(3 hours)   **[Total marks: 80]**

N.B. (1) Question No. 1 is compulsory.

(2) Answer **any Three** from remaining

(3)Figures to the right indicate full marks

(4) Use of statistical tables is allowed.

1.a) Show that the matrix A = $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{bmatrix}$ is non derogatory   5

b) Determine all basic solutions to the following problem-
Maximize $z = x_1 + 3x_2 + 3x_3$
Subject to
$x_1 + 2x_2 + 3x_3 = 4$
$2x_1 + 3x_2 + 5x_3 = 7$
$x_1, x_2, x_3, \geq 0$ 5

c) Prove that $\bar{F} = (2xy + z)i + (x^2 + 2yz^3)j + (3y^2z^2 + x)k$ is an irrotational vector and find the corresponding scalar ϕ such that $\bar{F} = \nabla\phi$.   5

d)Can it be concluded that the average lifespan of an Indian is more than 70 years if a random sample of l00 Indians has an average lifespan of 71.8 years with standard deviation of 8.9 years?   5

2.a)Show that the matrix A = $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ is diagonalizable. Also find the transforming matrix and the diagonal matrix.   6

b Using Green's Theorem ,evaluate $\oint_c (3x^2 - 8y^2)\,dx + (4y - 6xy)dy$ where C is the boundary of

the region defined by $y = x^2$ and $y = \sqrt{x}$.   6

c)Solve the following problem by simplex method
Maximize Z = $3x_1 + 2x_2$

Subject to $3x_1 + 2x_2 \leq 18,$
                                    $x_1 \leq 4,$
                           $x_2 \leq 6,$ $x_1, x_2 \geq 0$ 8

3. a) Use Stoke's theorem evaluate $\int \bar{F}.d\bar{r}$ $\bar{F}$ = 2y (1-x)i + (x-x²-y²)j + (x² + y² +z²)k where and *s* is

the surface of the plane x+y+z = 2 which is in the first octant   .   6

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b) The standard deviations calculated from two random samples of sizes 9 and 13 are 1.99 and 1.9.

Can the samples be regard as drawn from the normal populations with the same standard deviation?

(Given $F_{0.025}$ =3.51 with d.o.f. 8 and 12 and $F_{0.025}$ =4.20with d.o.f. 12 and 8 or $F_{0.05}$ =4.50 with d.o.f.

8and12)   6

c) Use Penalty Method (Big M method) to solve the following L.P.P.
   Minimize z = $6x_1 + 4x_2$
   Subject to the constraints
   $2x_1 + 3x_2 \leq 30$
   $3x_1 + 2x_2 \leq 24$
   $x_1 + x_2 \geq 3$, $x_1, x_2 \geq 0$

8

4.a)Verify Cayley-Hamilton theorem for the matrix A = $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$. Hence find A^{-1} 6

b) Marks obtained by students in an examination follow normal distributions. If 30% of students
   got below 35 marks and 10% got above 60 marks. Find mean and standard deviation.   6

c) Use the dual simplex method to solve the following L.P.P.
      Minimize   Z = $x_1 + x_2$
         Subject to $2x_1 + x_2 \geq 2$, $-x_1 - x_2 \geq 1$, $x_1, x_2 \geq 0$.   8

5.a) Find e^A and 4^A , if A = $\begin{bmatrix} \dfrac{3}{2} & \dfrac{1}{2} \\ \dfrac{1}{2} & \dfrac{3}{2} \end{bmatrix}$ 6

b)A random discrete variable x has the probability density function given

x	-2	-1	0	1	2	3
P(x)	0.1	k	0.2	2k	0.3	k

   find k, the mean and the variance   6

c) In an experiment on immunizations of cattle from Tuberculosis the following results were

obtained. Use χ^2 -test to determine the efficiency of vaccine in preventing tuberculosis.   8

	Affected	Not affected	Total
Inoculated	290	110	400
Not Inoculated	310	90	400
Total	600	200	800

6.a) Use Gauss divergence theorem to evaluate $\iint \bar{F}.\bar{N}\,ds$ where $\bar{F} = x^2\bar{\imath} + z\bar{\jmath} + yz\bar{k}$ and
      s is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1   6

b) The means of two random samples of size 9 and 7 are 196.42 and 198.82 respectively. The sum of the squares of the deviation from the mean are 26.94 and 18.73 respectively. Can the sample be considered to have drawn from the same normal population? 6

c) Reduce the quadratic form, $x_1^2 + 2x_2^2 + 3x_3^2 + 2x_1x_2 + 2x_2x_3 - 2x_3x_1$ to the canonical form.. Also find its rank, index and signature, using congruent transformations. 8

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Q. P. Code: 36431

[3hours]   Total Marks 80

N.B. (1) Question No 1 is compulsory

(2) Attempt any 3 of the remaining

(3) Use of statistical table is allowed

1. a) A variable X follows a Poisson distribution with variance 3. Find   (5)

    P(x=2) and P(x$\geq$ 2)

   b) Evaluate $\iint_s 9\,xi + 6\,yj - 10\,zk\,.d\overline{s}$ where s is surface of the sphere with radius 2,

    using Gauss divergence theorem.   (5)

   c) Ten individuals are chosen at random from a population and their heights are
     found to be 63, 63, 64, 65, 66, 69, 69, 70, 70, 71 inches.
     Discuss the suggestion that the mean height of the universe is 65 inches.   (5)

   d) Using Cayley- Hamilton Theorem find $2A^5 - 3A^4 + A^2 - 4I$ where $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ (5)

2. a) A continuous random variable X has the probability density function   (6)
      $f(x) = kx^2e^{-x}$, $x\geq 0$. Find k,mean and variance

  b) Ten school boys were given a test in statistics and their scores were

   recorded. They were given a months special coaching and a second test

   was given to them in the same subject at the end of the coaching period.

