4	5
y	5.2	27.8	62.1	110	161

b) The following table gives the viscosity of oil as function of temperature. Use Lagrange's interpolation formula to find viscosity of oil at temperature of 140°C

Temp°C	110	130	160	190
Viscosity	10.8	8.1	5.5	4.8

c) Using Newton's divided difference formula, evaluate f(8)

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

d) State addition and Multiplication laws of probability

e) Compute the standard deviation of 100 students.

Mass in Kg	60-62	63-65	66-68	69-71	72-74
No. of students	5	18	42	27	8

4) a) A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the table below. Using Simpson's 1/3 rule, find the velocity of the rocket at t = 80 seconds. [4]

t (sec)	0	10	20	30	40	50	60	70	80
f (cm/sec²)	30	31.63	33.34	35.47	37.35	40.53	43.25	46.09	50.67

b) Solve any two:

i) Evaluate $\int_0^{\pi/2} e^{\sin\theta}\, d\theta$ using the 3-point Gaussian Quadrature. [6]

ii) Evaluate the integral $\int_1^5 \ln x\, dx$ using Romberg's method, given that [6]

x	4	4.2	4.4	4.6	4.8	5	5.2
y	1.2861	1.4351	1.4816	1.526	1.5685	1.6094	1.6486

iii) The distance travelled by a point P in X-Y plane in a mechanism is as shown in the table below. Estimate the distance travelled, velocity and acceleration of point P when x = 4.5 [6]

x (mm)	1	2	3	4	5
y (mm)	14	30	62	126	198

Q5) a) Apply Runge Kutta method to find approximate value of y for $x = 1.2$

i) if $\frac{dy}{dx} = \frac{2xy + e^x}{x^2 + e^x}$ given $x_0 = 1, y_0 = 0$

b) Solve any two

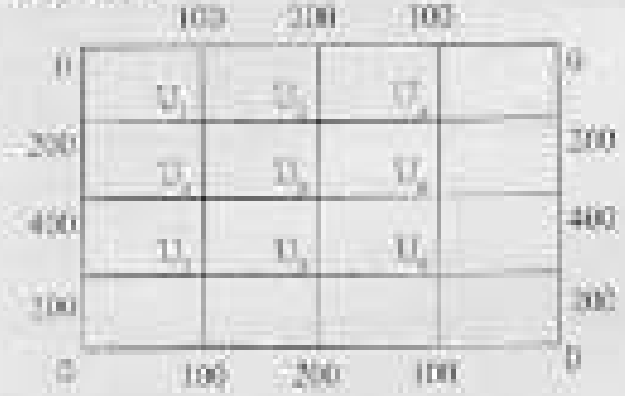
i) Use Euler's method to solve $dy/dx = 2 + \sqrt{(x+y)}$, $y(1) = 1$. Find $y(1.2)$ by taking 2 steps.

ii) Find an approximate value of y when $x = 0.1$, if $dy/dx = x - y^2$ and $y = 1$ at $x = 0$ using Picard's method.

iii) Find the largest Eigen value and the associated Eigen vector for

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$ by power method.

Q6) a) Solve the equation $u_{xx} + u_{yy} = 0$ for the following square mesh with the boundary values.



b) Solve any two

i) Classify the following partial differential equations

1) $x^2 u_{xx} + u_{yy} + u_x^2 - u_y^2 + 3 = 1$

2) $f_{xx} + 2f_{xy} + f_{yy} = 0$

ii) Explain Crank Nicolson method.

iii) Use explicit method to solve for the temperature distribution along the rod of unit length of 10 cm and following values $\Delta x = 2$ cm, $\Delta t = 0.1$ second and $\lambda = 0.0303$ at time $t = 0.1$ second, 0.2 second. $x(x) = 0$ the temperature of rod is zero and the boundary conditions are given for all times as $T(0) = 150°C$ and $T(10) = 50°C$.

Seat No.

SJ-321

Total No. of Pages : 3

S.E.(Mechanical) (Part-II) (Semester - IV) Examination, November - 2016

ANALYSIS OF MECHANICAL ELEMENTS

Sub. Code :16336]

Day and Date : Tuesday, 8 - 11 - 2016

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

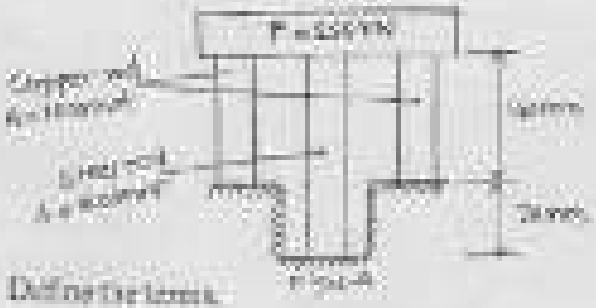
Total Marks : 100

Instructions : 1) All questions are compulsory.

2) Assume suitable data wherever necessary and state it clearly.

3) Figures to the right indicate full marks.

Q1) a) Two copper rods and one steel rod together support a load of 250KN as shown in fig :-a. Calculate load and stresses for each rod. Assume $E_s = 2 \times 10^5$ N/mm^2 and $E_{cu} = 1 \times 10^5$ N/mm^2. [12]



b) Define the terms. [8]

i) Bulk modulus

ii) Modulus of rigidity

iii) Poisson's ratio

OR

Q) A shaft is transmitting 97.2KW at 180rpm. If the allowable stress in the material is 60MPa. Find the suitable diameter for the shaft. Also find the shaft diameter from rigidity consideration. If the allowable twist in the shaft is 2° in a length of 2m. Take G = 80GPa. [9]

P.T.O.

Q2) Draw SFD and BMD for loading condition shown in fig 2. Locate point of inflection if any. [10]

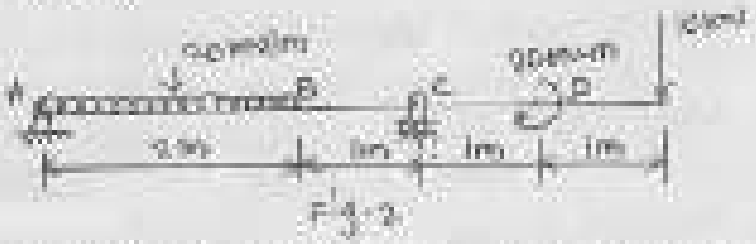
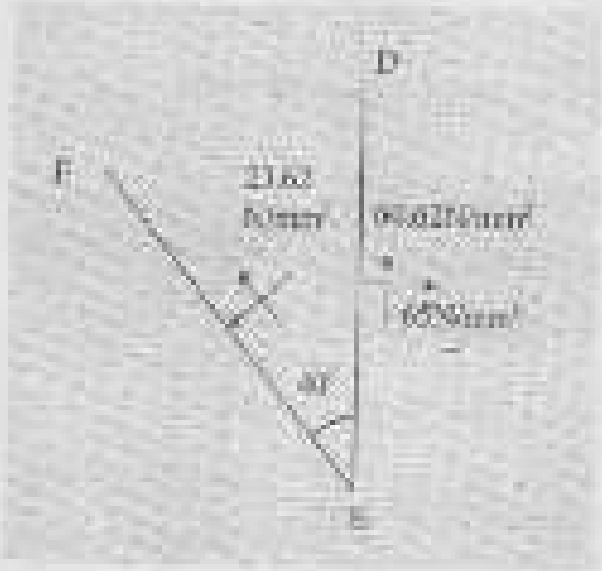


Fig 2

Q3) A T-section of simply supported beam of flange and web dimension 100 mm×56 mm each. It is subjected under B.M. of 3.4KN.m Find stresses at extreme fibers of cross section and show the stress distribution. Also calculate max tensile force and compressive force at section. [16]

Q4) a) Derive the expression for principle stresses and maximum shear stress for a member subjected to simple shear stress. Also show the locations of principle planes and planes of maximum shear stress. [8]

b) Fig 1.5b shows the normal and tangential stresses on two planes. Determine the principle stresses. [10]



OR

6) The shear force acting on a section of beam is 50 kN. The section of beam and its dimensions are as shown in Fig2. The moment of inertia about the horizontal neutral axis is 3134.321×10^4 mm^4. Calculate the shear stress at the neutral axis and at the junction of the web and the flange. Also show the shear stress distribution. [10]

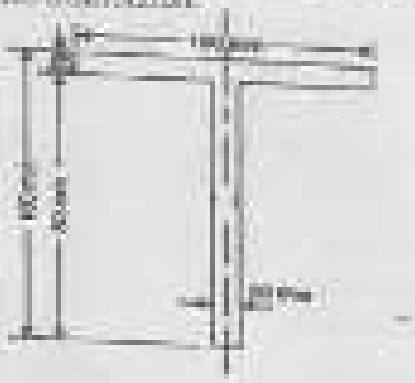


Fig 2

7) a) Derive the expression for slope and deflection of a cantilever subjected to uniformly distributed load (UDL) for a distance 'a' from the fixed end using double integration method. [9]

b) A cantilever of length 2 m carries a uniformly distributed load of 2.5 kN/m run for a length of 1.25 m from the fixed end and a point load of 1kN at the free end. Find the deflection at the free end if the section is rectangular 12 cm wide and 24 cm deep and E= 1×10^5 N/mm^2 [8]

OR

b) State the importance of theories to failure and explain the maximum shear stress theory (Guest's Theory) [8]

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

b) Derive the expression for the strain energy stored in a solid shaft due to pure torsion. [8]

❖ ❖ ❖

Seat No.

S.E (Mechanical) (Part-II) (Semester-IV) Examination, November - 2016
FLUID AND TURBO MACHINERY
Sub. Code :63362

Day and Date : Wednesday, 09 : 11 : 2016 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 calculator is allowed.

