

<b>4E1308</b>	Roll No. _____	[Total No. of Pages : <b>3</b> ]
	<b>4E1308</b>	
	<b>B.Tech. IV - Sem. (Main/Back) Examination, July - 2023</b> <b>Automobile/Mechanical Engineering</b> <b>4AE2-01 Data Analytics</b> <b>AE, ME, PT</b>	

**Time : 3 Hours**

**Maximum Marks : 70**

**Instructions to Candidates:**

*Attempt all ten questions from Part A, Attempt any five questions out of Seven questions from Part B and three questions out of Five questions from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205).*

**PART - A**

(Answer should be given up to 25 words only)

**All questions are compulsory**

**(10×2=20)**

1. What are the difference between Data Mining and Data Profiling?
2. Define the term 'Data Wrangling in Data Analytics'.
3. What is the significance of Exploratory Data Analysis (EDA)?
4. What is null hypothesis and how it is different from alternate hypothesis?
5. Explain what is an Outlier and how do you treat them?
6. Explain what is Hierarchical clustering algorithm?
7. Explain What is Map Reduce?
8. What is the difference between Bias and Error?
9. Differentiate between Mean, Median and Mode.
10. Explain the type I and Type II errors in statistics with suitable example?

## PART - B

(Analytical/Problem solving questions)

Attempt any Five questions

(5×4=20)

11. Explain descriptive, predictive, and prescriptive analytics.
12. What are the best methods for data cleaning?
13. Describe the following data properties in graphically form :
  - a. Skewness and kurtosis,
  - b. Outliers,
  - c. Normality,
  - d. Linearity,
  - e. Homoscedasticity.
14. Given  $f_X(X) = (\frac{1}{2})^X - 1 < x < 1$ , compute
  - i.  $E[X]$ .
  - ii.  $E[X^2]$ .
  - iii.  $\sigma_X$ .
  - iv.  $E[X/4+7]$ .
15. What is discriminant analysis? Describe the type of discriminant analysis with suitable example.
16. The following data relate the suicide rate  $y$  to the population size  $x_1$  and the yearly divorce rate  $x_2$  in eight different cities.

Location	Population (thousands)	Divorce rate per 100,000	Suicide rate per 100,000
Jaipur	679	30.4	11.6
Kota	1420	34.1	16.1
Udaipur	1349	17.2	9.3
Ajmer	296	26.8	9.1
Jodhpur	3975	29.1	8.4
Bikaner	323	18.7	7.7
Barmer	2200	32.6	11.3
Sirohi	633	32.5	8.4

  - a. Fit a multiple regression model to these data.
  - b. Predict the suicide rate in a city having a population of 400000 people and a divorce rate of 28.4 divorces yearly for every 1000 people.
17. List out some common problems faced by data analyst?

**PART - C**

(Descriptive/Analytical/Problem solving/Design Question)

Attempt any **Three** questions**(3×10=30)**

18. The following are the numbers of defective items produced by four workers using in turn three different machines.

Machine	Worker			
	1	2	3	4
A	41	42	40	35
B	35	42	43	36
C	42	39	44	47

Test whether there are significant differences between the machines and the workers.  
Test at 5% level of significance.

19. Describe univariate, bivariate, and multivariate analysis with examples.
20. A laboratory technician measures the breaking strength of each of 5 kinds of linen thread by means of 4 different instruments and obtains the following results (in ounces) :

	Measuring instrument			
	$I_1$	$I_2$	$I_3$	$I_4$
<b>Thread 1</b>	20.6	20.7	20.0	21.4
<b>Thread 2</b>	24.7	26.5	27.1	24.3
<b>Thread 3</b>	25.2	23.4	21.6	23.9
<b>Thread 4</b>	24.5	21.5	23.6	25.2
<b>Thread 5</b>	19.3	21.5	22.2	20.6

Looking at the threads as treatments and the instruments as blocks, perform an analysis of variance at the level of significance  $\alpha = 0.005$ .