   Test if the marks given below give evidence to the fact that the students are

   benefitted by the coaching.

   Marks in Test I   : 70, 68, 56, 75, 80, 90, 68, 75, 56, 58

   Marks in Test II :   68, 70, 52, 73, 75, 78, 80, 92, 54, 55   (6)

  c) Two lines of regression are given by x+6y = 6 ,and 3x+2y =10

   calculate (i) mean   values of x and y, (ii) the coefficient of correlation and   (8)

   (iii) estimate y when x = 12

3 .a) It is known that the probability of an item produced by a certain machine will be
    defective is 0.05. If the produced items are sent to the market in packets of 20,
    find the number of packets containing (i) at least2, (ii) exactly2 and (iii) at most
    2 defective items in a consignment of 1000 packets using Poisson distribution   (6)

b) Use Stoke's theorem to evaluate $\int_c \overline{F} . d\overline{r}$ where $\overline{F} = yzi + zxj + xyk$ and c is the

boundary of the circle $x^2 + y^2 + z^2 = 1$, z = 0 (6)

c) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ (8)

4. a) Out of 800 people 25% were literate and 300 had travelled beyond the

limits of the district. 40 % of the literates were among those who had not

travelled. Prepare a 2x2 table and test at 5% level of significance whether

there is any relation between travelling and literacy (6)

b) Compute rank correlation coefficient from the following

X : 10, 12, 18, 18, 15, 40

Y : 12, 18, 25, 25, 50, 25 (6)

c) The marks of 1000 students of a university are found to be normally

distributed with mean 70 and standard deviation 5. Estimate the number of

students whose marks will be (i) between 60 and 75 (ii) more than 75

(iii) less than 68 (8)

5.a) A machine is set to produce metal plates of thickness 1.5 cms with standard
deviation of 0.2 cms. A sample of 100 plates produced by the machine gave
an   average thickness of 1.52 cms. Is the machine fulfilling the purpose? (6)

b) Using the method of Lagrange's multipliers solve the following N.L.P.P

Optimise $z = 6x_1^2 + 5x_2^2$

Subject to $x_1 + 5x_2 = 7,$

$x_1, x_2 \geq 0$ (6)

c) If the vector field $\overline{F}$ is irrotational find the constants a,b,c where $\overline{F}$ is given by
$\overline{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$. Find the scalar potential of $\overline{F}$ .Then
find the   workdone in moving a particle in this field from (1,2,-4) to (3,3,2)
along the straight line joining these points (8)

6.a) Using Green's theorem evaluate $\int_c (xy + y^2)dx + x^2 dy$ where c is the closed curve

of the region bounded by $y = x, y = x^2$ (6)

b) Show that $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is derogatory and find its minimal polynomial (6)

c) Using the Kuhn-Tucker conditions solve the following problem (8)

Maximise $z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$

Subject to $x_1 + x_2 \leq 2$, $2x_1 + 3x_2 \leq 12$

$x_1, x_2, x_3 \geq 0$

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Q.P.Code: 39966

(3 Hours) [Total Marks: 80]

NB:
1. **Question No.1** is compulsory
2. Attempt **any three questions from remaining questions**.
3. **Neat diagram must be drawn** wherever necessary
4. **Assume suitable data** if necessary and **state clearly**.
5. **Appropriate figures** to the right indicate marks.

1   **Answer any four from the following**   20

a. An ornament weighing 36 gm in air weighs only 34 gm in water. Assuming that some copper is mixed with gold to prepare the ornament. Find the amount of copper in it. Specific gravity of gold is 19.3 and that of copper is 8.9.

b. Water is flowing from a hose attached to water main at 400 kPa (gauge). A child places a thumb to cover most of the hose outlet, causing a thin jet of high speed water to emerge. If the hose is held vertical upward, what is maximum height that jet could achieve .Assume flow is steady, incompressible and laminar.

c. A ball falling in a lake of depth 200 m creates a decrease 0.1% in its volume at the bottom. The bulk modulus of material of ball is.

d. Explain for the boundary layer flow, whether the curve representing δ (boundary layer thickness) as a function of X over a flat plate is a stream line of flow or not.

e. Distinguish with the help of neat sketches, between a hydrodynamically rough surface and hydrodynamically smooth surface.

2 a. For the laminar boundary layer on a flat plate is   **12**

$$f(\eta) = \frac{3\eta}{2} - \frac{\eta^3}{2} \quad \text{where, } \eta = \frac{y}{\delta} \text{ and } f(\eta) = \frac{u}{U}$$

Determine;

   a.   Boundary Layer Thickness

   b.   Local coefficient of drag

   c.   Check whether the flow is attached or not.

b. Air at an absolute pressure 60.0 kPa and 27^0C enters a passage at 486 m/s. The cross-   **08** sectional area at the entrance is 0.02 m². At section 2, further downstream, the pressure is 78.8 kPa (abs). Assuming isentropic flow, calculate the Mach number at section 2. Also identify the type of nozzle.