Q1) a) Explain the terms overall efficiency, jet ratio, speed ratio and coefficient of velocity. [8]

b) A pelton wheel is working under a gross head 400m. The water is supplied through penstock of diameter 1 m and 4 Km length from reservoir to the pelton wheel. The coefficient of friction for the penstock is given as 0.01. The jet of water discharge 150mm strikes the bucket of the wheel and gets deflected through 165°. The relative velocity of water at outlet is reduced by 15% due to friction between inside surface of the bucket and water. If the velocity of bucket is 0.45 times the jet velocity at inlet and mechanical efficiency is 85%. [8]

Find :i) Power given to runner
ii) Shaft power
iii) Hydraulic efficiency

OR

c) A pelton wheel has to develop 16.5MW under head of 330 m While running at 400 rpm at overall efficiency of 85%. Assuming suitable design data, calculate [8]

i) No. of jets
ii) Diameter of nozzle
iii) Flow rate
iv) No. of buckets

P.T.O.

Q2) a) What is a draft tube? Why it is used in reaction turbine? Describe with neat sketch the different types of draft tube. [8]

b) An inward flow reaction turbine has overall efficiency 75% and power output of 132 kW. The head is 60 m. The speed ratio and flow ratio are 0.95 and 0.35 respectively. The speed is 220 rpm and hydraulic efficiency is 0.85 find.

i) Angle of guide vanes

ii) Vane angle at inlet

iii) Runner diameter

iv) Width of runner at inlet

Assume velocity of flow to be constant and discharge to be radial.

OR

c) The outer diameter of impulse turbine is 4m and hub diameter is 2m. It works under net head of 100 m and develops 1000 kW. Guide vane angle at exit is edge of runner is 15°. The hydraulic and overall efficiency are 90% and 85% respectively. If water leaves turbine without whirl. Find vane angle at inlet and ratio of runner tips and speed of turbine. [8]

Q3) a) How the model testing of centrifugal pump is made? [8]

b) Write short notes (any two) [10]

i) Cavitation and their effects

ii) MOSH

iii) Multistaging of pump

OR

c) 1) A centrifugal pump delivers 30 lit of water per sec to height of 18 m through a pipe 90m long and 100mm diameter. If overall efficiency of pump is 75%. Find power required to drive the pump. Assume f= 0.012. [5]

2) It is required to predict the performance of a large centrifugal pump from that of a scale model 1/5th the diameter. The model absorbs 15 kW when pumping water under a net head of 6m at its best speed of 400rpm. The prototype pump is required to pump against head of 25m. What will be its working speed, power required to drive it and what will be the ratio of quantities discharged by the large pump to model. [5]

Q4) a) Derive the expression for work done per cycle by two stage reciprocating compressor with perfect intercooling and discuss work done in compression without intercooling. [8]

b) Write short notes on any two.

i) Industrial application of compressed air

ii) Derive expression for volumetric efficiency of the Reciprocating compressor.

iii) Construction and working of root blower. [10]

OR

b) Solve following two problems.

i) A three stage compressor compresses air from 1 bar to 35 bar and delivers it at the highest pressure into a receiver. The initial temperature is 17°C. The law of compression is $PV^{1.3}$=Constant, and is the same for each stage. Assuming condition of minimum work, perfect intercooling and that the effect of cylinder clearance and valve resistances etc. May be neglected, find the power required to deliver 14 m^3/ min air, measured at the suction conditions. [8]

ii) A reciprocating air compressor draws in 6 Kg of air per minute at 25° C. It compresses the air isothermally and delivers it at 105 °C. Find the power required for compressor, if shaft power is 14 KW. Find the Mechanical efficiency. Assume R = 287 J/kg.k. [Ans: 13.3, 5]

Q5) a) Describe briefly with a neat sketch the axial flow compressor. Also define degree of reaction for axial flow compressor and draw the velocity diagram for 50 % degree of reaction. [8]

b) A rotary air compressor working between 2 and 4 bar has internal and external diameters of impeller as 250 mm and 500 mm respectively. The vane angle at inlet and outlet are 30° and 45° respectively. If the air enters the impeller at 20 m/sec. Find

i) Speed of the impeller in RPM.

ii) Work done by the compressor per Kg of air. [8]

OR

SJ-323

Total No. of Pages : 3

Seat No. 92862

S.E. (Mechanical) (Part - II) (Semester - IV) (Revised) Examination, November - 2016

THEORY OF MACHINES - I

Sub. Code : 63363

Day and Date : Thursday, 10-11-2016 Total Marks : 100

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

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

Q1) a) Derive the condition for correct steering and explain any one steering gear mechanism satisfying this condition. [9]

OR

b) A Hooke's joint is used to connect two shafts. The driving shaft rotates at a uniform speed of 1000 r.p.m. Determine the greatest permissible angle between the axis of shafts so that the total fluctuation of speed may not exceed 120 r.p.m. Also find the maximum and minimum speeds of driven shaft. [9]

c) The length of crank and connecting rod of an I.C. engine mechanism is 50 mm and 200 mm respectively. The crank rotates at 200 r.p.m. as shown in fig. 1.b. For the given configuration, locate all the instantaneous centres and find: [9]

i) velocity of slider at B and

ii) angular velocity of AB

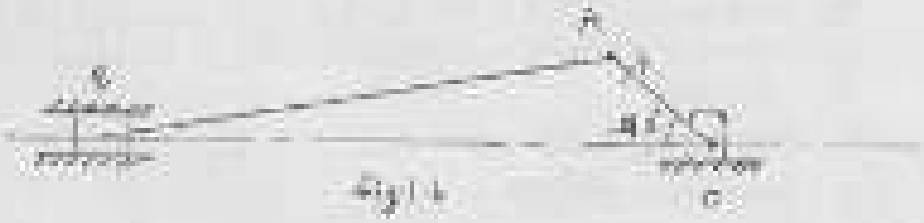


Fig. 1.b

P.T.O.

Q5) In a whitworth quick return mechanism as shown in fig.2. OA is a crank rotating at 30 r.p.m. in clockwise direction. The dimensions of various links are OA = 250 mm, OC = 300 mm, CD = 625 mm and DR = 500 mm. Determine: [10]

a) velocity of slider R,

b) acceleration of slider R and

c) angular acceleration of slotted lever BCD.

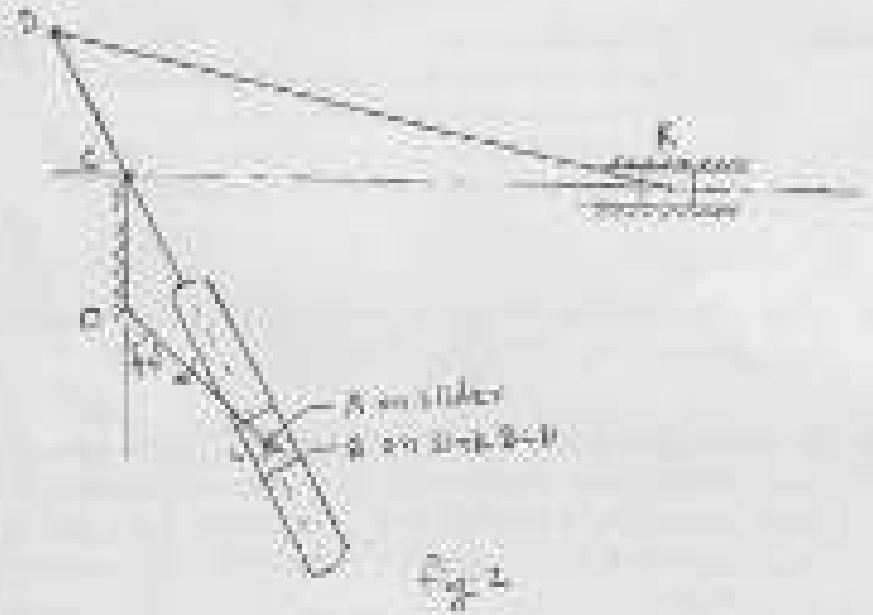


Fig. 2

Q6) a) Derive the equation for friction torque in case of conical pivot bearing assuming uniform wear with usual notations. [8]

OR

a) Derive the equation for torque required to lift the load by screw jack. [8]

b) The thrust on propeller shaft of a marine engine is taken up by 6 collars whose external and internal diameters 600 mm and 420 mm respectively. The thrust pressure is 0.4 MN/m^2 and may be assumed uniform. The coefficient of friction between shaft and collars is 0.04. If the shaft rotates at 90 r.p.m. find:

i) total thrust on collars and

ii) power lost in friction at the bearing.

Q4) a) Explain classification of follower with neat sketches [8]

b) For a oscillating follower and cam system, pivot center is 36 mm above cam center and follower arm length is 70 mm. Roller of follower has radius of 7 mm and its center is above cam center. Minimum radius of cam is 20 mm. Motion of follower is as follows [12]

Rise through 20° in 90° of cam rotation with SHM, Dwell for 90° of cam rotation, Fall in 90° of cam rotation with SHM. Draw the cam profile.

Q5) a) Explain Prony Brake Dynamometer with neat sketch. [6]

OR

a) Derive the equation of ratio of tight to slack side. [8]

b) A leather belt is required to transmit 9 kW from a pulley 120 mm in diameter running at 200 r.p.m. The angle of lap is 165° and coefficient of friction between leather belt and pulley is 0.3. If the safe working stress in belt is 1.40 N/mm², mass of belt is 0.001 Kg/cm³ and the thickness of belt is 3 mm, determine the width of the belt taking the centrifugal tension in account. [10]

Q6) a) Explain Watt's Centrifugal governor. How it differ from flywheel? [6]

OR

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

b) In a spring loaded Hartnell governor the lengths of horizontal and vertical arms of bell crank lever are 40 mm and 80 mm respectively. The mass of each ball is 1.2 kg. The extreme radii of rotation of balls are 30 mm and 105 mm. The distance of the fulcrum of each bell crank lever is 35 mm from the axis of rotation of the governor. The minimum equilibrium speed is 430 rpm and maximum equilibrium speed is 4% higher than this. Determine spring stiffness and initial compression. [10]

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Seat No.

SJ-324
Total No. of Pages : 2

S.E.(Mechanical) (Revised) (Part-II) (Semester - IV) Examination, November - 2016
MACHINE TOOLS AND PROCESSES
Sub. Code :63364

Day and Date : Friday, 11 - 11 - 2016
Time : 2.30 p.m. to 5.30 p.m.

Total Marks :100

Instructions :
1) All Questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data if necessary.
4) Use of Non-prog. summik/scientific calculator is allowed.