21. Describe the time series data analysis with formulation used for ARIMA model.



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	<b>4E1309</b>	
	<b>B.Tech. IV Sem. (Main/Back) Examination, July - 2023</b>	
	<b>Automobile Mech. Engineering</b> <b>4AE3-04 Digital Electronics</b> <b>AE, ME</b>	
<b>Time : 3 Hours</b>		<b>Maximum Marks : 70</b>

**Instructions to Candidates:**

*Attempt all ten questions from Part A, Attempt any five questions out of Seven questions from Part B and three questions out of Five questions from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205).*

**PART - A**

(Answer should be given upto 25 words only)

All questions are compulsory.

(10×2=20)

1. Give the circuit diagram of half wave and full wave rectifier.
2. What is the R-C timing circuit?
3. Give the difference between analog and digital signals.
4. Enlist about the various types of basic gates and universal gates.
5. What do you mean by transmission media?
6. What is an Op-Amp?
7. Define common mode rejection ratio.
8. Explain IEEE frequency spectrum.
9. What is Regulated power supply.
10. What is Barkhausen's criteria.

## **PART - B**

### **(Analytical/Problem Solving questions)**

Attempt any **Five** questions.

**(5×4=20)**

1. What is P-N junction diode. Explain with the help of V-I characteristic of P-N junction diode.
2. Describe about the inverting and non - inverting amplifier using Op-Amp.
3. With the help of truth - table, discuss about the full adder.
4. Discuss about the BJT as a single stage CE amplifier.
5. What are the R-C timing circuits?
6. What are the amplitude and frequency modulation schemes.
7. With the help of schematic diagram, explain block diagram of micro controller.

## **PART - C**

### **(Descriptive/Analytical/Problem Solving/Design question)**

Attempt any **Three** questions.

**(3×10=30)**

1. What do you mean by Op-Amp. Explain about the integrator and differentiator circuit using Op-Amp.
2. Draw the internal block diagram of IC - 555. Also discuss about the astable multivibrator operation of the IC - 555.
3. What are the multiplexer and demultiplexer. Design a 4:1 MUX.
4. What is the need of modulation. Give the different components of communication system.
5. What is Zener diode. Draw and discuss its V-I characteristics and its applications.

**4E1310****4E1310**

**B.Tech. IV Sem. (Main/Back) Examination, July - 2023**  
**Automobile/Mech. Engineering**  
**4AE4-05 Fluid Mechanics and Fluid Machines**  
**AE, ME**

**Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

*Attempt all ten questions from Part A, Attempt any five questions out of Seven questions from Part B and three questions out of Five questions from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205).*

**PART - A**

**(Answer should be given up to 25 words only)**

**All questions are compulsory.**

**(10×2=20)**

1. Define meta - centre and meta centric height.
2. Convert  $1 \text{ N s/m}^2$  into poise.
3. Define the terms (i) speed ratio (ii) flow ratio.
4. What is draft tube.
5. Write the names of flow measuring devices.
6. What is manometer?
7. Write the name of hydraulic turbines.
8. Define (i) coefficient of discharge (ii) coefficient of velocity.
9. State the bernoulli's theorem.
10. Define the terms (i) Gross head (ii) Net head.



## PART - B

### (Analytical/Problem solving questions)

Attempt any **Five** questions.

(5×4=20)

1. The velocity distribution for flow over a plate is given by  $u = 2y - y^2$ , where  $u$  is the point velocity in metre per second at a distance  $y$  metre above the plate. Determine the shear stress at  $y = 9$  cm. Assume dynamic viscosity as 8 poise.
2. Draw the diagrams of U-tube manometer and inverted U-tube manometer.
3. Derive an expression for the force exerted on a sub - merged vertical plane surface.
4. A wooden log of 0.5 m diameter and 6m length is floating vertical in water. Find the depth of wooden log in water when the specific gravity of the wooden log is 0.7.
5. Define (i) Laminar flow. (ii) Turbulent flow (iii) steady flow (iv) uniform flow (v) stream line.
6. Derive an expression  $C_d = C_v \times C_c$ .
7. Draw inlet and outlet velocity triangles for pelton wheel.

## PART - C

### (Descriptive/Analytical/Problem solving/Design questions)

Attempt any **Three** questions.