TURN OVER

3 a. Use the appropriate form of Navier-stokes equation to derive an equation of velocity **10**
profile in couette flow. State assumptions made at each stage. Plot the dimensionless
velocity profile for different value of $\dfrac{dp}{dx}$.

b. In a parallel two dimensional flow in the positive x- direction, the velocity varies **10**
linearly from zero at $y = 0$ to 32 m/s at $y = 1\,m$ in perpendicular direction. Determine
the expression for stream function (ψ) and plot streamline at interval of $d\psi = 3\,m^2/s$.
Is the flow is irrotational. Consider unit width of flow.

4 a. A pipe 0.6 m in diameter takes off water from the reservoir 150 m high above the **12**
datum. The pipe is 5000 m long and is laid completely at the datum level. For the last
1200 m, water is drawn by service pipe at uniform rate of 0.1 m^3/sec per 300 m. Find
the head lost in the last 1200 m length of pipe. Take friction factor as 0.04 and velocity
is zero at dead end.

b. Derive the expression for linear with angular deformation and pure rotation **08**
phenomenon in fluid flow.

5 Using Reynold's Transport Theorem derive the mass flow rate equation and momentum **06**
equation to solve the following

Water at a pressure of 72 kN/m^2 flows through a horizontal pipe of diameter 360 mm at
the rate of 300 lps. The direction of water is changed through 120^0 by a vertical bend **14**
whose exit diameter is 240 mm. The volume of the bend is 0.14 m^3. The exit of the
bend is 2.4 m above the inlet. Find the magnitude and direction of the resultant force on
the bend due to water. Neglect friction and minor losses.

6 Write short note for the following **20**

a. Moody's diagram

b. Induced drag on aerofoil

c. Stream function and velocity potential function and their importance in ideal fluid flow
theory.

d. Conditions of equilibrium for floating and submerged bodies.

_____

[Time : 3 hours]   [Marks : 80]

Instructions : Question no 1 is COMPULSORY

Attempt any 3 questions from question no 2 to 6

Use illustrative diagrams wherever possible

Assume suitable data if necessary

Q1		Solve any 4 of the 5 sub questions	
	a	Two large plane surfaces are 2.4cm apart. The space between the surfaces is filled with glycerin. What force is required to drag a very thin plate of surface area 0.5 square meter between the two large plane surfaces at a speed of 0.6m/s^2 · if the thin plate is at a distance of 0.8cm from one of the plane surfaces ? Take dynamic viscosity of glycerin = 0.81 N-s/m^2	**5**
	b	The stream function for a two dimensional flow is given by ψ =2xy, calculate the velocity of the point P(2,3).	**5**
	c	A projectile travels in air of pressure 10.1043 N/cm^2 at 10^{0}C at a speed of 1500 kmph. Find the Mach number and the Mach angle. Take k=1.4 and R= 287 J/kg K	**5**
	d	Define the following terms : i) Boundary Layer Thickness ii) Displacement Thickness	**5**
	e	Explain the working of a Orificemeter	**5**
Q2	**a**	A simple manometer is used to measure the pressure of oil (sp gr 0.8) flowing in the pipeline. It's right limb is open to atmosphere and the left limb is connected to the pipe. The centre of the pipe is 9cm below the level of mercury (sp gr 13.6) in the right limb. If the difference of mercury level in the two limbs is 15cm, determine the absolute pressure of the oil in the pipe in N/cm^2.	**8**
	b	A horizontal pipe line 50m long is connected to a water tank at one end discharges freely into the atmosphere at the other end. For the first 30m of its length from the tank, the pipe is 200mm in diameter and its diameter is suddenly enlarged to 400mm. The height of water level in the tank is 10m above the centre of the pipe. Considering all minor losses, determine the rate of flow. Take f = 0.01 for both sections of the pipe.	**12**
Q3	**a**	For a two dimensional potential flow, the velocity potential function is given by : Φ =4x (3y-4), determine the velocity at the point (2,3). Also determine the value of the stream function ψ at the point (2,3)	**10**
	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 main stream velocity and δ is the boundary layer thickness.
Determine the   i) Displacement thickness and ii) Momentum thickness

Q4 **a** Derive the Euler's equation of motion and obtain the Bernoulli's equation. State **10**
the assumptions made.

b Calculate the stagnation pressure , temperature and density at the stagnation point **10**
on the nose of a plane, which is flying at 800 kmph through still air having a
pressure of 8.0 N/cm^2 (abs) and temperature -10^0 C . Take R = 287 J/kg K and
k=1.4

Q5 **a** A 300mm diameter pipe carries water under a head of 20 meters with a velocity of **10**
3.5m/s. If the axis of the pipe turns 45^0, find the magnitude and the direction of the
resultant force of the bend. Assume the pipe to be in the horizontal plane.

b A fluid of viscosity 0.7 N-s/m^2 and specific gravity 1.3 is flowing through a circular **10**
pipe of diameter 100mm. The maximum shear stress at the pipe wall is given as
192.6 N/m^2, find the   i) pressure gradient ii) average velocity iii) Reynold's
number of the flow.

Q6 **a** Draw a neat sketch of Venturimeter and derive an expression for discharge through **10**
the venturimeter. Explain the terms C_d, C_v and C_c.

b Solve any 2 of 3 sub questions below

i Define the terms Drag and Lift **5**

ii State and explain the hydro static law **5**

iii Explain the Critical Pressure ratio **5**

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Paper / Subject Code: 39606 / INDUSTRIAL ELECTRONICS (MECH)

S.E. Sem. IV (CBSGS) Dec 2018.

