QP code: 10082457

SE sem-IV Mechanical R-19 C scheme

Time: 3 hours **Max. Marks: 80**

Note: 1. Assume suitable data if necessary
2. Figures to the right indicate full marks
3. Question No. 1 is compulsory
4. Solve any **three** out of the remaining **five** questions

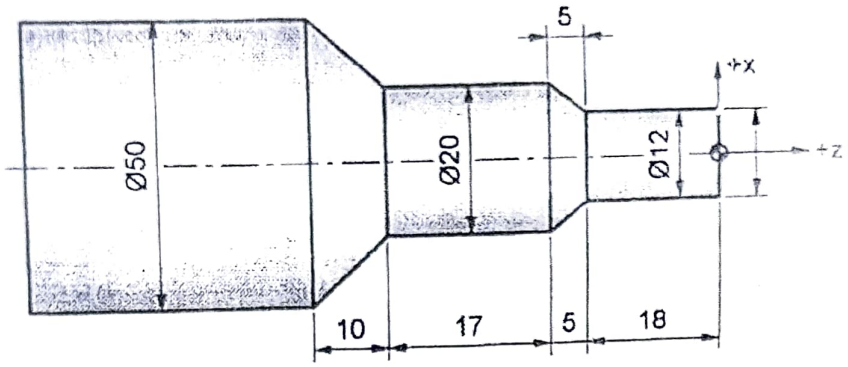
Q1.	**Solve any four**	
A	Draw and explain labelled V-I characteristics of zener diode	5
B	List the important characteristic of comparator	5
C	Implement basic gate using NAND gate	5
D	Explain need of digital to analogue conversion	5
E	Draw and explain equivalent circuit of an OP-Amp	5
Q2.		
A	Classify types of loads on the basis of time duration	10
B	Explain in brief functional block diagram of MSP430	10
Q3.		
A	What do you understand by a Digital circuit? Explain following terms regarding digital circuit 1. Logic level 2. Nosie immunity 3. Propagation delay 4. Fan out	10
B	Explain in detail first order low pass active filter	10
Q4.		
A	Explain Positive and Negative feedback of Open loop configuration of an Op-Amp	10
B	Comparison of SCR and TRIAC	10
Q5.		
A	Explain single-phase bridge inverter operation with neat circuit diagram and waveforms	10
B	Explain construction and characteristics of power BJT	10
Q 6.		
A	Explain GTO. How does it differ from an SCR	10
B	Compare Monostable and Astable Multivibrators	10

Q. 4 a Explain the significance of medical scan data in biomedical modeling. How are medical scan data acquired and processed for further analysis? [10]

b A Hermite cubic spline is defined by points (1,1) and (6,5), having tangent vectors as (0,4) and (4,0). Find the coordinates of the mid-point and slope at the same point. [10]

Q. 5 a Explain the working of Cone Beam CT with its advantages and disadvantages [10]

b Write a manual part program for the finishing the following component as shown in figure. Illustrate the meaning of each code used in the program and the tool movement by showing the tool path. Assume suitable data if needed. [10]



Q. 6 a Compare SLA, SLS, 3D Printing, FDM, and LOM in terms of their working principles and capabilities. [10]

b Discuss the potential challenges and limitations of Virtual Manufacturing. [5]

c Explain the socio-economic aspects of Virtual Manufacturing. [5]

 QP code: 10081222

SE Sem IV Mechanical R-19 C scheme

Duration: 3 Hours

Max. Marks: 80

N.B. (1) **Question No.1 is Compulsory**
(2) **Attempt any three questions out of remaining five questions.**
(3) **Figures to the right indicate full marks.**
(4) **Assume suitable data, if required and state it clearly.**

Q. 1 Solve **ANY FOUR** **[20]**

a What is the significance of CAD/CAM in the product life cycle?

b What are 2D transformation matrices for i) Translation ii) Rotation iii) Scaling iv) Mirroring.

c List the advantages, disadvantages, and applications of MRI scan.

d Explain at least 5 Standard G and M codes need to be included in the beginning and ending of any general program.

e Explain basic steps in rapid prototyping process.