(3×10=30)

1. A solid cylinder of diameter 5 m has a height of 5.0 m. Find the meta - centric height of the cylinder if the specific gravity of the material of cylinder is 0.7 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.
2. Derive an expression for depth of centre of pressure ( $h^*$ ) of an immersed vertical surface from free surface of the liquid  $h^* = \frac{I_G}{Ah} + \bar{h}$ .
3. Prove that the discharge through a venturimeter is given by the relation
 
$$Q = C_d \frac{a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \sqrt{2gh}$$
4. A circular tank of diameter 3m contains water upto height of 4m. The tank is provided with an orifice of diameter 0.4 m at the bottom. Find the time taken by water for completely emptying the tank. Take  $C_d = 0.6$ .
5. Derive an expression for the loss of head due to sudden enlargement of a pipe.

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	<b>4E1311</b>	
	<b>B.Tech. IV-Sem. (Main/Back) Examination, July - 2023</b> <b>Automobile Engineering</b> <b>4AE4-06 Manufacturing Processes</b> <b>AE, ME</b>	

**Time : 3 Hours**

**Maximum Marks : 70**

**Instructions to Candidates:**

*Attempt all ten questions from Part A, Attempt any five questions out of Seven questions from Part B and three questions out of Five questions from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (As Mentioned in form No. 205).*

**PART - A**

(word limit 25)

**All questions are compulsory.**

(10×2=20)

1. Define Permeability of moulding sand.
2. Explain what is a "core print".
3. Define hot working.
4. Give four applications of hot rolling.
5. Explain backward extrusion.
6. Explain blanking operation.
7. What is brazing?
8. Define carburizing flame in gas welding.
9. Name any four properties of powder processed materials.
10. Give any four applications of powder metallurgy.



**PART - B****(word limit 100)****Attempt any five questions.****(5×4=20)**

1. Name and explain different types of pattern allowances.
2. Name and explain any five casting defects and their causes.
3. Explain with neat sketch different types of rolling mills.
4. Explain cup drawing and deep drawing processes with neat sketches.
5. Discuss thermit welding process and its applications.
6. Explain explosive welding process.
7. Define following elements of gating system with a neat sketch.
  - a. Pouring basin.
  - b. Sprue.
  - c. runner.
  - d. riser.

**PART - C****Attempt any Three questions.****(3×10=30)**

1. Explain hot chamber die casting process with a neat sketch. What are its applications?
  2. Classify forging operations. Explain drop forging and press forging methods and their typical applications.
  3. Explain following types of press tool dies.
    - a. Combination die.
    - b. Compound dies.
    - c. Progressive die
    - d. Transfer die.
  4. Explain TIG and MIG welding process with neat sketches.
  5. Explain various steps involved in powder metallurgy process in detail.
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	4E1234	
	<b>B.Tech. IV - Sem. (Back) Examination, July - 2023</b> <b>PCC Automobile Engineering</b> <b>4AE4-06 Manufacturing Processes</b> <b>AE, ME</b>	

**Time : 3 Hours**

**Maximum Marks : 120**

**Min. Passing Marks : 42**

***Instructions to Candidates:***

*Attempt all ten questions from Part A, five questions out of Seven from Part B and Four questions out of Five from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205).*

**PART - A**

**(Answer should be given up to 25 words only)**

**All questions are compulsory.**

**(10×2=20)**

1. What are four primary manufacturing processes?
2. What are the distinguishing features between a casting and a pattern?
3. What is meant by double - shrinkage allowance?
4. Explain why the sprue should be tapered?
5. Give examples of the typical products of the following processes : die casting, centrifugal casting, permanent mould casting, shell moulding.
6. What is draft allowance? How is it provided for patterns?
7. "Natural sand is often not suitable for moulding purposes" Comment on this statement giving reasons.
8. What are the various elements that comprise the gating system?
9. Explain sintering process in connection with the powder metallurgy.
10. How is brazing different from welding?



## PART - B

### (Analytical/Problem solving questions)

Attempt any **Five** questions.