(3 Hours)　　　　　　　　　　　　　　　　　　　[Total Marks: 80]

N.B: (1) Question no.1 is compulsory
　　　 (2) Solve any three from remaining five questions
　　　 (3) Assume suitable data if necessary
　　　 (4) Figures to the right indicate full marks

1. Solve any 4:　　　　　　　　　　　　　　　　　　　　　　　　　　　20
　　(a) List the characteristics of an ideal op-amp.
　　(b) What is SCR and state it's application.
　　(c) Realize basic gates using NAND gate.
　　(d) Explain Back EMF in D.C motors.
　　(e) State advantages of Digital Circuits.

2. (a) What is an inverter? Classify it according to their input supply and explain any one.　　7
　　(b) Derive the output voltage for full wave fully controlled rectifier and find firing angle for
　　　　maximum output.　　7
　　(c) Compare power BJT, power MOSFET and IGBT.　　6

3. (a) Explain in detail the concept of R-L-E load in converters　　7
　　(b) Draw and explain architecture of MSP430 microcontroller　　7
　　(c) Discuss Torque Speed characteristic of D.C motor? Classify types of load on the basis of
　　　　Time duration.　　6

4. (a) What is the necessity of inner current loop control circuit.　　7
　　(b) Explain IC 555 as a Monostable Multivibrator.　　7
　　(c) How SCR Gate Drive R-C Circuit Work.　　6

5. (a) Explain any one application circuit of TRIAC-DIAC pair. Also, draw the V-I
　　　　characteristics of TRIAC and DIAC.　　7
　　(b) Compare combinational and sequential circuits. Explain any one combinational circuit.　　7
　　(c) Explain minimum six distinguishing features of MSP430 Microcontroller　　6

6. (a) Explain register related to configuration of digital input/output port of MSP 430
　　　　microcontroller.　　7
　　(b) Explain how to select a motor for water pumping application and describe with Speed
　　　　Torque Characteristic?　　7
　　(c) What do you understand by a digital circuit? Elaborate following terms
　　　　related to digital circuits:
　　　　(i)　　Logic level　　(ii) Noise immunity　　　　　(iii) Propagation delay
　　　　(iv)　 Power dissipation　 (v) Fan out　　6

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1T01424 - S.E.(MECHANICAL)(Sem IV) (Choice Based) / 41203 Industrial Electronics

(3 Hours) **[Total Marks : 80]**

N.B: (1)Question no.**1** is **compulsory**
    (2)Solve any **three** from remaining questions
    (3)Assume **suitable** data if**necessary**
    (4)**Figures** to the right indicate full marks

1. Solve any 4: 20

    (a)State and prove DeMorgan's theorem.

    (b)Draw the characteristics of power BJT, power MOSFET and IGBT.

    (c)Mention the importance of Instrumentation amplifier and Voltage Follower.

    (d)Compare A.C and D.C motors.

    (e)Explain basic principle of single phase inverter.

2. (a) Draw and explain block diagram of closed loop speed control of DC motor. 7

   (b) Write a short note on selection of motors for various industrial applications. 7

   (c) Compare SCR and TRIAC. 6

3. (a) With neat circuit diagram and waveforms, explain single phase full wave half controlled

      rectifier circuit supplying a resistive load. 7

   (b) Draw and explain architecture of MSP430 microcontroller 7

   (c) Describe in detail Low Pass filter. 6

4. (a)Draw circuit diagram and waveform of 3 phase bridge inverter with R load (180

      degree mode of conduction) 7

   (b)Explain the working principle of a GTO with proper diagram. 7

   (c)Compare Monostable and Astable multivibrators. 6

5. (a) Explain UJT triggering method of SCR. 7

   (b) What is a flip flop? Explain the different types of flip flops. 7

   (c) Compare microprocessor and microcontroller. 6

6. (a)Explain the application of microcontroller in Piezoelectric Actuator Drive. 7

   (b)Explain any one method for the speed control of A.C induction motors. 7

   (c)Write a short note on Multiplexer and Demultiplexer. 6

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Sem IV MECH, CBCWS, Dec 18

15/12/18

LC

(3 hours)

Total Marks: 80

NB
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 rigid and resistant bodies? Elaborate.
B. What is fundamental equation of steering gears? Which steering gear fulfil this condition?
C. Two points located along the radius of a wheel have velocities of 8 m/s and 14 m/s respectively. The distance between the points is 300 mm. What is radial distance of outer point from the centre.
D. Define base circle, pitch circle, trace point, pitch curve and pressure angle.
E. State and derive law of gearing.

Q2 A. A pinion of 120 mm pitch circle diameter and having 20 involute teeth drives a rack. The (10) addendum of both the pinion and rack is 6 mm. Determine the least value of the pressure angle to avoid interference. With this value of pressure angle, find the length of arc of contact and the minimum number of teeth in contact at a time.

B. What is the effect of centrifugal tension on the power transmitted? (5)

C State and explain Kennedy's theorem. (5)

Q3 A. In an open-belt drive, the diameters of the larger and smaller pulley are 1.2 m and 0.8 m (10) respectively. The smaller pulley rotates at 320 rpm. The center distance between the shaft is 4 m. When stationary, the initial tension on the belt is 2.8 kN. The mass of belt is 1.8 kg/m and the coefficient of friction between the belt and pulley is 0.25. Determine the power transmitted.

