SE / Mech / Civil / Auto / Sem IV / CBSGS / AM-IV / 2017

Q. P. Code: 25068

Total Marks: 80 **Time: Three hours**

1. Q1 is compulsory

2. Solve any three out of the remaining from Q.2 to Q. 6.

3. Figures on the right hand side indicate marks.

4. Use of statistical tables is allowed.

Q.1. a) A continuous random variable has P.D.F, $f(x) = kx^2(1-x^3)$, $0 \le x \le 1$, and $f(x) = 0$, otherwise.. Find k and mean. 5

b) If $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ then prove that $A^{-1} = A^2 - 5A + 9I$. 5

c) By using Green's theorem evaluate the integral over the square formed by the line $x = \pm 1, y = +1$, $\oint (x^2 + xy)dx + (x^2+y^2)dy$ 5

d) Calculate Karl Pearson's coefficient of correlation from the data. 5

x	3	5	4	6	2
y	3	4	5	2	6

2. a) Random sample of 900 items is found to have a mean of 65.3cm. Can it be regarded as a sample from a large population whose mean is 66.2 cm. and standard deviation 5cm. at 5% level of significance? 6

b) Use the Lagrange's method of multipliers to solve the NLPP, optimize

$Z = 6x_1^2 + 5x_2^2$, *subjected to* $x_1 + 5x_2 = 7, x_1, x_2 \ge 0$ 6

c) A vector field is given by $\bar{F} = (x^2 + xy^2)i + (y^2 + x^2y)j$, prove that $\bar{F}$ is irrotational, find the scalar potential 8

Q3. a) If x is a Poisson variable such that, p(x=1) = p(x=2).find E (x^2) 6

b) Evaluate by using Stokes theorem, $\oint 3ydx + 4zdy + 6ydz$ where c is the curve of the intersection of sphere $x^2 + y^2 + z^2 = 8z$ *and* $z = x + 4$. 6

c) A die was thrown 132 times and the following frequencies were observed. Test the hypothesis that the die is unbiased. 8

[PTO

Number obtained	1	2	3	4	5	6	Total
Frequency	15	20	25	15	29	28	132

Q.4 a) Obtain Spearman's coefficient of rank correlation from the given data. 6

x	32	55	49	60	43	37	43	49	10	20
y	40	30	70	20	30	50	72	60	45	25

b) Use Gauss's divergence theorem to evaluate, $\iint x^2 dydz + y^2 dzdx + 2z(xy - x - y)dxdy$ and S is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1. 6

c) Using the Kuhn Tucker method solve the NLPP, Maximize $Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$ subjected to $x_1 + x_2 \leq 2, 2x_1 + 3x_2 \leq 12, x_1, x_2 \geq 0$ 8

Q.5. a) Show that the matrix $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$ is diagonalizable. Find the transforming matrix and the diagonal matrix. 6

b) Regression lines are given by 6y = 5x +90, 15x = 8y+130, $\sigma_x^2 = 16$,

Find mean for x and y, correlation coefficient between x and y, and σ_y^2. 6

c) The standard deviations calculated from two random samples of sizes 9 and 13 are 1.99 and 1.9. can it be regarded as a sample drawn from the normal populations with the same standard deviations? (Given: $F_{0.025} = 3.51, with\ dof = 8 and\ 12, F_{0.025} = 4.20, with\ dof = 12\ and\ 8$) 8

Q6.a) Find A^{50} if $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ 6

b) The monthly salary x in a big organization is normally distributed, with mean Rs. 3000 and standard deviation Rs 250. What should be the minimum salary of a worker in this organization so that the probability that he belongs to top 5% workers? 6

c) The heights of six randomly chosen sailors are in inches: 63, 65, 68, 69,71and 72. The heights of ten randomly selected soldiers are 61, 62, 65,66 69,69,70,71,72 and 73. Discuss in the light that this data suggests that the soldiers are on an average taller than sailors. 8

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S·E/Mech Auto/Sem IV/fm/CBSGS/28/11/17

Q. P. Code: 13610

Instructions: Question no.1 **is compulsory.**

Attempt any **THREE** from question no. 2 to 6.

Use illustrative diagrams where ever required.