Q1) a) What are the steps involved in sand casting process? State its advantages and limitations. [8]

b) Describe with neat sketch elements of gating system. [8]

OR

c) Explain Centrifugal casting process and state its applications. [8]

Q2) a) Give classification of rolling mill and explain any one type of rolling mill with neat sketch. [8]

b) Compare direct extrusion and indirect extrusion process? [8]

OR

c) With neat sketch explain closed die forging process? [8]

Q3) Write a short note on (any three) [18]
a) Properties of core sand.
b) Defects in forging.
c) Brine molding.
d) Gravity die casting process.

P.T.O.

Q4) a) Calculate the gear train for cutting the 6 TPI pitch on work piece if the lead screw of lathe is 4 TPI. [3]

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.

b) A lathe is provided with a change gear set from 20 to 120 with in steps of 5 teeth and an additional gear of 127 teeth. Find the gear train for cutting metric thread of # 25 mm pitch on a lathe having lead screw pitch as 6 TPI [5]

c) How is the lathe specified? Explain in detail attachment of profile turning on lathe? [8]

OR

c) Describe with neat sketch construction and working of vertical boring machine. [8]

Q5) a) Draw block diagram of Center lathe and explain any indexing mechanism in detail. [8]

b) Describe with sketch working of Universal milling machine. [8]

OR

b) Give the details of the various accessories and its specific purpose used on drilling machine. [8]

Q6) Write a short note on (any three) [18]

a) Gear Rolling.

b) Ultrasonic machining.

c) Various operations performed on planning machine.

d) Jig Boring machine

Seat No.

S.E.(Mechanical) (Pre-Revised) (Part-II) (Semester -IV) (Old) Examination, November - 2016

MACHINE TOOLS

Sub. Code : 43595

Day and Date : Friday, 11 - 11 - 2016 Total Marks : 100
Time : 2.30 p.m. to 5.30 p.m.

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

SECTION - I

Q1) a) Draw block diagram of lathe. Name different parts and state the function of each. [8]

b) What are different methods of taper turning on lathe? Describe in brief any two methods. [8]

Q2) a) Explain turret indexing mechanism with neat sketch. [8]

b) With neat sketch describe crank and slotted link quick return mechanism in shaper. [8]

Q3) a) List various work holding devices used on drilling machine. Describe any three in brief. [8]

b) Classify planning machines and explain double housing planer with neat sketch. [8]

Q4) Write a short note on (any three) [18]

a) Orthogonal and oblique cutting.

b) Table drive and feed mechanism in planer.

c) Horizontal boring machine.

d) Jig boring machine.

P.T.O.

SECTION - II

Q5) a) Explain construction & working of column & Knee type milling machine. [8]

b) Draw neat sketch of vertical milling attachment on horizontal milling machine and describe in brief. [8]

Q6) a) Describe various standard accessories used for milling machine. [8]

b) Describe gear shaving process with neat sketch. [8]

Q7) a) State the specification of grinding wheels and explain the terms used in it. [8]

b) Explain construction of CNC machine with block diagram. [8]

Q8) Write short note on (Any Three) [18]

a) Surface grinder.

b) Gear shaping.

c) CNC tooling.

d) Classification of broaching machines.

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SL-308

Total No. of Pages : 4

Seat No.	

S.E. (Mechanical Engineering) (Semester-IV) Examination, April - 2017

APPLIED NUMERICAL METHODS

Sub. Code : 63360

Day and Date : Tuesday, 25-04-2017 **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) Solve any two [2×5=10]

i) Solve for a positive root of $x-\cos x=0$ by Regula Falsi method.

ii) Using Newton Raphson method find the root between 0 and 1 of $x^3=6x-4$.

iii) Explain approximate error with an example.

b) Perform two iterations of the Newton Raphson method to solve the system of equations

$x^2+xy=10;\ y+3xy^2=57$

Take initial approximations as $x_0=1.8,\ y_0=3.1$. [10]

Q2) Solve any three 3×5=15]

a) The currents i_1, i_2, i_3 and i_4 in an electric network satisfy the system of linear equation

$3i_1+2i_2-i_4=60$

$2i_1-i_2+4i_3=160$

$4i_2+i_3-2i_4=20$

$5i_1-i_2-2i_3+i_4=0$

Using Gauss Jordan method, find i_1, i_2, i_3 and i_4.

P.T.O.

b) Solve the following equations by Gauss-Seidal method.

$83x+11y-4z=95$

$3x+8y+29z=71$

$7x+52y+13z=104$

c) Solve the system of equations using LU Decomposition.

$5x-2y+z=4$

$7x+y-5z=8$

$3x+7y+4z=10$

d) Solve the system of equations using Gauss Elimination method

$x+2y+z=3$

$2x+3y+3z=10$

$3x+y+2z=13$

Q3) Solve any three: [3×5=15]

a) From the table given below, find the best values of 'a' and 'b' for curve $y=ae^{bx}$ by the method of least squares.

x:	1	2	3	4
y:	1.65	2.7	4.5	7.35

b) Using Lagrange's formula of interpolation find y(9.5).

x:	7	8	9	10
y:	3	1	1	9

c) Find f(x) as a polynomial in x and hence f(0) for the following data by Newton's divided difference formula.

x:	−1	1	2	3
f(x):	−21	15	12	3

d) Define Independent, repeated, Bernoulli trials and hence explain binomial distribution with an example.

Q4) Solve any three. [3×5=15]

a) Given the data below, find the isothermal work done on the gas as it is compressed from 23 litres to 3 litres. $W=\int_{v_1}^{v_2} pdv$ using Simpsons 1/3rd Rule.

V (lit):	3	8	13	18	23
P (atm):	12.5	3.5	1.8	1.4	1.2

b) Use Romberg's method to evaluate $\int_0^1 (dx/(x^*x+4))$ take h=1.0,0.5,and 0.25.

c) Evaluate $\int_0^{\pi/2} (\sin x)dx$ by two point Gaussian Quadrature formula.

d) The table given below reveals the velocity 'v' of a body during the time 't'. Find its acceleration at t=1.1.

t	1.0	1.1	1.2	1.3	1.4
v	43.1	47.7	52.1	56.4	60.8

Q5) Solve any three. [3×5=15]

a) Using modified Eulers method find y at x=1.5 if $y'=2y/x$ Given y(1)=2 take h=0.25

b) Find the eigen values and corresponding eigen vectors of

$$\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$ by both power method

c) Given the boundary value problem $\frac{d^2y}{dx^2}=ex^2$; 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.

d) Solve $\frac{dy}{dx}+y=x^2$; given y(0)=1 by picard's method. Obtain the values of(y(0.1), y(0.2).

Q6) a) Classify the following partial differential equations: [5]

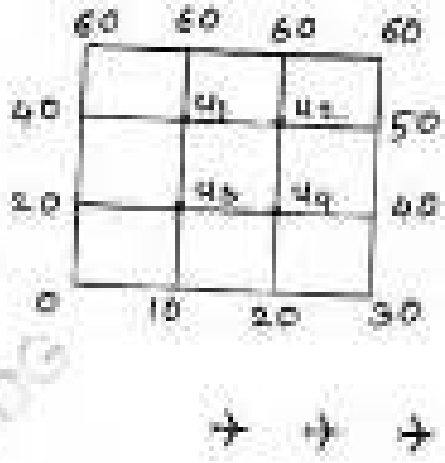
i) $U_{xx}+4U_{xy}+4U_{yy}=0$

ii) $x^2U_{xx}+(1-y^2)U_{yy}=0;x>0,y>0$

iii) $y^2U_{xx}+U_{yy}=0$

b) Explain implicit method with a neat sketch. [5]

c) Solve $U_{xx}+U_{yy}=0$ in the square region as shown in fig.1 by Liebmann's method. Take $\Delta x=\Delta y$. Perform three iterations of Gauss Seidal method. [10]



Seat No.

SL-309
Total No. of Pages : 3

S.E. (Mech.) (Part-II) (Revised) (Semester-IV) Examination, April - 2017
ANALYSIS OF MECHANICAL ELEMENTS
Sub. Code : 63361

Day and Date : Thursday, 27-04-2017
Time : 10.00 a.m. to 1.00 p.m.

Total Marks : 100

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

Q1) a) Two brass rods and one steel rod together support a load as shown in Fig.1. If the stresses in brass and steel are not to exceed 60N/mm^2 and 120N/mm^2, find the safe load that can be supported. Take E for steel=2×10^5N/mm^2 and E for Brass=1×10^5N/mm^2. The cross sectional area of steel rod is 1500mm^2 and of each brass rod is 1000mm^2. [12]

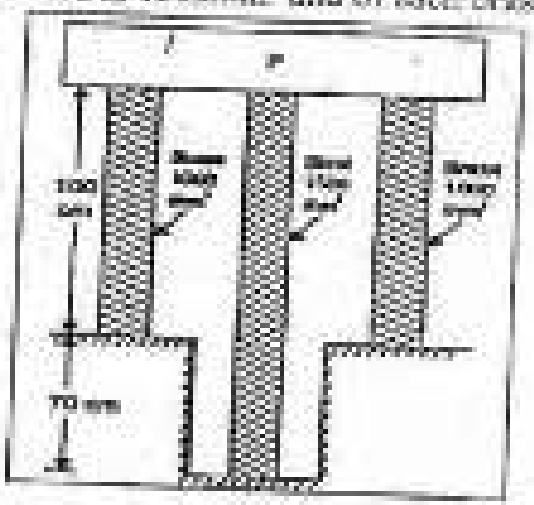


Fig. 1

b) Explain the concept of thermal stresses giving the equations. [6]

OR

b) A hollow shaft having an inside diameter 60% of its outer diameter, is to replace a solid shaft transmitting the same power at the same speed. Calculate the percentage saving in the material, if the material to be used is also the same. [6]

P.T.O.