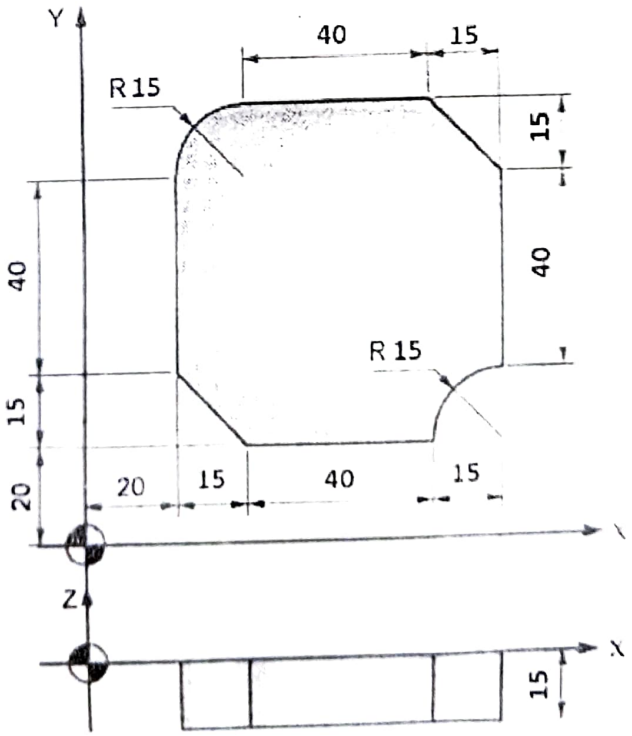
f Write short note on scope of Virtual Manufacturing.

Q. 2 a Explain working principle, application, advantages & disadvantages of Stereolithography Apparatus (SLA) **[10]**

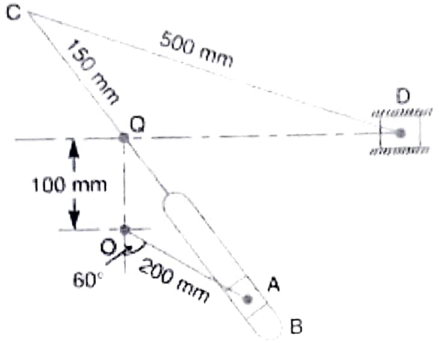
b A triangle PQR has its vertices P(0,0), Q(4,0) and R(2,3). It is translated by 4 units in X direction and 2 units in Y direction. It is then rotated by 90 degree in anticlockwise direction about the new position of point R. Find the vertices of the triangle. **[10]**

Q. 3 a i) Compare analytical and synthetic curves. **[5]**
ii) What are the applications of 3D solid CAD model. **[5]**

b Write a CNC part program using G and M codes for contouring a component as shown in following figure having thickness 15 mm. Assume suitable data if needed. **[10]**



B A quick return motion mechanism in which the driving crank OA rotates at 120 r.p.m. in a clockwise direction. For the position shown in figure , determine the magnitude and direction of the acceleration of the block D ; and the angular acceleration of the slotted bar QB. [10]



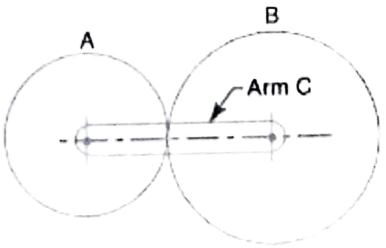
4 A A shaft rotating at 200 r.p.m. drives another shaft at 300 r.p.m. and transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is 1. an open belt drive, and 2. a cross belt drive. Take $\mu = 0.3$. [10]

B A pair of 20° full depth involute spur gears having 30 and 50 teeth respectively of module 4 mm are in mesh. The smaller gear rotates at 1000 r.p.m. Determine : 1. Sliding velocities at engagement and at disengagement of pair of a teeth, and 2. contact ratio. [10]

5 A A cam is rotating at 200 rpm operate a reciprocating roller follower of radius 2.5 cm. The least radius of cam is 30 mm, stroke of follower is 5 cm. Ascent takes place by uniform acceleration and deceleration and descent by simple harmonic motion. Ascent takes place by 70^0 and descent during 50^0 of cam rotation. Dwellbetween ascent and descent 60^0. Sketch displacement, velocity, acceleration, diagram. Indicate the maximum values of velocity and acceleration and state the nature of curve. [12]

B Obtain an expression for the length of a chain. [8]

6 A In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B. [10]



B Classify cams and follower and explain cam terminology. [10]

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QP code : 10085468

-SE sem IV Mechanical R-19 C scheme

Duration: 3hrs **[Max Marks:80]**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume any suitable data, wherever required, but justify the same. Assumptions made should be clearly stated.
(5) Illustrate the answers with sketches, wherever required.