Q1 **Solve any four**

a An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m x 0.9 m & inclined plane having an angle of inclination 30°. The weight of the square plate is 392.4 N & it slides down the plane with uniform velocity of 0.2 m/s. Find the dynamic viscosity of the oil. 05

b Define i) Irrotational Vortex ii) Circulation 05

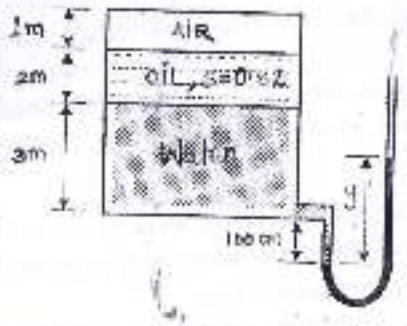
c Explain the working principle of the Pitot tube 05

d Water in a reservoir A is at a level 6m above the water level in reservoir B. The reservoirs are connected by a 5cm diameter horizontal pipe 200m long. The pressure in reservoir B is 70 kPa gauge while the reservoir A is exposed to atmosphere. Assuming the Darcy friction factor of the pipe to be 0.02 and neglecting minor losses, determine the direction of flow. 05

e Examine the following profile for Boundary layer separation 05

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right)^2 + \left(\frac{y}{\delta}\right)^3 - 2\left(\frac{y}{\delta}\right)^4$$

Q2 a A manometer is attached to a tank containing 3 different fluids as shown fig. What will be the deflection of mercury column 'y' for the given configuration? 08



b Derive the equation of velocity distribution in a circular pipe for Laminar Steady flow, incompressible fluid. 12

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Q3 a A two dimensional flow is described in Lagrangian system as 10

$x = x_0 e^{-ct} + y_0\left(1 - e^{-2ct}\right)$ and $y = y_0 e^{ct}$

Find :

i) The equation of fluid particle in flow field

ii) The velocity components in Eulerian system

b The velocity profile within a laminar boundary layer over a flat plate is given by 10

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

Where U is the mean stream velocity and δ is the boundary layer thickness.

Determine the i) Displacement thickness and

ii) Momentum Thickness.

Q4 a Using N-S Equation find, the velocity distribution, maximum velocity, average velocity, discharge and shear stress for Plane Poiseuille's flow. State the assumptions made. 10

b In a normal shock wave occurring in a Helium (k=1.66) the density downstream of the shock is three times that on the upstream. Calculate the corresponding pressure ratio and velocity ratio. What are the Mach numbers upstream and downstream of the shock? 10

Q5 a A reducing bend is placed in a pipe line such that the direction of flow of water is turned through 60° upward and the pipe diameter is reduced from 0.25 m to 0.15 m. The volume of the bend is 0.015 m^3. The exit of the bend is 15 cm above the inlet. The velocity and pressure at the entry to the bend are 1.5 m/s and 300kN/m^2 gauge respectively. it is desired to determine the force exerted by the bend on the water using Reynold's Transport Theorem. 10

i) With the help of neat figure, show the control volume

ii) List all the assumptions considered while solving the problem

iii) Determine the required force

iv) What would be the force of the water on the bend?

b Three pipes with details as following are connected in parallel between two points 10

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When the total discharge of 0.3 m^3/s flows through the system. Calculate distribution of discharge and head loss between the junction.

Pipe	Length (m)	Diameter (cm)	Friction factor f
1	1500	20	0.02
2	2000	30	0.015
3	1000	15	0.02

Q6 a Air flows steadily though a long, straight round pipe of radius R. At a plane wall downstream the entrance, the velocity u varies with radius r according to the equation 10

$$\frac{u}{U_{max}} = 1 - \left(\frac{r}{R}\right)^2$$

Where U_{max} is the maximum velocity at the centre line of the pipe.

Evaluate the ratio

$\frac{U_{avg}}{U_{max}}$ if U_{avg} is the average velocity in the pipe.

b **Solve any 2** 10

i) Write a short note on Aerofoil theory

ii) Find the speed of sound in oxygen at a pressure of 100 k Pa absolute and 25° C.

Take R= 260 J/kg K and k =1.4

iii) Write a short note on Stability of floating bodies.

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S.E / Sem II / Mech Auto / Tom-I / CBSGS / 05/12/17

Q.P. Code: 22665

(3 Hours) Total Marks: 80

N.B. 1) Question No.1 is compulsory.
2) Attempt any three questions out of the remaining five questions.
3) Figures to the right indicate full marks.
4) Assume suitable data wherever required but justify the same.