(5×8=40)

1. For resistance spot welding of two aluminium sheets, each 2 mm thick, a current of 5000 A was passed for 0.15 sec. The total resistance was estimated to be  $75 \mu\Omega$  and the nugget diameter and thickness were measured to be 5 mm and 2.5 mm respectively. What would be the proportion of heat energy utilized for welding if the melting energy per unit volume for aluminium is taken as  $2.9 \text{ J/mm}^3$ ?
2. Calculate the permeability number of sand if it takes 1 min 25 s to pass  $2000 \text{ cm}^3$  of air at a pressure of  $5 \text{ gm/cm}^2$  through the standard sample.
3. Explain the principle underlying the resistance - welding process. Give names of products where in the following processes are used :
  - a. Spot welding.
  - b. Seam welding.
  - c. Flash welding.
4. What is meant by core prints? Explain how they are to be provided?
5. What are the various methods available for making the metal powder?
6. What are TIG and MIG welding processes and give their differences with suitable example.
7. "Extrusion is a process involving three - dimensional compression". Explain why brittle materials can be worked by extrusion more successfully than by some other metal - working methods.

## PART - C

### (Descriptive/Analytical/Problem Solving/Design questions)

Attempt any **Four** questions.

(4×15=60)

1. Give a step - by - step procedure for the cold chamber diecasting process. Also discuss the advantages and limitations of hot and cold chamber processes.
2. Describe any four common type of discontinuities that may develop in a welded joint. What remedies you suggest to avoid them?
3. Enumerate the steps involved in powder metallurgy process. Discuss these steps. Name the materials used in powder metallurgy. What are the limitations of powder metallurgy?
4. Calculate the size of a cylindrical riser (height and diameter equal) necessary to feed a steel slab casting  $25 \times 25 \times 5 \text{ cm}$ , with a top riser casting poured horizontally into the mold.
5. Determine the die and punch sizes for blanking a circular disc of 20 mm diameter from a C20 steel sheet whose thickness is 1.5 mm (shear strength of annealed C20 steel 294 MPa).



<b>4E1312</b>	Roll No. _____	[Total No. of Pages : <b>3</b> ]
	<b>4E1312</b>	
	<b>B.Tech. IV - Sem. (Main/Back) Examination, July - 2023</b> <b>Automobile/Mech. Engineering</b> <b>4AE4-07 Theory of Machines</b> <b>AE, ME</b>	

Time : 3 Hours

Maximum Marks : 70

**Instructions to Candidates:**

*Attempt all ten questions from Part A, Attempt any five questions out of Seven questions from Part B and three questions out of Five questions from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205).*

**PART - A**

(Answer should be given up to 25 words only)

**All questions are compulsory.**

(10×2=20)

1. State the Grashof's law.
2. Differentiate between joint and pair in kinematics.
3. Why does the solid friction not depend on area of contact? Explain.
4. What are the factors those play important role in selection of the clutch face material?
5. State the law of gearing.
6. What do you understand by the term 'interference' as applied to gears?
7. What are the different types of motion with which a follower can move?
8. Briefly explain the application of gyroscopic principles.
9. State the necessary conditions to achieve static balancing and dynamic balancing.
10. Explain the term 'Hammer blow' for an uncoupled two cylinder locomotive engine.

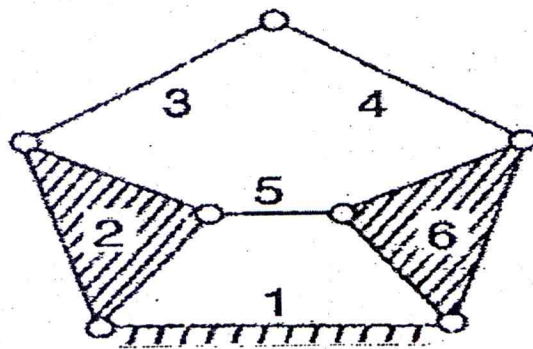
## PART - B

(Analytical/Problem solving questions)

Attempt any five questions.

(5×4=20)

1. Derive an equation for the efficiency of self locking screws.
2. The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from bow. Determine the gyroscopic couple and its effect upon the ship when the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h.
3. Explain the effect of tractive effort and swaying couple on two cylinder locomotives.
4. Define the following terms as applied to cam with a neat sketch :
  - i. Base circle,
  - ii. Pitch circle,
  - iii. Pressure angle, and
  - iv. Stroke of the follower.
5. Determine the degree of freedom of the mechanism shown in below figure using Kutzbach mobility criterion.