1 Attempt any FOUR [20]

A Classify Kinematic pairs with suitable example [05]

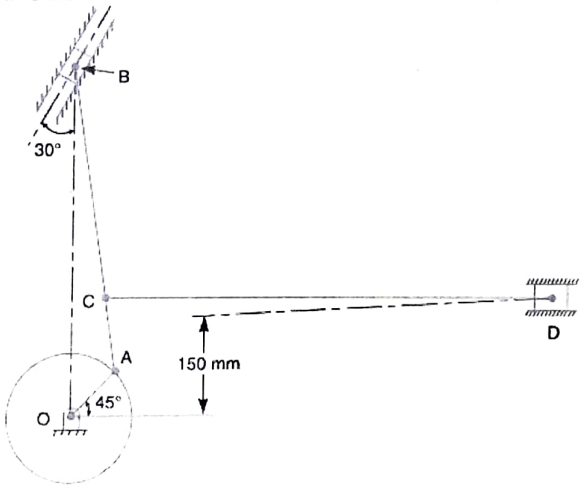
B Illustrate with neat sketch band brake and state its applications. [05]

C Classify gears with neat sketch and explain the law of gearing. [05]

D Differentiate between Involute and cycloidal gear tooth profile. [05]

E How Peaucellier's mechanism converts rotary motion into straight-line motion, explain in brief supported with a diagram. [05]

2 A The crank OA of a mechanism, as shown in Fig., rotates clockwise at 120 r.p.m. The lengths of various links are : OA = 100 mm ; AB = 500 mm ; AC = 100 mm and CD = 750 mm. Find, Velocity of point C ; Velocity of slider D ; and Angular velocities of the links AB and CD. [12]



B Explain the concept of centrifugal tension in case of belt drive and derive its equation and also state its effect on power transmission. [8]

3 A List the inversions of the single slider mechanism and explain the working of the oscillating cylinder engine mechanism. [8]

Q.5 A) 360 litres per second of water is flowing in a pipe. The pipe is bent by 120°. The pipe bend measures 360 mm × 240 mm and volume of the bend is 0.14 m^3. The pressure at the entrance is 73 kN/m^2 and the exit is 2.4 m above the entrance section. Find the force exerted on the bend. 10

B) Derive an expression for velocity distribution, discharge per unit width and shear stress when laminar flow between two parallel fixed plate. 10

Q.6 A) A horizontal pipeline 40 m long is connected to a water tank at 1 end, and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter, and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the center of the pipe. Considering all losses of head which occurs, determine the rate of low. Take f = 0.01 for both sections of the pipe. 10

B) Write a short note on **(any two)** 10
i) Newtonion and Non-Newtonion Fluids.
ii) Streamline and Bluff bodies.
iii) Importance of Reynold's transport theorem

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QPcode: 1008533

SE Sem IV R-19 C Scheme Mechanical

Time: 3 Hours **Total Marks: 80**

N.B. : (1) **Question No. 1 is compulsory.**
(2) Attempt any three questions out of remaining five questions.
(3) Figures to the right indicates full marks.
(4) Assume any suitable data if necessary and justify the same.

Q.1 Solve any **FOUR**

A) Explain velocity potential and stream function. 5

B) Calculate the weight density, density and specific gravity of one litre of liquid which weighs 7N. 5

C) Define boundary layer and explain boundary layer formation. 5

D) State and prove Pascal's Law and give some application. 5

E) Write a short note on Reynold's experiment. 5

Q.2 A) The velocity vector in a fluid flow is given as $V = 4x^3i - 10x^2yj + 2tk$ Find the velocity and acceleration of a fluid particle at (2, 1, 3) at t = 1. 10

B) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60 litres/sec. Find the reading of oil mercury differential manometer. Take Cd = 0.98 10

Q.3 A) An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and a length 300 m. The rate of flow of fluid through the pipe is 3.5 litres/s. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall. 10

B) Derive Euler's equation of motion and from that derive Bernoulli's equation. 10

Q.4 A) The velocity distribution in boundary layer is given by, 10

$$\frac{u}{U} = \frac{3}{2}\frac{y}{\delta} - \frac{1}{2}\frac{y^2}{\delta^2}$$

Calculate the following
i) Displacement thickness ii) Momentum thickness iii) Energy thickness
iv) check whether the boundary layer separation occurs or not.