Q1. **Attempt any four** (20)

A. What are the different types of constrained motions?

B. What is the initial tension in a belt drive?

C. What are the different types of instantaneous centers?

D. Derive the fundamental equation for correct steering in steering gear mechanism.

E. State and explain law of gearing.

Q2 A. A flat belt is required to transmit 35 kW from a pulley of 1.5 m effective diameter running at 300 rpm. The angle of contact is spread over 11/24 of the circumference and the coefficient of friction between the belt and pulley surface is 0.3. Determine, taking centrifugal tension into account, width of the belt required. It is given that the belt thickness is 9.5 mm, density of its material is 1.1×10^3 kg/m^3 and the related permissible working stress is 2.5 N/mm^2. (10)

B. Two mating gear wheels have 20 and 40 involute teeth of 10 mm module and 20° pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel and the length of the line of contact. If the smaller wheel rotates at 250 rpm, find the velocity of point of contact along the surface of each tooth at the instant when the tip of a tooth on a smaller wheel is in contact. (10)

Q3 A. With the help of a neat sketch derive the equation for the length of path of contact, arc of contact and contact ratio for the two gears in mesh. (10)

B. Derive the equation for the length of an open belt drive. (10)

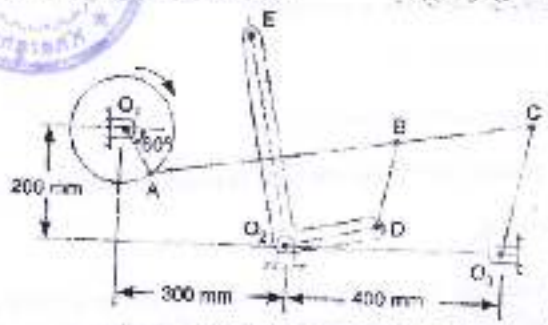
Q4 A. A cam with a minimum radius of 25 mm, rotating clockwise at a uniform speed of 100 rpm, to give a roller follower at the end of a valve rod, motion described below, (10)
i) To raise the valve through 50 mm during 120° rotation of the cam.
ii) To keep the valve fully raised through next 30°.
iii) To lower the valve during next 60°.
iv) To keep the valve closed during rest of the revolution.
The displacement of the valve, while being raised and lowered, is to take place with SHM. Draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam.

B. A uniform bar of mass 'm' and length 'L' hangs from a frictionless hinge. It is released from the horizontal position. Find the angular velocity of the center of mass 'G', when it is in vertical position. Solve by work energy principle. (10)

{ Turn Over }

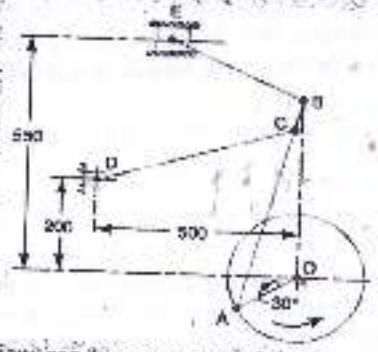
Q5 A. The mechanism of a wrapping machine, as shown in figure, has the following dimensions: (14)
O_1A = 100 mm, AC = 700 mm, BC = 200 mm, O_1C = 200 mm, O_2E = 400 mm, O_2D = 200 mm, BD = 150 mm.
The crank O_1A rotates at a uniform speed of 100 rad/s. Find the velocity of the point E of the bell crank lever by

i) Instantaneous Center method
ii) Relative Velocity method



B. Classify follower in detail. (6)

Q6 A. Figure shows the mechanism of a radial valve gear. The crank OA turns uniformly at 150 rpm and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as center and DC as radius. The dimensions of various links are: OA = 150 mm, AB = 550 mm, AC = 450 mm, DC = 500 mm, BC = 350 mm. Determine velocity and acceleration of the ram E for the given position of the mechanism. (14)



B. Prove that Hart's mechanism can trace exact straight line. (6)

S.E/ Sem IV / Mech Auto / PP-II / CBSGS / 12/12/19

Q.P. Code: 27664

(3 Hours) [Total Marks : 80]

N.B. (1) Question no. 1 is **compulsory.**
(2) Attempt any **three** questions out of remaining **five** questions.
(3) **Illustrate** your answer with **necessary** sketch wherever **necessary.**
(4) **Figures** to the **right** indicate full **marks.**

1. **Attempt any FOUR of the following :** (20)
   (a) Write short note on Honing Machine.
   (b) What are the features of a horizontal CNC machine?
   (c) Explain what is a tool dynamometer with a neat sketch.
   (d) State the factors for selection of grinding wheel.
   (e) Explain the steps for designing the broach tools.