B. Use following data of a cam in which a knief-edge follower is raised with uniform (10) acceleration and deceleration and is lowered with simple harmonic motion: least radius of cam=60 mm, Lift of follower=45 mm, Angle of ascent= 60°, dwell between ascent and descent= 40°, Angle of descent= 70°
If cam rotates at 180 rpm, determine the maximum velocity and acceleration during ascent and descent.

Q4 A. In a reduction gear shown in fig. 1, the input S has 24 teeth. P and C constitute a compound (10) planet having 30 and 18 teeth respectively. If all gears are of the same pitch, find ratio of reduction gear. Assume A to be fixed.
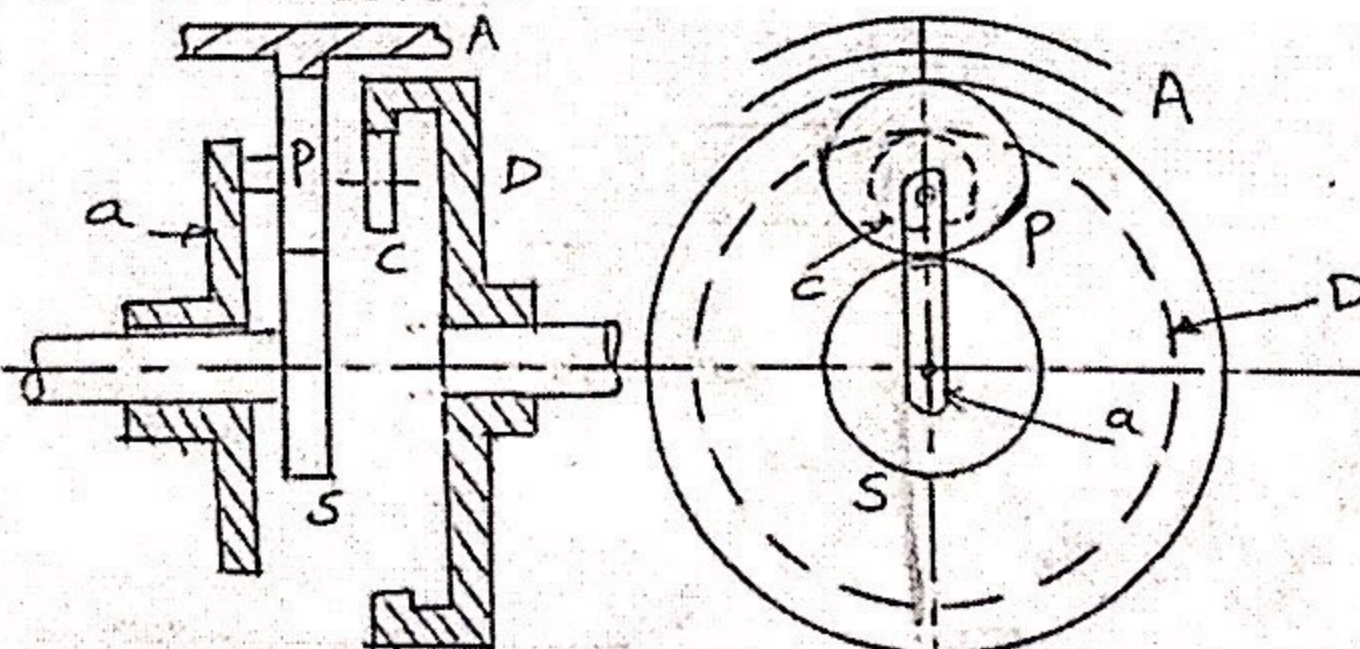

Fig. 1 Reduction Gear Mechanism

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B. A uniform 50-kg crate rest on a horizontal surface for which coefficient of kinetic friction (10) is 0.2. Determine the crate acceleration if a force of P=600 N is applied to the crate as shown in fig 2.
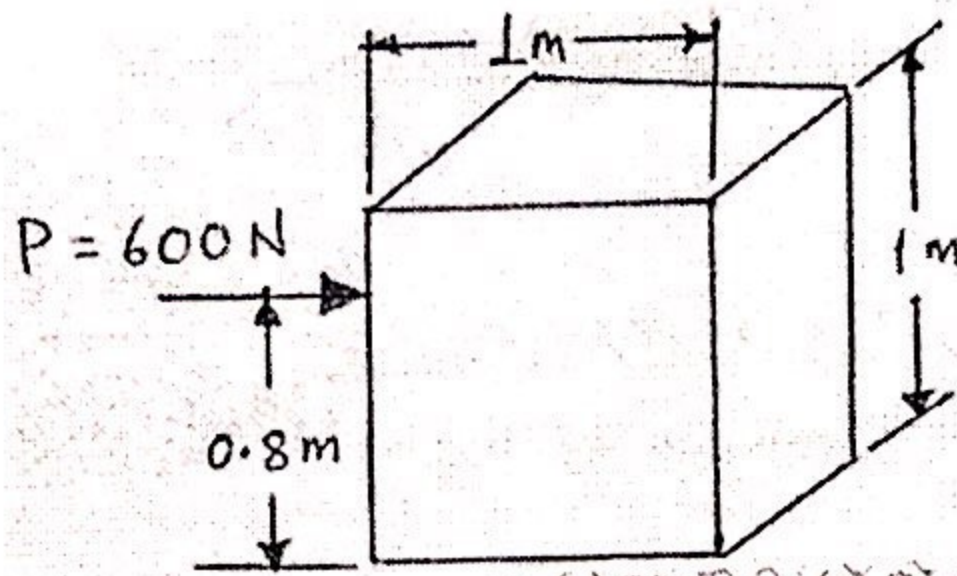