B) The resisting force F of a plane during flight can be considered as dependent upon the length of aircraft *l*, velocity υ, air viscosity μ, air density ρ, and bulk modulus of air K. Express the functional relationship between these variables and the resisting force using dimensional analysis. 10

Q.4 (a) Use Gauss Divergence theorem to evaluate $\iint_s \bar{F}.\hat{n}ds$ where $\bar{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$ and s is the surface of the cube bounded by $x = 0,\ x = 1,\ y = 0,\ y = 1, z = 0, z = 1$. (6)

(b) Find the lines of regression for the following data to estimate y corresponding to $x = 155$ (6)

X	100	110	120	130	140	150	160	170	180	190
Y	45	51	54	61	66	70	74	78	85	89

(c) Find all possible Laurent's series expansion of the function $f(z) = \frac{5z+7}{(z+3)(z+2)}$ about $z = 0$ indicating region of convergence. (8)

Q.5 (a) The standard deviation from two random samples of sizes 9 and 13 are 1.99 and 1.9. Can the samples be regard as drawn from normal population with same standard deviation? $(F_{(8,12)}(0.025) = 3.51, F_{(12,8)}(0.025) = 4.20)$ (6)

(b) Using Stoke's Theorem to evaluate $\int_c \bar{F}.d\bar{r}$ where $\bar{F} = yi + zj + xk$ and c is the boundary of surface $x^2 + y^2 = 1 - z,\ z > 0$. (6)

(c) In an experiment on immunization of cattle from tuberculosis the following results were obtained (use 5% LOS) (8)

	Affected	Not Affected	Total
Inoculated	267	27	294
Not Inoculated	757	155	912
Total	1024	182	1206

Use Chi Square test to determine the efficiency of vaccine in preventing tuberculosis.

Q.6 (a) A bag contains 7 red balls and 3 black balls and another bag contains 4 red balls and 5 black balls. One ball is transferred from the first bag to the second bag then a ball is drawn from the second bag. If this ball happens to be red, Use Bayes' theorem to find the probability that a black ball was transferred. (6)

(b) A car hire firm has 2 cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the probability of days on which some demand is refused. (6)

(c) Show that $\bar{F} = (2xy + z)i + (x^2 + 2yz^3)j + (3y^2z^2 + x)k$ is conservative. Find scalar potential such that $\bar{F} = \nabla\emptyset$ and hence, find the work done by $\bar{F}$ in displacing a particle from (1,2,0) to (2,2,1). (8)

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14/5/25 QPcode: 10082313

SE Sem IV R-19 C Scheme Mechanical

(3 Hours) [Total Marks: 80]

N.B. : 1) Question No. **1** is **Compulsory**.
2) Answer **any THREE** questions from Q.2 to Q.6.
3) Figures to the right indicate full marks.

Q.1 **(a)** Fit a straight line to the following data **(5)**

X	1	2	3	4	5	6
Y	49	54	60	73	80	86

(b) Calculate Correlation coefficient between the variables x and y for the following data **(5)**

X	12	15	18	21	27
Y	2	4	6	8	12

(c) Let X be a continuous random variable with probability density function **(5)**

$f(x) = \frac{x}{6} + k,\ 0 \le x \le 3$ Find k and $(1 \le x \le 2)$.

(d) Find the line integral of $\bar{F} = x^2 i + xyj$ along line OP where, **(5)**

$O = (0,0)\ and\ P = (1,1)$.

Q.2 **(a)** A random variable x has the following probability function **(6)**

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

Find i) k ii) P(x > 2) iii) E(X)

(b) Prove that $\bar{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is solenoidal and find the constants a,b,c if $\bar{F}$ is irrotational. **(6)**

(c) Evaluate $\int_c \frac{z+6}{z^2-4} dz$ where c is (i) $|z| = 1$ (ii) $|z - 2| = 1$ (iii) $|z + 2| = 1$. **(8)**

Q.3 **(a)** The average breaking strength of steel rods is specified to be 17.5 (in units of 1000 kg) to test this sample of 14 rods tested & gave the following results: 15, 18, 16, 21, 19, 21, 17, 17, 15, 17, 20, 19, 17, 18. Is the result of the experiment significant? **(6)**

(b) Use Green's theorem to evaluate $\int_c (2x^2 - y^2)\,dx + (x^2 + y^2)dy$ where c is the boundary of the region enclosed by the lines $x = 0, y = 0, x = 2, y = 2$. **(6)**

(c) If height of 500 students are normally distributed with mean 68 inches and standard deviation 4 inches, Find the number of students having heights (i) greater than 72 inches (ii) between 65 and 71 inches (iii) less than 62 inches. **(8)**