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

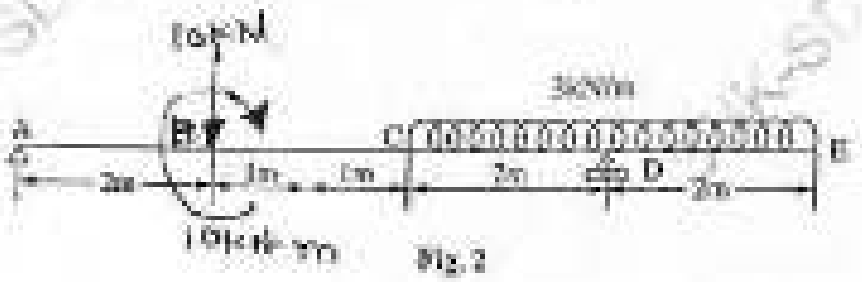


Fig. 2

Q3) A cast iron beam is of T-section as shown in Fig.3. The beam is simply supported on a span of 8m. The beam carries an UDL of 1.5kN/m on the entire span. Determine the maximum tensile and compressive stresses. [16]

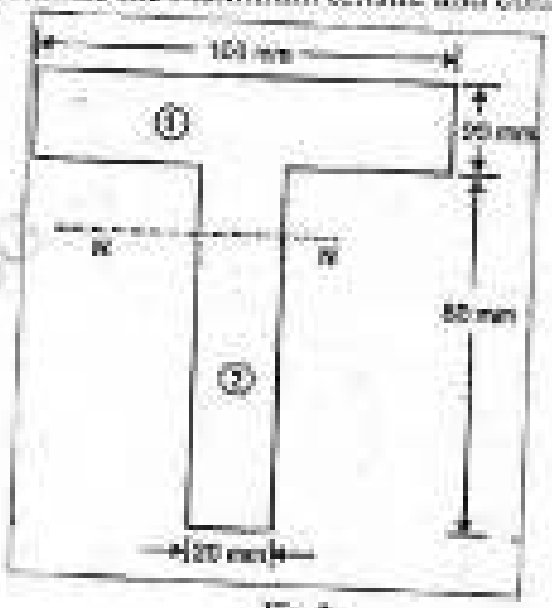


Fig. 3

Q4) a) Derive an expression for normal stress and tangential stress when a member subjected to like direct stresses in two mutually perpendicular directions. [8]

b) At a point in a strained material the principal stresses are 100N/mm² (tensile) and 60N/mm² (compressive). Determine the normal stress, shear stress and the resultant stress on a plane inclined at 40° with the major principal plane. Determine also the obliquity. [10]

OR

b) If the cross-section of beam is symmetrical I section about y axis with following dimensions. Top flange: 300mm×20mm, Web: 15mm×300mm, Bottom flange: 200mm×20mm. Maximum shear force on the section is 202KN. Calculate the shear stresses across the section and represent graphically. Take M.I about N.A I=283.01×10⁶mm⁴. [10]

Q5) a) Derive an expression for slope and deflection of a simply supported beam of length L, carrying UDL throughout the beam. Use double integration method. [8]

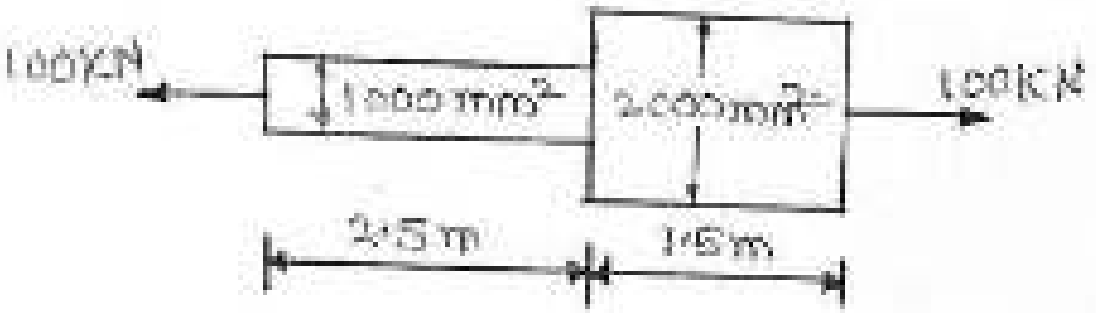
b) A cantilever of length 3m is carrying a point load of 25KN at the free end. If the moment of inertia of the beam=10⁸mm⁴ and value of E=2.1×10⁵N/mm², find slope of the cantilever at the free end and deflection at the free end. [8]

OR

b) List the different theories of elastic failure and explain maximum strain energy theory. [8]

Q6) a) Derive Rankine formula of a buckling load. [6]

b) A tension test bar 4m long is made up of two parts, one 2.5m long has a cross section area of 1000mm² and another 1.5m long having cross sectional area of 2000mm². If an axial load of 100KN is gradually applied. Find the total strain energy produced in the bar and compare it with the strain energy for a uniform bar of same length and same volume under same load. Assume E=200GPa. [10]



SL-310

Total No. of Pages :4

Seat No.

S.E. (Mech.) (Part - II) (Semester - IV)
Examination, April - 2017
FLUID AND TURBO MACHINERY
Sub. Code : 63362

Day and Date : Saturday,29-04-2017 Total Marks :100

Time : 10.00 a.m. to 1.30 p.m.

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

Q1) a) What is turbo machine? How water turbine are classified. [8]

b) A Pelton wheel works under a gross head of 500m one third of which is lost in friction in penstock. The rate of flow is 2 m³/s. The jet is deflected through an angle of 165°. Determine the power developed and the hydraulic efficiency of the turbine. Take speed ratio as 0.45 and C_v as 0.98. [8]

OR

c) A three jet Pelton turbine is required to generate 10000 kW of power under net head of 400 m. The blade angle at outlet is 15° and reduction in relative velocity while passing over blade is 5%. If overall efficiency is 80%, C_v = 0.98 and speed ratio = 0.46 find [8]

i) Diameter of jet.

ii) Total flow in m³/sec

iii) Force exerted by jet on buckets.

P.T.O.

Q2) a) Give the important relations of Francis turbine. [8]

b) A reaction turbine is supplied with 100 m³/sec of water under head of 150m. The runner diameter is 3.6m at inlet and 2.4 m at outlet. It's inlet vane angle is 120° and discharge is radial at 15m/s. Assuming breadth of wheel to remain constant and hydraulic efficiency 90%. Find power developed and speed of the turbine. [8]

OR

c) A conical draft tube has internal diameter and outer diameter of 1500 mm and 2250 mm respectively. The velocity of flow at outlet of draft tube is 2m/sec. The length of draft tube is 6m out of which 1m is submerged in the tail water. The atmospheric pressure at tail race level is 10m of water. Loss of head due to friction and other causes is 0.25 times the velocity head at outlet of draft tube. Find pressure head at inlet of tube and efficiency of draft tube. [8]

Q3) a) What is pump? Define the terms, delivery head, static head and manometric head. [8]

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

i) Working of single stage centrifugal pump.

ii) Efficiencies of centrifugal pumps.

iii) Performance curves for pumps.

OR

c) i) A single stage centrifugal pump with impeller diameter of 30 cm rotates at 2000 rpm and lifts 3m³/sec of water to a height of 30 m with an efficiency of 75%. Find the number of stages and diameter of each impeller of a similar multistage pump to lift 5m³/sec of water to a height of 200 meters when rotating at 1500 rpm. [5]

ii) The internal and external diameter of the impeller of centrifugal pump are 200mm and 400mm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. [5]

Q4) a) Prove that minimum work input in two stage reciprocating compressor is required when the optimum intermediate pressure is [8]

$$P_2 = \sqrt{P_1 P_3}$$

Where,

P_1 is inlet pressure in low pressure cylinder

P_2 is intermediate pressure

P_3 is outlet pressure in high pressure cylinder.

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

i) Construction of Root blower and Vane blower.

ii) Difference between reciprocating compressor and rotary compressor.

iii) Different efficiencies of reciprocating compressor.

OR

5) i) Find the percentage saving in work by compairing air in two stages from 1 bar to 7 bar instead of 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 compressor takes in 7.5 m³/min of air at 1 bar 80°C and delivers it at 5 bar. The clearance is 5% of the stroke. The expansion and compression index is 1.3. Calculate volumetric efficiency of compressor. [5]

Q5) a) Explain the losses and isentropic efficiency in centrifugal compressors [8]

b) A centrifugal compressor delivers 16.5 kg/s of air with a total head pressure ratio 4:1. The speed of the compressor is 15000 rpm. Inlet total head temperature is 20°C, slip factor 0.9, Power input factor 1.04 and isentropic efficiency 80%. Calculate [8]

i) Overall diameter of the impeller.

ii) Power input (Assume C_p = 1.005 kJ/kgK)

OR

b) Determine

i) Velocity of flow

ii) Number of stages for an axial flow compressor.

When compressor has compression ratio as 8, draws air at 293 K delivers it at 523 K and rotates with blade velocity 180 m/sec. The mean blade speed and velocity are the constant throughout the compressor.

Take Work factor is 0.87, $\alpha_1 = 15°$, $\beta_1 = 40°$, $C_p = 1.005$ kJ/kgK. Assume degree of reaction is 50%. [8]

Q6) a) Explain working of closed cycle Gas Turbine along with P-V diagram. Also explain why the actual Brayton cycle differs from ideal cycle. [8]

b) The gas turbine unit operating on air standard cycle in which the air enters the compressor at 1.0 bar and 20°C. The pressure of air leaving the compressor is 3.5 bar and the temperature at turbine inlet is 600°C. Determine perkg of air: [8]

i) Efficiency of the cycle,

ii) Heat supplied to air,

iii) Work available at the shaft,

iv) Heat rejected in the cooler, and

v) Temperature of air leaving the turbine. For air $\gamma = 1.4$ and $C_p = 1.005$ kJ/kg K.

OR

b) In Gas turbine, the isentropic efficiency of the compressor and turbine are 0.90. A turbine unit has a pressure ratio 5:1 and maximum cycle temperature of 580°C. Calculate the workdone by turbine, compressor work input and total work when the air enters the compressor at 15°C at the rate of 15 kg/s.

Take $C_p = 1.005$ kJ/kgK and $\gamma = 1.4$ for the compression and $C_p = 1.11$ kJ/ kgK and $\gamma = 1.35$ for the expansion. [8]

Seat No.	