6. State and prove the law of gearing.
7. Four masses  $m_1$ ,  $m_2$ ,  $m_3$  and  $m_4$  are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are  $45^\circ$ ,  $75^\circ$  and  $135^\circ$ . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.



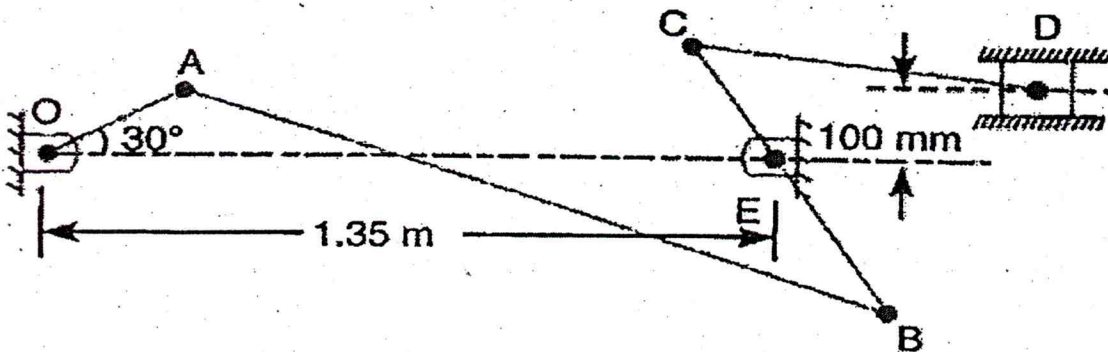
## PART - C

(Descriptive/Analytical/Problem solving/Design questions)

Attempt any Three questions.

(3×10=30)

1. A mechanism as shown in below figure has the dimensions,  $OA = 200 \text{ mm}$ ;  $AB = 1500 \text{ mm}$ ;  $BC = 600 \text{ mm}$ ;  $CD = 500 \text{ mm}$  and  $BE = 400 \text{ mm}$ . Locate all the instantaneous centres. If crank  $OA$  rotates uniformly at  $120 \text{ r.p.m.}$  clockwise, find the velocity of points  $B, C$  and  $D$ .



2. Describe with the help of a neat sketch the principles of operation of an internal expanding shoe. Derive the expression for the braking torque.
3. Two shafts  $A$  and  $B$  are co-axial. A gear  $C$  (50 teeth) is rigidly mounted on shaft  $A$ . A compound gear  $D-E$  gears with  $C$  and an internal gear  $G$ .  $D$  has 20 teeth and gears with  $C$  and  $E$  has 35 teeth and gears with an internal gear  $G$ . The gear  $G$  is fixed and is concentric with the shaft axis. The compound gear  $D-E$  is mounted on a pin which projects from an arm keyed to the shaft  $B$ . Sketch the arrangement and determine the number of teeth on internal gear  $G$  assuming that all gears have the same module. If the shaft  $A$  rotates at  $110 \text{ r.p.m.}$ , find the speed of shaft  $B$ .
4. A cam is to be designed for a knife edge follower with the data, Cam lift =  $40 \text{ mm}$  during  $90^\circ$  of cam rotation with simple harmonic motion, Dwell for the next  $30^\circ$ , During the next  $60^\circ$  of cam rotation, the follower returns to its original position with simple harmonic motion, and Dwell during the remaining  $180^\circ$ . The radius of the base circle of the cam is  $40 \text{ mm}$ . Draw the profile of the cam when, (i) the line of stroke of the follower passes through the axis of the cam shaft, and (ii) the line of stroke is offset  $20 \text{ mm}$  from the axis of the cam shaft.
5. Discuss the concept of primary and secondary balancing. Also explain why the unbalanced force due to reciprocating masses is partially balanced by revolving mass.



