R22

Code No: R22A0310

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester Supplementary Examinations, November 2025

Dynamics of Machinery

(ME)

Roll No										

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B
Part A is compulsory which carries 10 marks and Answer all questions.
Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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		PART-A (10 Marks) (Write all answers of this part at one place)	BCLL	CO(s)	Marks
1	A	Write the formula for Gyroscopic couple?	L2	CO-I	[1M]
	B	What is the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve?	L1	CO-I	[1M]
	C	The acceleration of the piston in a reciprocating steam engine is _____	L1	CO-II	[1M]
	D	Explain Limiting friction?	L3	CO-II	[1M]
	E	What is the difference between absorption and transmission dynamometers?	L2	CO-III	[1M]
	F	Draw the turning moment diagram of a four-stroke cycle internal combustion engine?	L3	CO-III	[1M]
	G	Define dynamic balancing?	L2	CO-IV	[1M]
	H	Define frequency?	L2	CO-IV	[1M]
	I	Define free vibrations?	L2	CO-V	[1M]
	J	What do you understand by transmissibility ?	L1	CO-V	[1M]
		PART-B (50 Marks) **SECTION-I**			
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 stern. Determine the gyroscopic couple and its effect upon the ship: 1. when the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h. 2. when the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.	L3	CO-I	[10M]
		OR			
3		A four-wheeled trolley car of mass 2500 kg runs on rails, which are 1.5 m apart and travels around a curve of 30 m	L3	CO-I	[10M]

radius at 24 km / hr. The rails are at the same level. Each wheel of the trolley is 0.75 m in diameter and each of the two axles is driven by a motor running in a direction opposite to that of the wheels at a speed of five times the speed of rotation of the wheels. The moment of inertia of each axle with gear and wheels is 18 kg-m^2. Each motor with shaft and gear pinion has a moment of inertia of 12 kg-m^2. The centre of gravity of the car is 0.9 m above the rail level. Determine the vertical force exerted by each wheel on the rails taking into consideration the centrifugal and gyroscopic effects. State the centrifugal and gyroscopic effects on the trolley.

SECTION-II

4	A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 r.p.m. The reciprocating parts has a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2. Calculate the effective turning moment on the crank shaft.	**L3**	**CO-II**	**[10M]**
	OR			
5	A centrifugal clutch is to transmit 15 kW at 900 r.p.m. The shoes are four in number. The speed at which the engagement begins is 3/4th of the running speed. The inside radius of the pulley rim is 150 mm and the centre of gravity of the shoe lies at 120 mm from the centre of the spider. The shoes are lined with Ferrodo for which the coefficient of friction may be taken as 0.25. Determine: 1. Mass of the shoes, and 2. Size of the shoes, if angle subtended by the shoes at the centre of the spider is 60º and the pressure exerted on the shoes is 0.1 N/mm^2.	**L4**	**CO-II**	**[10M]**

SECTION-III

6	A single cylinder, single acting, four stroke gas engine develops 20 kW at 300 r.p.m. The work done by the gases during the expansion stroke is three times the work done on the gases during the compression stroke, the work done during the suction and exhaust strokes being negligible. If the total fluctuation of speed is not to exceed ± 2 per cent of the mean speed and the turning moment diagram during compression and expansion is assumed to be triangular in shape, find the moment of inertia of the flywheel.	**L3**	**CO-III**	**[10M]**
	OR			
7	Explain with a schematic diagram Proney brake Dynamometer.	**L3**	**CO-III**	**[10M]**

SECTION-IV

8	An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and has a stroke of 0.6 m. The rotating masses	**L3**	**CO-IV**	**[10M]**

	per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 1.5 m apart. The cranks are at right angles. The whole of the rotating and 2/3 of the recipro cating masses are to be balanced by masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses. Find the fluctuation in rail pressure under one wheel, variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 r.p.m.			
	OR			
9	A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor.	**L3**	**CO-IV**	**[10M]**
	SECTION-V			
10	Explain in detail the types of vibrations?	**L3**	**CO-V**	**[10M]**
	OR			
11	A beam of length 10 m carries two loads of mass 200 kg at distances of 3 m from each end together with a central load of mass 1000 kg. Calculate the frequency of transverse vibrations. Neglect the mass of the beam and take $I = 10^9$ mm4 and $E = 205\times10^3$ N/mm^2.	**L4**	**CO-V**	**[10M]**

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R22

R22

Code No: R22A0308

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester Supplementary Examinations, November 2025

Thermal Engineering-I

(ME)

Roll No										

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B
Part A is compulsory which carries 10 marks and Answer all questions.
Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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Note: Steam tables and Mollier charts are permitted