S.E. (Mechanical) (Part-II) (Semester-IV) (Revised) Examination, May - 2017
THEORY OF MACHINES-I
Sub. Code : 63363

Day and Date : Wednesday, 3-05-2017 Total Marks : 100
Time : 9.00 a.m. to 1.00 p.m.

Instructions:
1) All questions are compulsory.
2) Figures to the right indicate full marks to the question.
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) Explain the inversions of single-slider crank chain with neat sketches.[8]

OR

a) Explain different types of kinematic pairs with the help of neat sketches. [8]

b) A four-bar mechanism is shown in fig.1.b. Crank OA rotates at 250 r.p.m. Lengths of various links are: OA=250mm, AB=400 mm, BC=350 mm and OC=700 mm. Locate all the instantaneous centres and find the angular velocities of links AB and BC. [8]

Fig. 1-b

P.T.O.

Q2) Crank OA of the mechanism shown in fig.2 rotates uniformly at 150 r.p.m. The dimensions of the various links are: OA=150 mm, AB=375 mm, AC=400 mm, BC=65 mm, BQ=200 mm, CP=400 mm. For the given configuration, find: (i) velocity of piston P, (ii) acceleration of piston P and (iii)angular acceleration of link ABC. [18]

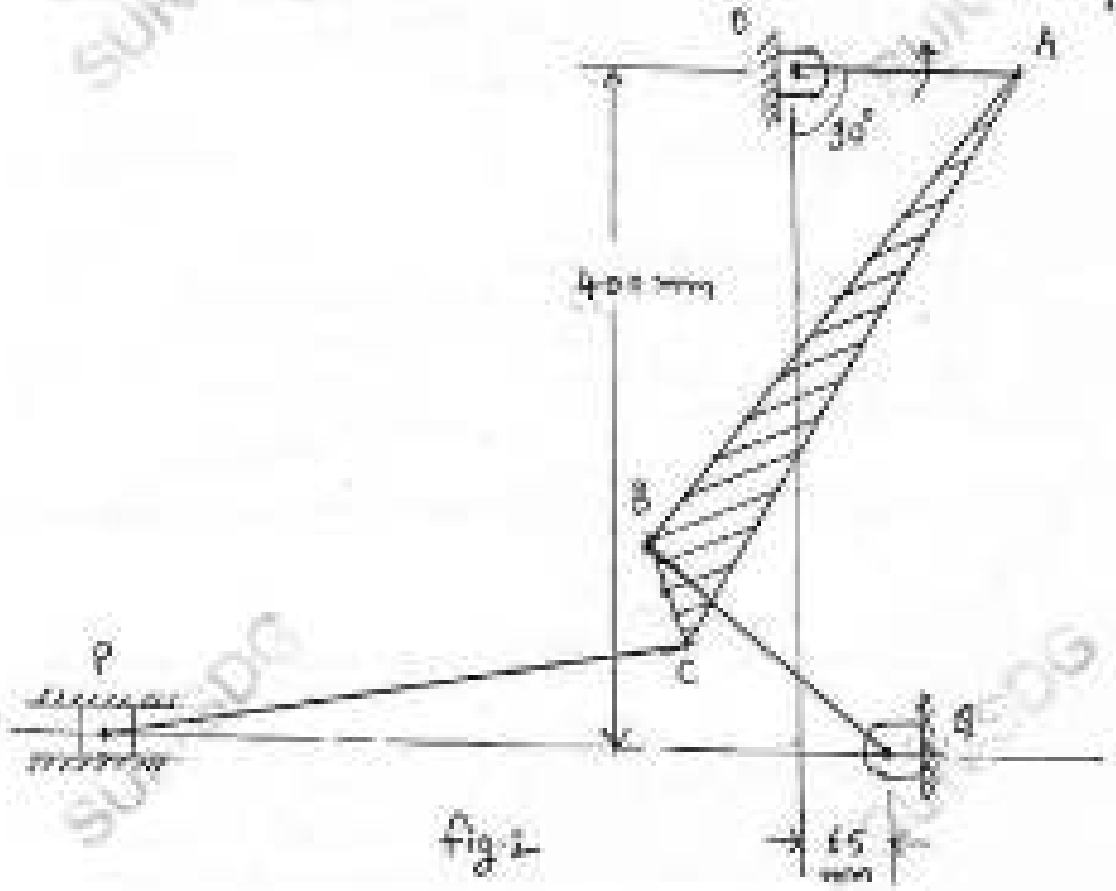


fig:2

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

OR

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

b) A truncated conical pivot supports a load of 20 kN and has angle of cone equal to 120°. The external radius is twice the internal radius. The shaft is running at 100 r.p.m. The intensity of pressure is equal to 0.3 MN/m². The coefficient of friction is 0.04. Determine the power lost in friction assuming uniform wear. [8]

Q4) a) Draw Displacement, Velocity and Acceleration diagram for follower moving with cycloidal motion. Also write equations of Maximum velocity and acceleration of follower. [6]

b) A cam rotating at uniform speed of 1000 rpm is required to give following motion,

- Follower to move outwards through 50 mm during 120°
- Follower to dwell for next 60° of cam rotation.
- Follower return to its starting position during next 90° of cam rotation
- Follower to dwell for rest of cam rotation.

The minimum radius of cam is 50 mm and the diameter of roller is 12 mm. The line of stroke of the follower is off-set by 20 mm from the axis of cam shaft. If the displacement of the follower takes place with uniform acceleration and retardation for both the outward and return stroke, draw the profile of the cam. [12]

Q5) a) Explain what is Dynamometer. What are different types of dynamometer? Explain any one in detail. [6]

OR

a) Explain initial tension and Centrifugal tension in belt. [6]

b) A shaft running at 90 r.p.m. is to drive another shaft at 225 r.p.m. and transmit 10.3 kW. The belt is 115 mm wide and 12 mm thick and coefficient of friction between belt and pulley is 0.25. The distance between the shafts is 2.75 m and the smaller pulley is 600 mm in diameter. Calculate the stress in an open belt connecting the two pulleys. [10]

Q6) a) Explain controlling force curve for Governor. [6]

OR

a) What is sensitiveness? Discuss the effect of friction at sleeve on the performance of a Governor. [6]

b) The mass of each ball of a Hartnell governor is 1.4 kg. The length of weight arm and sleeve arm are 160 mm and 50 mm respectively. The distance of fulcrum of bell crank lever from the axis of rotation is 80 mm. The extreme radii of rotation of balls are 75 mm and 112.5 mm. The maximum equilibrium speed is 6% greater than minimum equilibrium speed which is 300 rpm. Determine stiffness of spring. If radius of rotation of balls is 90mm what will be the equilibrium speed? [10]

Seat No.	

S.E. (Mechanical) (Part-II) (Semester-IV) (Revised) Examination, May - 2017
MACHINE TOOLS AND PROCESSES
Sub. Code : 63364

Day and Date : Friday, 05-05-2017
Time : 10.00 a.m. to 1.00 p.m.

Total Marks : 100

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) a) State and explain the properties of molding sand. [8]

b) Explain with neat sketch a suitable furnace used for melting of non-ferrous metals. [8]

OR

b) Explain investment casting process and state its applications. [8]

Q2) a) List the various metal forming processes and state the advantages of hot working over cold working of metals. [8]

b) Compare open die forging process and closed die forging process. [8]

OR

b) Indicate by means of a line diagram and explain different stages in manufacture of steel sheet, starting from steel ingots. [8]

Q3) Write a short note on (Any Three) [18]

a) Core making processes

b) Defects in Extrusion

c) Injection molding

d) Induction furnace

P.T.O.

Q4) a) Calculate the gear train for cutting the 5 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. [3]

b) A lathe is provided with a change gear set from 20 to 120 teeth in steps of 5 teeth and an additional gear of 127 teeth. Find the gear train for cutting metric thread of 3 mm pitch on a lathe having lead screw pitch as 6 TPI. [5]

c) Explain various accessories used on lathe. [8]

OR

c) Describe with neat sketch construction & working of horizontal boring machine. [8]

Q5) a) Explain bar feeding mechanism on a capston lathe. [8]

b) Describe with neat sketch vertical milling attachment for horizontal milling. [8]

OR

b) With neat sketch explain construction and working of radial drilling machine. [8]

Q6) Write a short note on (Any Three). [18]

a) Gear Shaving

b) Laser Beam machining

c) Various operations performed on shaping machine

d) Turret indexing mechanism

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Total No. of Pages : 2

Seat No.	

S.E. (Mechanical) (Pre-revised) (Part-II) (Semester-IV) (Old) Examination, May-2017

MACHINE TOOLS

Sub. Code : 43595

Day and Date : Monday, 22-05-2017 Total Marks : 100

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

Instructions : 1) Answer any three questions from each section.
2) Figures to the right indicate full marks.
3) Assume suitable data if necessary.
4) Use of Non-programmable Scientific Calculator is allowed.

SECTION-I

Q1) a) What are principal parts of lathe? State the function of each. [8]

b) Describe with neat sketch any two methods of taper turning on lathe? [8]

Q2) a) State and explain various operations performed on drilling machine? [8]

b) Explain construction and working of shaping machine? [8]

Q3) a) With the help of neat sketch explain Crank and slotted link quick return mechanism in shaper. [8]

b) List the classification of planer? Explain any one with block diagram. [8]

Q4) Write a short note on (any three) [18]

a) Various attachments used on lathe.

b) Bar feeding mechanism.

c) Jig boring machine.

d) Classification of machine tools.

P.T.O.

SECTION-II

Q5) a) Describe the main features of the following milling machines. [8]

i) Plain milling machine

ii) Vertical Milling Machine

iii) Universal milling machine

b) What are the various job holding devices used on milling machine. [8]

Q6) a) Explain BIS marking system of grinding wheels. [8]

b) How are the grinding machine classified? Describe any one in detail. [8]

Q7) a) List Gear manufacturing processes. Explain gear hobbing process. [8]

b) Draw a neat sketch of an internal broaching tool and describe its various elements. [8]

Q8) Write a short note on (any three) [18]

a) Tool and cutter grinder.

b) Accessories used on milling machine.

c) Gear burnishing.

d) Types of CNC machines.

♦ ♦ ♦

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Total No. of Pages : 4

Seat No.	