Fig. 2 Crate subjected to force

Q5   A.   A toggle mechanism shown in fig 3. Find the velocities of the slider by   (14)
    i) relative velocity method
    ii) Instantaneous center method

OA = 30
AB = 80
QB = BC = 100

(mm)
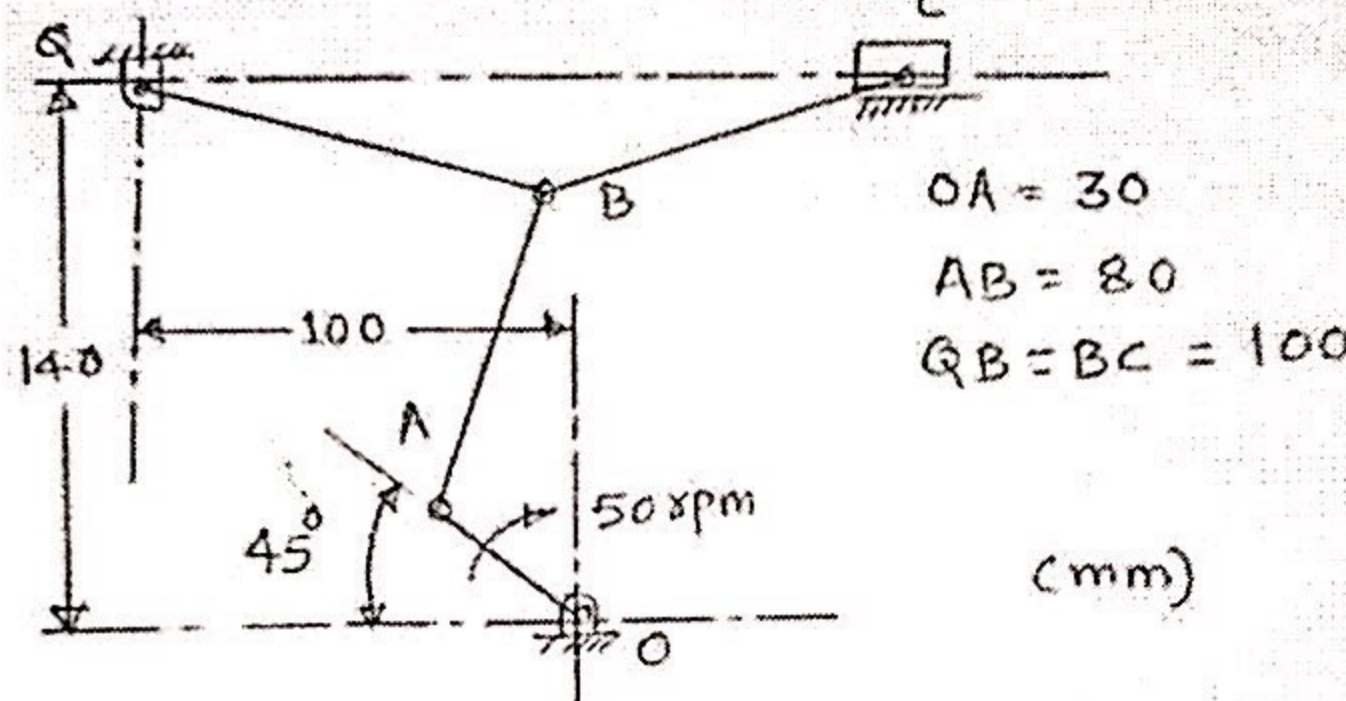
Fig. 3 Toggle Mechanism

B.   Explain self locking and self energising brakes.   (06)

Q6   A.   In the toggle mechanism as shown Fig. 3, the crank OA rotates at 210 rpm   (14)
    counterclockwise increasing at the rate of 60 rad/s2. For the given configuration,
    determine i) velocity of slider D and angular velocity of lin BD ii) acceleration of slider D
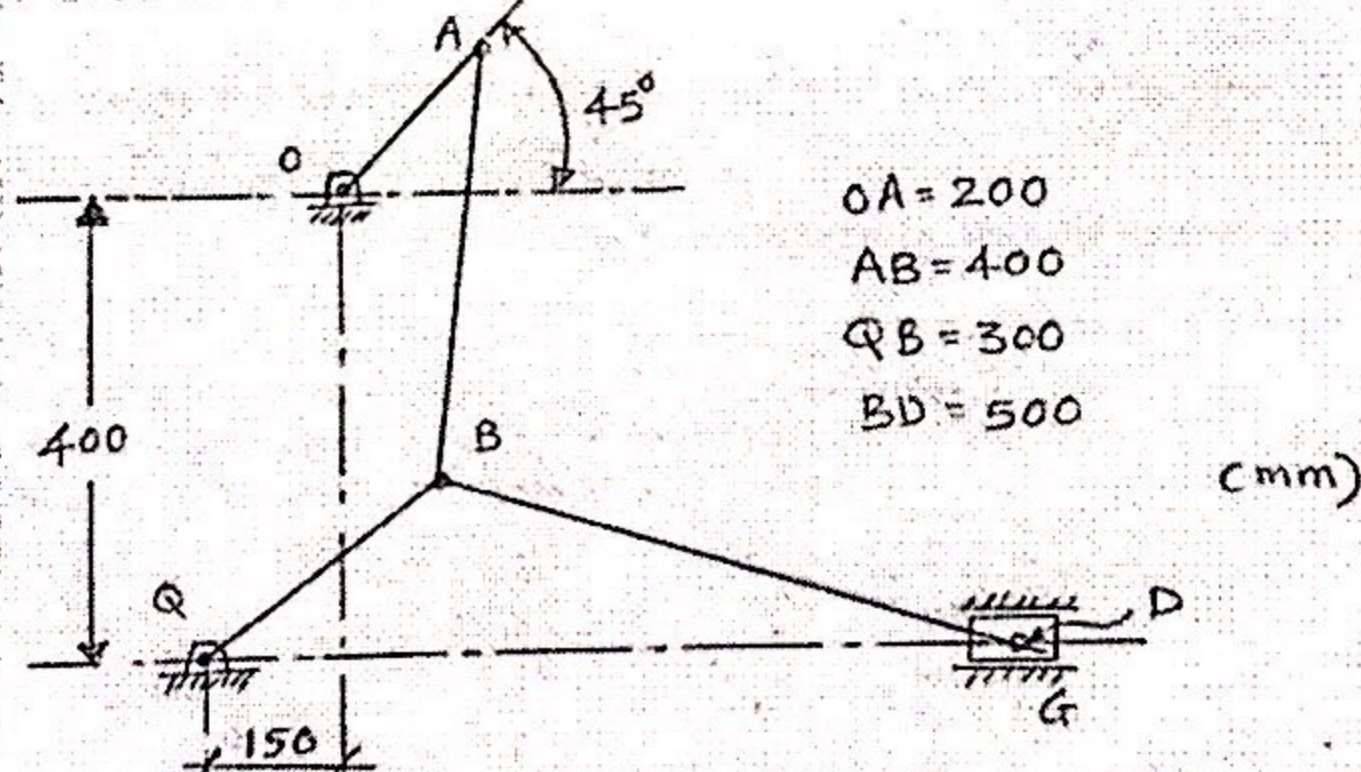   and angular acceleration of link BD.

OA = 200
AB = 400
QB = 300
BD = 500

(mm)

Fig. 4 Toggle Mechanism

B.   A fixed gear having 200 teeth meshes with a pinion having 50 teeth. The two are connected   (06)
    by an arm. What is the number of turns made by the pinion for one complete revolution
    of the arm about center of the gear?

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1T01424 - S.E.(MECHANICAL)(Sem IV) (Choice Based) / 41204 - PRODUCTION PROCESS II

(3 Hours) [Total Marks: 80]

NB (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**.

Q.1   Attempt any four: **20**
(a)   Classify various Additive Manufacturing Processes.
(b)   Classify various non-traditional machining processes
(c)   Specification of grinding wheel
(d)   Describe how a compound and combination die differ from each other.
(e)   Prove that in metal cutting, chip-flow velocity = cutting velocity **x** chip thickness coefficient

Q.2 (a) What is EDM? Write about its applications, advantages and limitations. Also state the functions and requirements of di-electric fluid **10**
Q.2 (b) State the different sources of heat in metal cutting? **10**

Q.3 (a) Explain various sheet metal production process with neat sketches **10**
Q.3 (b) Define jigs and fixtures. Describe the following with neat sketches: **10**