2. (a) Explain the different gear finishing methods. (10)
   (b) Draw and explain the different terms of a twist drill. (6)
   (c) Write in brief about tool signature. (4)

3. (a) State the different sources of heat in metal cutting. (10)
   (b) Explain the mechanism of chip formation. (6)
   (c) Compare Shaper and Planer machines. (4)

4. (a) What are the functions of cutting fluid? Explain different types of cutting fluid. (10)
   (b) In an orthogonal cutting with a tool rake angle 10°, the following observations were made: (6)
   Chip thickness ratio = 0.4
   Horizontal component of the cutting force = 1200 N
   Vertical component of the cutting force = 1600 N
   From Merchant's theory, calculate:
   (i) Shear plane angle (ii) Shear force along the rake face (iii) Normal force on the rake face (iv) Coefficient of friction (μ) at the chip tool interface (v) Friction angle.
   (c) Explain the rack planning process. (4)

5. (a) With the help of neat sketch describe vertical machining centers. (10)
   (b) Write short note on : Cutting tool materials. (6)
   (c) Write short notes on: Coordinate measuring machine. (4)

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6. Write short notes on any **FOUR** : 20

(a) Machinability.

(b) Surface Finish in machining.

(c) Geometry of milling cutter.

(d) Carbide inserts.

(e) GM codes in CNC machines.

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Sem - IV

Q.P. Code:13964

(3 Hours) [Total Marks: 80]

N. B. 1) Question No. 1 is compulsory.
2) Attempt any three questions from remaining five questions.
3) Figures at right indicate marks.
4) Draw neat well labeled sketches.

Q. 1 Write note on any four:- (20)
a) Austempering
b) Creep mechanism.
c) Effect of Alloy on TTT diagram.
d) Factors governing formation of substitutional solid solution.
e) Thermal Fatigue

Q. 2 A) What do you mean by Nano-materials? Explain their properties and practical applications. (7)
B) What is Fatigue? Explain fatigue testing in detail. (7)
C) Explain Carburizing treatment. (6)

Q. 3 A) Draw Fe-Fe$_3$C Diagram and give all critical temperatures. (7)
B) How dislocations are generated at Frank Reed Source? Explain dislocation Jog. (7)
C) Explain general effect of alloying element on Fe-c dia and properties of material. (6)

Q. 4 A) Draw and explain construction of Time Temperature Transformation (TTT) diagram. (7)
B) Derive an expression for Griffith theory of brittle fracture. Explain Orowan's Modification. (7)
C) Explain Induction Hardening. (6)

Q. 5 A) What are the type's deformation? Explain mechanism of plastic deformation. (7)
B) Classify crystal imperfections. Explain Edge and Screw dislocation. (7)
C) Explain creep test and Andrade's analysis of creep curve. (6)

Q. 6 Write short note on any four (20)
a) FCC to BCT conversion (Bain's model)
b) Tempering
c) Strain Aging
d) Hardenability test
e) Normalizing

SE/MECH & AUTO/IV/IC 8565/1E/22/10/17

Q. P. Code : 25080

Total Time: **3 Hrs** Total Marks: **80**

Instructions:

1. Question No: **1** is **compulsory**.
2. Answer any **three** from the **remaining five** questions.
3. Figures to the right indicate full marks.

	Solve **any four**:-	**(20)**
a)	Draw application circuit of triac-diac and associated waveforms.	
b)	Enlist applications of inverter?	
c)	Draw buffer, integrator and Schmitt trigger circuit.	
d)	Define and describe logic operation, power dissipation and propagation delay in digital circuits.	
e)	Draw and explain generic microcontroller.	
a)	Describe speed torque characteristics of dc and ac motors.	**(07)**
b)	Explain three phase inverter operation with waveforms.	**(07)**
c)	Describe in detail instrumentation amplifier. State its need and applications.	**(06)**
a)	Explain an ac to dc converter supplying resistive load. Derive equation for calculating dc voltage.	**(07)**
b)	Explain procedure to select a motor for an application and describe with the speed torque characteristics.	**(07)**
c)	Explain in detail low pass active filter	**(06)**
a)	Explain need of digital to analogue conversion. How the ADC in MSP430 works?	**(07)**
b)	Compare analogue and digital circuits. Enlist some of them.	**(07)**
c)	Describe closed loop speed control of DC motor.	**(06)**
a)	Draw and explain architecture MSP 430 microcontroller?	**(07)**
b)	What is MOSFET? Explain its working. What are similarities between MOSFET and IGBT?	**(07)**
c)	Explain IC 555 timer as Monostable Multivibrator.	**(06)**
a)	Explain with circuit diagram any forced commutation method of SCR.	**(07)**
b)	Compare microprocessor and microcontroller.	**(07)**
c)	Explain Demultiplexer and Decoder.	**(06)**