B.Sc., B.Sc. (Biotech), B.Sc. (Sugar Tech.), B.Sc. (I.T.), B.Sc. (Animation Science), B.Sc. (Forensic Science), B.Sc. (Food Processing), B.C.A., B.B.A., Law, B. Tech., B.Sc. (Nano Science), B.I.D., B.F.T.M.,B. Desh., B.D.F.C., B.C.S., B.Form, S.E.,B. Architecture, B. Textiles, B.M.M.,B.Voc. (All Degree) (Semester - IV) Examination, May - 2018

ENVIRONMENTAL STUDIES (New) (Compulsory)

Day and Date : Sunday, 20 - 05 - 2018 Sub. Code: 67185 Total Marks : 70

Time : 11.00 a.m. to 02.00 p.m.

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

Q1) Select correct answer from the given alternatives. [10]

i) Ozone in the stratosphere is present in the layer _____
a) Stratosphere b) Troposphere
c) Thermosphere d) Ionosphere

ii) Maharashtra has large mineral deposits of _____
a) Mica b) Iron
c) Bauxite d) Gold

iii) Following is a man-made disaster.
a) Rain b) Cyclone
c) Nuclear hazard d) Drought

iv) Environmental day is celebrated on _____
a) 15 August b) 5 June
c) 22 April d) 16 September

v) Air pollution (prevention and control) Act in India was enacted in the year.
a) 1972 b) 1986
c) 1989 d) 1981

vi) Following is Ex-situ biodiversity conservation method.
a) National Park b) Seed bank
c) Biosphere reserve d) None of the above

vii) Following is non-renewable resource.
a) Wind b) Water
c) Sunlight d) Petroleum

P.T.O.

viii) Following gas is responsible for acid rain.
a) CFC b) CO
c) SO_2 d) H_2S

ix) Noise pollution is measured by
a) Hertz b) Dynes
c) Joules d) Decibel

x) The disposing method for biomedical waste is
a) Incineration b) Vermicomposting
c) Landfilling d) Composting

Q7) Answer any three of the following [15]
a) What are various method for controlling the growing population in our country?
b) Define food chain. Explain the types of foodchain with suitable examples.
c) Give an account of consumerism in relation to environment.
d) Give disaster management of earthquake.
e) Discuss the causes of deforestation.

Q8) Write short notes on any three. [15]
a) Mining
b) Water pollution
c) Insitu conservation
d) Global Warming
e) Human right
f) Environmental Ethics

Q9) Discuss the concept and importances of environmental studies related to public awareness. [10]

OR

What are natural resources? Give the type of natural resources. Discuss forest as a resource.

Q10) Give formation and environmental impact of acid rain and Ozone depletion [10]

OR

Give salient features of wildlife protection Act of India.

Q11) What are the steps taken for water conservation. Discuss rain water harvesting techniques. [10]

OR

Explain the concept of ecosystem & discuss energy flow in it?

मराठी रूपांतर

सूचना : 1) सर्व प्रश्न सोडविणे आवश्यक आहे.
2) उजवीकडील अंक प्रश्नांचे पूर्ण गुण दर्शवितात.

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

i) ओझोनचा थर वातावरणाच्या कोणत्या थरात आढळतो.
 अ) स्ट्रॅटोस्फियर ब) ट्रोपोस्फियर
 क) थर्मोस्फियर ड) आयनोस्फियर

ii) [illegible]
 अ) [illegible] ब) [illegible]
 क) [illegible] ड) [illegible]

iii) खालीलपैकी कोणता घटक [illegible] आहे.
 अ) [illegible] ब) [illegible]
 क) [illegible] ड) [illegible]

iv) पर्यावरण दिन कोणत्या दिवशी साजरा केला जातो.
 अ) 15 ऑगस्ट ब) 5 जून
 क) 22 एप्रिल ड) 16 सप्टेंबर

v) भारतात हवा प्रदूषण (नियंत्रण व प्रतिबंध) कायदा कोणत्या साली पास झाला.
 अ) 1972 ब) 1986
 क) 1989 ड) 1981

vi) खालीलपैकी कोणती जैवविविधतेची [illegible] पद्धत नाही.
 अ) राष्ट्रीय उद्याने ब) बीज बँक
 क) जैवविविधता आरक्षित क्षेत्र ड) [illegible]

vii) खालीलपैकी कोणते संसाधन अपुनर्निर्मितीक्षम आहे.
 अ) [illegible] ब) [illegible]
 क) सूर्यप्रकाश ड) पेट्रोलियम

viii) आम्लवर्षासाठी कोणता वायू जबाबदार असतो.
 अ) CFC ब) CO
 क) SO_2 ड) H_2S

ix) [illegible]?
 अ) [illegible] ब) [illegible]
 क) [illegible] ड) [illegible]

5) [illegible] ?

अ) [illegible] ब) [illegible]

क) [illegible] ड) [illegible]

प्र.2) [illegible] तीन प्रश्नांची उत्तरे लिहा. [15]

अ) [illegible] ?

ब) [illegible].

क) [illegible].

ड) [illegible].

इ) [illegible].

प्र.3) [illegible] तीन टिपा लिहा. [15]

अ) [illegible]

ब) [illegible]

क) [illegible]

ड) [illegible]

इ) [illegible]

फ) [illegible]

प्र.4) [illegible]. [10]

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[illegible].

प्र.5) [illegible]. [10]

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[illegible].

प्र.6) [illegible]. [10]

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[illegible].

▽▽▽▽

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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 $f(x)=e^x-4x-8.95=0$.

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 $x^3-3x-2=0$, which lies between 2 and 3.

Q2) Solve any two : [2×8=16]

a) Solve the following equations by Gauss-Jordan method

$2x+4y-5z=18$

$2x-y+8z=13$

$5x-y+7z=20$

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 $\int_4^{5.2} \log x\,dx$ 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 Runge Kutta 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) $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$

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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Total No. of Pages : 4

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

ANALYSIS OF MECHANICAL ELEMENTS

Sub. Code: 63361

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

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

Instructions : 1) All questions are compulsory.

2) Assume suitable data wherever necessary and state it clearly.

3) Figures to the right indicate full marks.

4) Draw neat and labeled sketches wherever necessary.

5) Use of non programmable calculator is allowed.

Q1) a) Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 30 cm apart as shown in Fig. 1. Diameters and lengths of each rod are 2 cm and 6 m respectively. A cross 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 $= 2 \times 10^5$ N/mm^2 and E for copper 1×10^5 N/mm^2. [12]

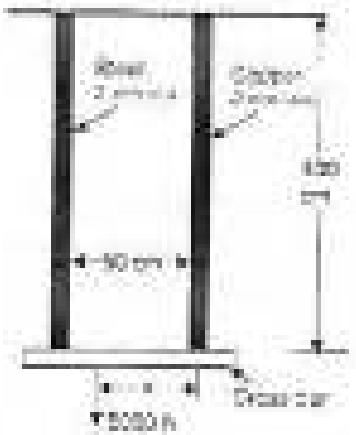

Fig. 1

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 perpendicular 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]

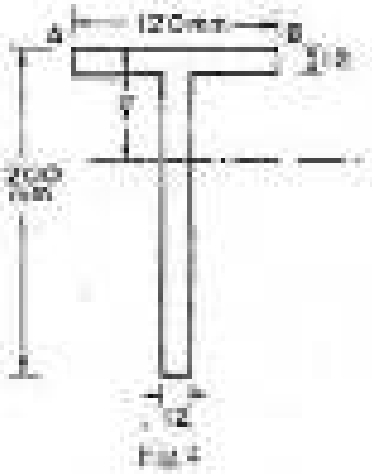

Fig. 4

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 mm^2. [8]

OR

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

Q6) 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 cm^2 while the remaining 2 m has an cross sectional area of 20 cm^2. 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 = 2×10^5 N/mm^2. [8]

Fig. 5

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Total No. of Pages : 4

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

APPLIED NUMERICAL METHODS

Sub. Code: 63360

Day and Date : Tuesday, 14 - 05 - 2019

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

Total Marks : 100

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 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 $X_0 = 0; X_1 = 1; X_2 = 2$.

Q2) Solve any two

i) 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.

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

Q3) 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 $v = xT^n$.

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: [8]

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

Q4) 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 $\int_1^2 (2x^2-1)dx$ using two associated points of Gaussian Quadrature.

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

Q5) 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

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

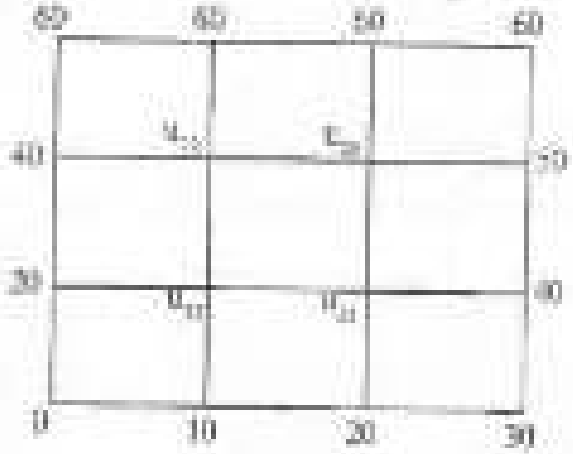
(Q6) a) Classify the following partial differential equations [6]

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

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

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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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 : 108

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 calculator 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]

Determine:

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 m³/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, precautions.

iii) Explain performance curves of pump.

OR

c) Solve following problems. [10]

i) A centrifugal pump is used to discharge 0.118 m³/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 need capacity of each pump is 0.16 m³/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.

iii) 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 $PV^{1.3}$ = 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 m³/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 6h0 m³/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

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]

b) A gas turbine unit has a pressure ratio of 5:1 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 : 3

Seat No.	

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]

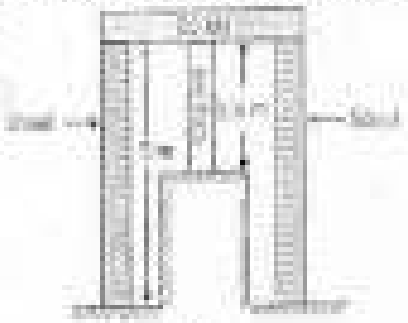

Fig.1

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 if the maximum stress is not to exceed 60N/mm^2. [6]

P.T.O.