Roll No. \_\_\_\_\_

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4E1235

4E1235

**B.Tech. IV - Sem. (Back) Examination, July - 2023****Automobile Engineering****4AE4-07 Theory of Machines****Time : 3 Hours****Maximum Marks : 160****Min. Passing Marks : 56****Instructions to Candidates:**

*Attempt all ten questions from Part A, five questions out of Seven questions from Part B and Four questions out of Five questions from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205).*

**PART - A****(Answer should be given up to 25 words only)****All questions are compulsory.****(10×3=30)**

1. Differentiate between kinematic chain and mechanism.
2. State the law of gearing.
3. What are the course objectives of theory of machines?
4. Find the degree of freedom of a four bar mechanism with the help of kutzbach equation.
5. Make a comparison of involute and cycloidal tooth forms.
6. Write down the principle of gyroscopic couple.
7. What is meant by static and dynamic balancing?
8. Discuss various types of cams.
9. What is the function of clutch?
10. What is reverted gear train? Where it is used?

## PART - B

### (Analytical/Problem solving questions)

Attempt any **Five** questions.

(5×10=50)

1. Sketch and explain the inversions of a single slider crank chain.
2. Give the classification of various types of brakes and clutches used in automobiles.
3. The pitch of 50 mm mean diameter threaded screw of a screw jack is 12.5 mm. The coefficient of friction between the screw and nut is 0.13. Determine the torque required on the screw to raise a load of 25kN, assuming the load to rotate with the screw. Determine the ratio of the torque required to raise the load to the torque required to lower the load and also the efficiency of machine.
4. Explain the gyroscopic effect on four wheeled vehicles.
5. What is path of contact? Derive the relation for its magnitude. Also define the arc of contact.
6. A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the mass revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg and 4 kg respectively.  
Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.
7. In a slider crank mechanism, the length of the crank and the connecting rod are 200mm and 800 mm respectively. Locate all the I-centres of the mechanism for the position of crank when it has turned 30° from the inner dead centre. Also, find the velocity of the slider and the angular velocity of the connecting rod if the crank rotates at 40 rad/s.

## PART - C

### (Descriptive/Analytical/Problem Solving/Design questions)

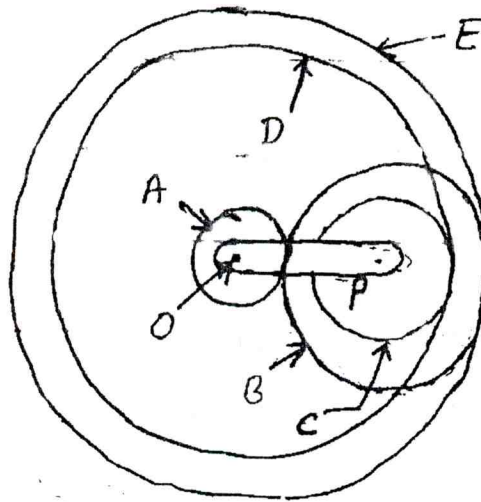
Attempt any **Four** questions.

(4×20=80)

1. Write a short note on :
  - a. Ackermann steering mechanism.
  - b. Quick return mechanism.
2.
  - a. Derive an expression for the minimum number of teeth required on the wheel in order to avoid interference when it meshes with pinion.
  - b. Two gears in mesh having a module of 8 mm and a pressure angle of 20°. The larger gear has 57 teeth while the pinion has 23 teeth. If the addendum on pinion and gear wheel is equal to one module, determine the number of pairs of teeth in contact and the angle of action of the pinion and the gear wheel.

3. Construct the profile of a cam to suit the following :  
 cam shaft diameter = 40 mm; least radius of cam = 25 mm, Diameter of roller = 25 mm ; Angle of lift =  $120^\circ$ , Angle of fall =  $150^\circ$ ; lift of the follower = 40 mm. Number of pauses are two of equal interval between motions during the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of cam shaft is uniform. The line of stroke of the follower is off - set 12.5 mm from the centre of the cam.
4. Figure shows diagrammatically a compound epicyclic gear train wheels A, D and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P, on the end of arm OP. All the teeth on different wheels have same module. A has 12 teeth, B has 30 teeth and C has 14 teeth externally. Find the number of teeth on wheels D and E which are cut internally.

If the wheel A is driven clock wise at 1 r.p.s while D is driven counter clockwise at 5 r.p.s. determine the magnitude and direction of the angular velocities of arm OP and wheel E.



5. Derive the following expressions, for an uncoupled two cylinder locomotive engine.
1. Variation in tractive force.
  2. Swaying couple.
  3. Hammer blow.