    (i) Locators (ii) Clamping devices (any two each)

Q.4 (a) While machining steel with a tool of [0-10-6-6-8-75-1] ORS shape following observations were made; **10**
(i)   Spindle speed 300 rpm   (ii)   Work diameter 40 mm
(iii)   Depth of cut 3.5 mm   (iv)   Tool feed rate 70 mm/min
(v)   Cut chip thickness 0.55 mm

Determine (i) Chip thickness ratio   (ii)   Shear plane angle
        (iii) Dynamic shear   (iv)   Theoretical continuous chip length per minute

Q.4 (b) Explain Photo Polymerization w.r.t principle of operation, process, advantages and disadvantages. Explain its application in relevance CMET (Tokyo) and 3D systems (US) **10**

Q.5 (a) Discuss the geometry and design steps for a broach tool with the help of a diagram **10**
Q.5 (b) Discuss in detail various factors affecting the tool life. Two cutting tools are being compared for a machining operation. The tool life equations are: Carbide tool: $VT^{1.8}$ = 2000 & HSS tool: $VT^{0.8}$ = 135, where V is the cutting speed in m/min and T is the tool life in min. Calculate the cutting speed value so that the carbide tool will provide higher tool life then HSS tool. **10**

Q.6 Write short notes on: **20**
(i)   Concept and importance of Additive Manufacturing
(ii)   Laser beam machining
(iii) Lathe tool dynamometer
(iv)   Diamond pin locator
(v)   Single point cutting tool geometry in ASA system

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1T01414 S.E.(MECHANICAL)(SEM IV) (R 2012) (CBSGS) / 39604 PRODUCTION PROCESSES-II

(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**.
       (5) Assume suitable data wherever **necessary**.

1.   **Attempt any FOUR of the following :**   **(20)**
      (a)   What is undercutting of gear teeth?
      (b)   Explain about closed loop systems in CNC machines.
      (c)   Explain the expression for shear plane angle in metal cutting.
      (d)   What is surface finish?
      (e)   Explain different types of milling cutters.