Q2) Draw SFD and BMD for loading condition shown in Fig.3. Locate point of contraflecture if any. [16]

Fig. 3

Q3) 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]

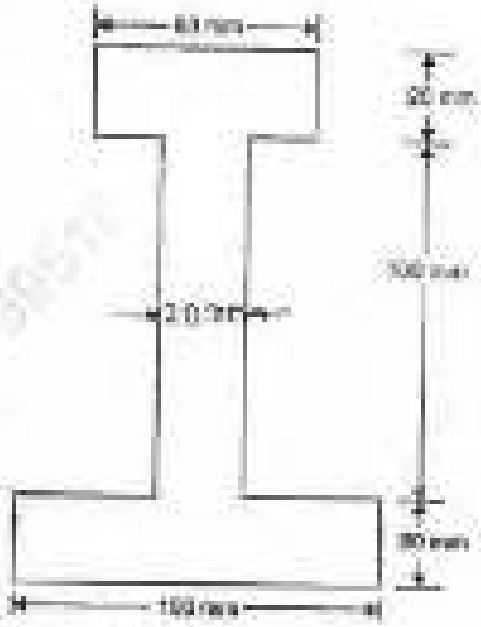

Fig 4

Q4) 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 80 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 inclinations with normal components of the plane.

Q5) 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 1×10^8 mm4 and the modulus of elasticity is 21×10^4 N/mm^2, Determine by moment area 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]

Q6) 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/mm^2. [8]

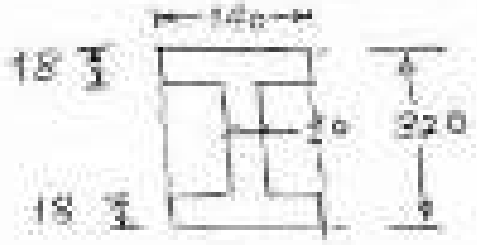

Fig 4a

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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 18° 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.

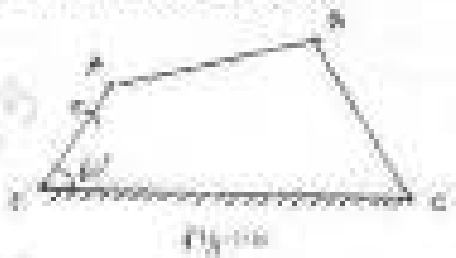

Fig. 1.b

P.T.O.

Q2) The dimensions of the various links of a mechanism shown in fig. 2 are: OA = 30 mm, AB = 90 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.

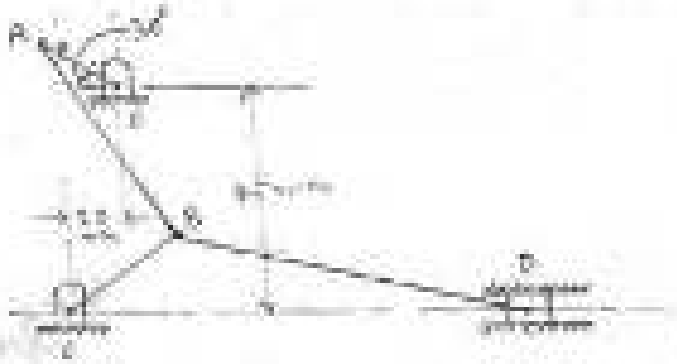

Fig. 2

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 150°; 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 1250 mm and 550 mm diameters, on parallel shafts 4 m apart. The maximum tension in the belt is 1455.3 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. Neglect the sleeve mass. [10]

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Total No. of Pages : 4

Seat No.	

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

Day and Date : Monday, 20 - 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 calculator is allowed.

Q1) a) Show that the maximum hydraulic efficiency of pelton wheel is given by $\eta_h = \frac{1+\cos\phi}{2}$ where 'ϕ' is bucket outlet angle. [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 9Q^2 where 'Q' is the discharge in m^3/s. Assuming the gross head and efficiency of the wheel to be constant and c_v for the nozzle 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]

P.T.O.

Q3) a) Explain the construction of francis & kaplan turbines 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, η_h = 94%, η_o = 85%, flow ratio ϕ = 0.15, breadth ratio n = 0.1, inner diameter of runner is 0.6 time 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 ϕ as 0.5 and the hub diameter as 0.35 times the outer diameter, find the diameter and speed of the turbine. [8]

Q3) 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 pipeline. The overall efficiency of pump is 70% and Darcy's f = 0.06 for the pipeline. Assume inlet losses in suction pipe equal to 0.33m. [10]

Q4) 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 $PV^{1.3}$ = constant

Q9) 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 13kg/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 130 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, γ = 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 γ = 1.4.

Q6) 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 820 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 γ 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 turbine 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 42805kJ/kg.

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SV-82

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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Total No. of Pages : 3

Seat No.	

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 indicate full marks.
3) Assume if necessary, suitable data and state clearly.
4) Use of non programmable 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° from IDC clockwise and is rotating at 240 r.p.m [8]

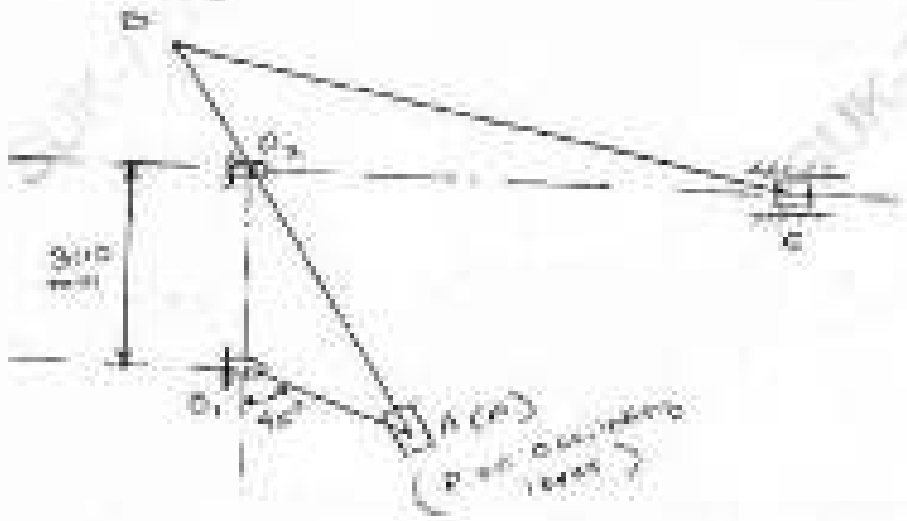
Q2) Draw the velocity and acceleration diagram for the Withworth mechanism shown in following figure. The crank O A rotates at 120 rpm clockwise. Determine; [18]

a) Velocity and acceleration of ram c

P.T.O.

b) Angular acceleration of link BC.

Various link lengths are; O_2O_4 = 300 mm, O_2A = 200 mm, PB = 700 mm, BC = 800 mm.



Q3) 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 120° 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]

Q4) 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]

Q5) 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 5 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]

Q6) 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-angled bell crank levers moves between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15 mm. The sleeve arm and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120mm from the governor 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]

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Total No. of Pages : 2

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 [4]
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]

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Total No. of Pages : 3

S.E. (Mechanical) (Part - II) (Revised) (Semester - IV)

Examination, May - 2015

THEORY OF MACHINES - I

Sub. Code : 63363

Day and Date : Tuesday, 12 - 05 - 2015 Total Marks : 100

Time : 09.00 a.m. to 01.00 p.m.

Instructions : 1) Attempt all questions.
2) Figures to the right indicate full marks to the question.
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) Explain the inversions of single-slider crank chain with neat sketches. [8]

OR

Explain Ackerman steering gear mechanism with the help of neat diagram and derive the condition for correct steering.

b) The crank and connecting rod of a reciprocating engine are 100mm and 400mm respectively. The crank is rotating at 200 r.p.m. as shown in fig. 1.c. Find, with the help of Klein's construction, the velocity and acceleration of the piston. [8]

Fig 1.c

P.T.O.

Q2) The driving Crank AB of the quick return mechanism as shown in fig. 2 revolves at uniform speed of 200 r.p.m. Find the velocity and acceleration of the tool-box R in the position shown when the crank makes an angle of 60° with the vertical line PA. The dimensions of the links are: AB = 75 mm, PQ = 175 mm, QR = 500 mm, PA = 200 mm. **[18]**

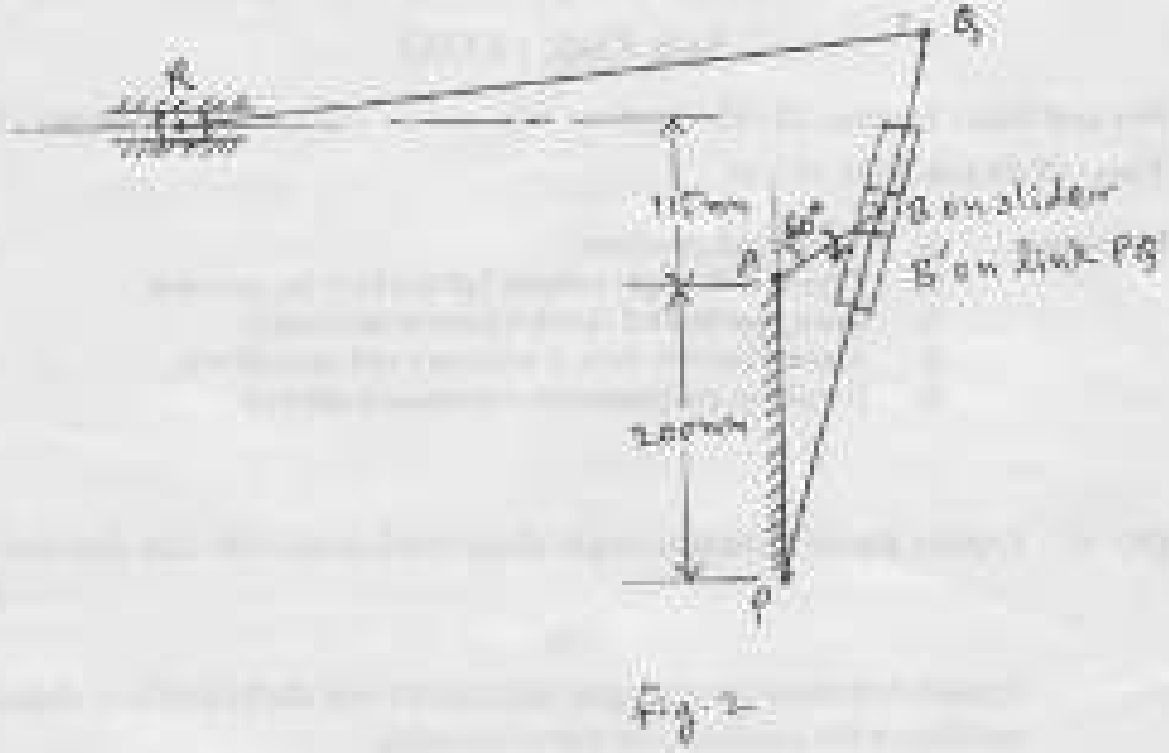

Fig. 2

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

OR

Derive the equation for torque required to lift the load by screw jack.

b) A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30kN. The angle of 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. by assuming :

i) uniform pressure and

ii) uniform wear.

[8]

Q4) a) Draw sketch of displacement diagram, velocity diagram and acceleration diagram for uniform acceleration and retardation motion of follower. [4]

b) Draw the profile of a cam with oscillating roller follower to the following specification. [14]

i) Follower to move outwards through an angular displacement of 20° during 120° of cam rotation with SHM.

ii) Follower to return to its initial position during 120° of cam rotation with SHM.

iii) Follower to dwell for remaining 120° of cam rotation.

The pivot of the oscillating follower is 120 mm from axis of rotation cam. The distance between the pivot center and the roller center is 110 mm. The minimum radius of cam is 45 mm and the roller diameter is 30 mm.

Q5) a) A shaft rotating at 200 r.p.m. drives another shaft at 300 r.p.m. and transmits 6kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4m. The smaller pulley is 0.5m in diameter. Calculate the stress in belt, if it is [10]

i) An open belt drive and

ii) A cross belt drive.

Take coefficient of friction as 0.3. Neglect belt thickness while calculating velocity.

b) Derive the relation between tension in belts on tight side and on slack side. [6]

OR

Explain belt transmission dynamometer with neat sketch.

Q6) a) The arms of Porter governor are pivoted on the governor axis and are each 250 mm long. Mass of each ball is 5 kg and the mass of the sleeve is 40 kg. The arms are at an angle of 30° to the governor axis in lowermost position of the sleeve. Lift is equal to 50mm. Determine the force of friction at sleeve if the speeds at the moment the sleeve start lifting from lowermost position, is same as the speed at the moment it falls from uppermost position. Also determine the range of the governor. [10]

b) With the help of neat sketch explain Hartnell governor. [6]

OR

Explain controlling force curve.

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Total No. of Pages : 4

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - IV) Examination, May - 2015

THEORY OF MACHINES - I

Sub. Code : 43596

Day and Date : Thursday, 14 - 05 - 2015 Total Marks : 100

Time : 9.00 a.m. to 1.00 p.m.

Instructions : 1) Q.2 and Q.5 are compulsory, from the remaining questions of each section answer any two questions.
2) Figures to the right indicate full marks.
3) Draw neat labeled sketch wherever necessary.
4) Assume if necessary, suitable data and state clearly.
5) Use of Non programmable calculator is permitted.

SECTION - I

Q1) a) What is the degree of freedom of mechanism? Explain Kutzbach criterion for finding number of degree of freedom of plane mechanism. [6]

b) Explain types of constrained motions. [4]

c) In a four bar chain as shown in Fig.1 AB = 20cm, BC = 30cm, CD = 32 cm and AD = 55 cm. Crank AB rotates at a uniform speed of 200 rpm in anticlockwise direction. When the crank AB has turned 60°, locate all instantaneous centres and find the Angular velocity of link BC. [6]

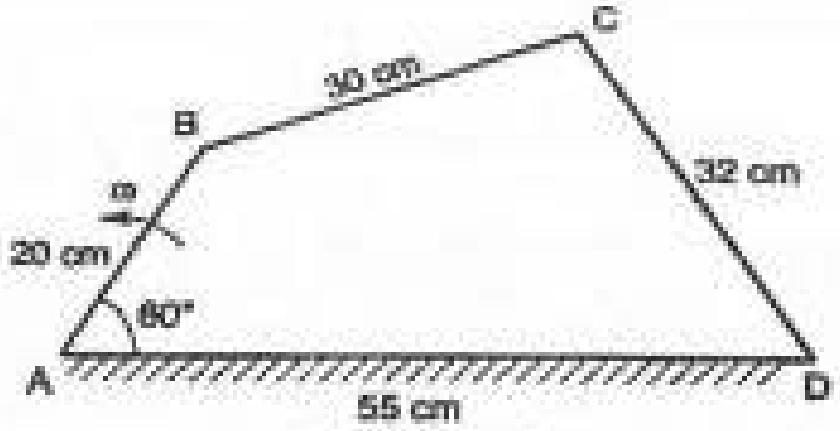

Fig. 1 (Not to scale)

P.T.O.

Q2) In a Whitworth quick return motion mechanism as shown in Fig. 2, OA is a crank rotating at 30 rpm in a clockwise direction. The dimensions of various links are: OA = 150 mm, OC = 100 mm, CD = 125 mm, and DR = 500 mm. Determine the acceleration of the sliding block R and angular acceleration of the slotted lever CA. **[18]**

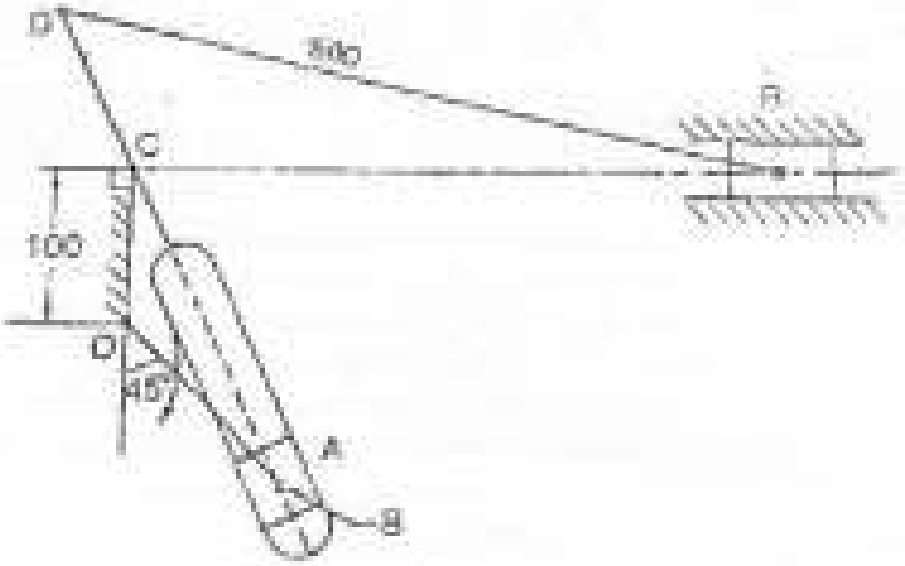

Fig. 2 (Not to scale)

Q3) a) Sketch and explain Hart's straight line mechanism and prove that it is exact straight line mechanism. **[8]**

b) Two shafts are connected by a Hooke's joint. The driving shaft revolves uniformly at 500 rpm. If the total permissible variation in speed of the driven shaft is not to exceed ± 6% of the mean speed. Find the greatest permissible angle between the centre lines of the shafts. **[8]**

Q4) a) Derive an expression for velocity and acceleration of piston in slider crank mechanism. **[8]**

b) The connecting rod of a gasoline engine is 360 mm long between its centres. It has a mass of 15 kg and mass moment of inertia of 7000 kg-mm^2. Its centre of gravity is at 200 mm from its small end centre. Determine the dynamically equivalent two mass system of the connecting rod if one of the masses is located at the small end centre. **[8]**

SECTION - II

Q5) a) Draw displacement, velocity and acceleration diagram for uniform acceleration and retardation motion program of follower. [4]

b) The following data relate to a cam operating an oscillating roller follower:

Minimum radius of cam = 44 mm

Diameter of roller = 14 mm

Length of follower arm = 40 mm

Distance of fulcrum center from cam centre = 50 mm

Angle of ascent = 70°

Angle of descent = 105°

Angle of dwell for follower in highest position = 80°

Angle of oscillation of follower = 28°

cam rpm = 100

Draw the profile of cam if the ascent and descent takes place with SHM. Also calculate maximum velocity and acceleration of follower for outward and return stroke. [14]

Q6) a) Derive the condition for maximum power transmission in case of flat belt drives considering centrifugal tension. [6]

b) A conical pivot supports a load of 25 KN, the cone angle being 120°, and the intensity of normal pressure does not exceed 0.25 Mpa. The external radius is twice the internal radius. Find the inner and outer radii of bearing surface. If the shaft rotates at 180 rpm and the coefficient of friction is 0.15, find the power lost in friction assuming uniform pressure. [10]

Q7) a) What is difference between governor and flywheel? [6]

b) Two parallel shafts, whose center lines are 4.8 m apart, are connected by open belt drive. The diameter of the larger pulley is 1.5 m and that of smaller pulley is 1 m. The initial tension in the belt when belt is stationary is 3 KN. The mass of belt is 1.5 kg/m length. The coefficient of friction between the belt and the pulley is 0.3. Taking centrifugal tension into account calculate power transmitted when smaller pulley rotates at 400 rpm. [10]

(8) a) Derive the equation of the efficiency of an inclined plane when a body moves up the plane. [6]

b) A Hartnell governor having a central sleeve spring and two right angled bell crank levers operates between 290 rpm and 310 rpm for a sleeve lift of 15 mm. The sleeve arms and weight arms are 80mm and 120mm respectively. The levers are pivoted at 120mm from the governor axis and mass of each fly 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. Also calculate stiffness of spring. [10]

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