2.   **(a)**   What are the basic elements of drilling machine? Explain function of each.   **(10)**
      (b)   Writes about GM codes in CNC machines.   **(6)**
      (c)   Write about the maintenance of CNC machines.   **(4)**

3.   **(a)**   While machining a mild steel rod on the lathe, following results were obtained: **(10)** Width of cut = 2.5 mm, Uncut chip thickness = 0.27 mm, Chip thickness = 0.7 mm, Rake angle = 0 degree, Cutting force = 900 N, Thrust force = feed force = 450 N. Determine (i) Chip thickness ratio (ii) Chip reduction ratio (iii) Shear plane angle (iv) Coefficient of friction (v) Friction angle.
      (b)   What is gear grinding?   **(6)**
      (c)   Explain gear hobbing process of gear manufacturing.   **(4)**

4.   **(a)**   State the requirement of dynamometer and explain any one mechanical **(10)** dynamometer.
      (b)   Explain machinability.   **(6)**
      (c)   Write about tool angles in ASA (American Standards Association) system with **(4)** neat sketch.

5.   **(a)**   Describe HSS (High Speed Steel) tool.   **(10)**
      (b)   Write about Single point cutting tool.   **(6)**
      (c)   Describe various broach terms with neat sketch. Write the formula for the **(4)** following elements- Total number of teeth in a broach, Effective length.

6.   Write short notes on: **(20)**
      (a)   Classification of shapers.
      (b)   Geometry of milling cutter.
      (c)   Nomenclature of drilling tool.
      (d)   Form tool.
      (e)   Factors affecting tool life.

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Q.P. Code: 22666

(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 advantages and disadvantages of chain drive over belt drive?

  B. Differentiate between cycloidal and involute teeth gear.

  C. What are the different types of instantaneous centers?

  D. Classify Cams in detail.

  E. State and explain Work – Energy principle and conservation of energy.

Q2 A. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on **(10)**
    parallel shafts 1.95 m apart and are connected by cross belt. Find the length of
    the belt required and the angle of contact between the belt and each pulley. What
    power can be transmitted by the belt when the larger pulley rotates at 200 rpm,
    if the maximum permissible tension in the belt is 1×10^3 N and the coefficient of
    friction between the belt and the pulley is 0.25?

  B. Two mating gears have 20 and 40 involute teeth of module 10 mm and 20^0 **(10)**
    pressure angle. If addendum on each wheel is such that path of contact is
    maximum and interference is just avoided, find the path of contact, arc of contact
    and contact ratio. Also find the addendum for each wheel.

Q3 A. A cam rotating at 150 rpm operates a reciprocating roller follower of radius 2.5 **(10)**
    cm. The least radius of the cam is 5 cm and the stroke of the follower is 5 cm.
    Ascent and descent both takes place by uniform acceleration and retardation.
    Ascent takes place during 75^0 and descent during 90^0 of cam rotation. Dwell
    between ascent and descent is 60^0. Sketch displacement, velocity and
    acceleration diagrams and mark salient features.

  B. Derive an expression for the ratio of shaft velocities for Hooke's joint and draw the polar **(10)**
    diagram depicting the salient features of driven shaft speed.

Q4 A. The reduction of speed from 360 rpm to 120 rpm is desired by the use of chain **(10)**
    drive. The driving sprocket has 10 teeth. Find the number of teeth on the driven
    sprocket. If the pitch radius of the driven sprocket is 250 mm and the center to
    center distance between the two sprocket is 400 mm, find the pitch and the
   length of the chain.

  B. Derive an expression for minimum number of teeth required on a pinion to **(10)**
    avoid interference in involute gear teeth when it meshes with wheel.

{ Turn Over

Q5 A. What do you understand by coriolis component of acceleration? Explain with the help of an example. Draw all the directions of coriolis component of acceleration. **(10)**

B. A cylinder with mass of 50 kg is released from the rest on a plane inclined at 300 to the horizontal. The diameter of the cylinder is 2 m. If the cylinder rolls without slipping, then compute, i) the speed of the center point C of the cylinder after it has moved 2 m along the inclined plane and ii) friction force acting on the cylinder. **(10)**

Q6 A. Figure shows a Whitworth quick return motion mechanism. The various dimensions are : OQ = 100 mm; OA = 200 mm; QC = 150 mm; CD = 500 mm. The crank OA makes an angle of 60^0 with the vertical and rotates at 120 rpm in the clockwise direction. By instantaneous center method find the velocity of the ram D. Compare your answer with relative velocity method. **(14)**
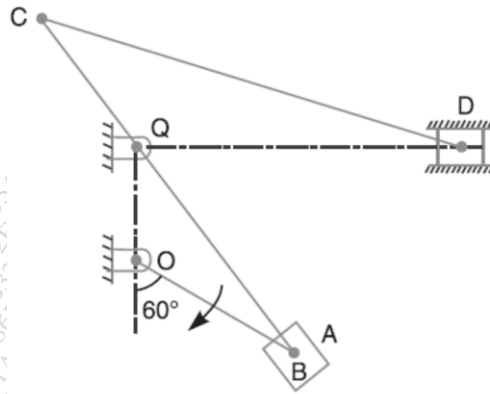
B. With the help of a neat sketch explain the terms base circle, prime circle and pitch circle with respect to cams. **(6)**

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