		PART-A (10 Marks)	BCLL	CO(s)	Marks
		(Write all answers of this part at one place)			
1	A	How to increase efficiency of Rankine cycle?	**L1**	**CO-I**	**[1M]**
	B	Describe the accessories of boiler.	**L2**	**CO-I**	**[1M]**
	C	What do you mean by a supersaturated flow?	**L1**	**CO-II**	**[1M]**
	D	How will you classify condensers?	**L2**	**CO-II**	**[1M]**
	E	Discuss the advantages of a steam turbine.	**L4**	**CO-III**	**[1M]**
	F	What is the maximum efficiency for Parson's reaction turbine.	**L3**	**CO-III**	**[1M]**
	G	How to increase the Regenerative cycle thermal efficiency.	**L4**	**CO-IV**	**[1M]**
	H	Draw Open cycle gas turbine layout.	**L6**	**CO-IV**	**[1M]**
	I	Write the classification of jet propulsive engines.	**L5**	**CO-V**	**[1M]**
	J	Draw the T-S diagram for jet propulsive engine.	**L6**	**CO-V**	**[1M]**
		PART-B (50 Marks)			
		SECTION-I			
2	A	State the methods of increasing the thermal efficiency of a Rankine cycle.	**L1**	**CO-I**	**[5M]**
	B	Explain with a neat diagram the working of a Reheating cycle.	**L4**	**CO-I**	**[5M]**
		OR			
3	A	Describe the working principle with sketches including any one HP boiler.	**L2**	**CO-I**	**[5M]**
	B	What is the Working principle of boiler?	**L3**	**CO-I**	**[5M]**
		SECTION-II			
4	A	Dry saturated steam enters a steam nozzle at a pressure of 15 bar and is discharged at a pressure of 2.0 bar. If the dryness fraction of discharge steam is 0.96, what will be the final velocity of steam? Neglect initial velocity of steam. If 10% of heat drop is lost in friction, find the percentage reduction in the final velocity.	**L4**	**CO-II**	**[5M]**
	B	What is the effect of friction on the flow through a steam	**L5**	**CO-II**	**[5M]**

nozzle? Explain with the help of h-s diagram.

OR

5	A	Explain the effects of air leakage in a condenser.	**L2**	**CO-II**	**[5M]**
	B	A surface condenser is designed to handle 10000 kg of steam per hour. The steam enters at 0.08 bar abs. and 0.9 dryness and the condensate leaves at the corresponding saturation temperature. The pressure is constant throughout the condenser. Estimate the cooling water flow rate per hour, if the cooling water temperature rise is limited to 10°C.	**L5**	**CO-II**	**[5M]**

SECTION-III

6	A	Explain with a neat sketch the working of an impulse steam turbine.	**L3**	**CO-III**	**[5M]**
	B	Define the following as related to steam turbines, Speed ratio; Blade velocity co-efficient and Diagram efficiency.	**L4**	**CO-III**	**[5M]**

OR

7	A	Explain the pressure and velocity variations along the axial direction of an impulse turbine.	**L1**	**CO-III**	**[5M]**
	B	The outlet angle of the blade of a Parson's turbine is 20° and the axial velocity of flow of steam is 0.5 times the mean blade velocity. If the diameter of the ring is 1.25 m and the rotational speed is 3000 rpm. determine: Inlet angles of blades.	**L5**	**CO-III**	**[5M]**

SECTION-IV

8		Describe the different operations of simple gas turbine. Derive also the expression for its efficiency.	**L1**	**CO-IV**	**[10M]**

OR

9		State the methods of increasing the thermal efficiency of a open cycle gas turbine explain any one method with neat sketch.	**L2**	**CO-IV**	**[10M]**

SECTION-V

10	A	Describe with neat sketches the working of a turbo jet engine.	**L6**	**CO-V**	**[5M]**
	B	What are the needs and demands by turbo jet engines.	**L4**	**CO-V**	**[5M]**

OR

11	A	Write a short note on Liquid propellant Rocket Engine.	**L3**	**CO-V**	**[5M]**
	B	State the fundamental differences between the jet propulsion and rocket propulsion	**L5**	**CO-V**	**[5M]**

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R22

R22

Code No: R22A0309

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester Supplementary Examinations, November 2025

Strength of Materials

(ME)

Roll No										

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B
Part A is compulsory which carries 10 marks and Answer all questions.
Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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			BCLL	CO(s)	Marks
		PART-A (10 Marks)			
		(Write all answers of this part at one place)			
1	A	Write the relation between Young's modulus, Bulk modulus, and Modulus of rigidity.	**L2**	**CO-I**	**[1M]**
	B	Define Factor of Safety.	**L2**	**CO-I**	**[1M]**
	C	What is the point of contraflexure?	**L2**	**CO-II**	**[1M]**
	D	Draw the S.F. diagram for a cantilever beam with a point load at the free end.	**L2**	**CO-II**	**[1M]**
	E	Write the formula for shear stress in a beam.	**L2**	**CO-III**	**[1M]**
	F	What are the assumptions in the theory of simple bending?	**L2**	**CO-III**	**[1M]**
	G	Define slope and deflection.	**L2**	**CO-IV**	**[1M]**
	H	What is the moment area method?	**L2**	**CO-IV**	**[1M]**
	I	Write Lame's equations for thick cylinders.	**L2**	**CO-V**	**[1M]**
	J	What is polar section modulus?	**L2**	**CO-V**	**[1M]**
		PART-B (50 Marks)			
		SECTION-I			
2	A	A bar of 30 mm diameter is subjected to an axial load of 60 kN. Calculate the stress and strain in the bar if E = 200 GPa.	**L3**	**CO-I**	**[5M]**
	B	A bar 1.5 m long is subjected to an axial pull of 50 kN. If the cross-sectional area is 300 mm^2 and Young's modulus is 2×10^5 N/mm^2, calculate the elongation.	**L4**	**CO-I**	**[5M]**
		OR			
3		A steel bar is 900 mm long; its two ends are 40 mm and 30 mm in diameter and the length of each rod is 200 mm. The middle portion of the bar is 15 mm in diameter and 500 mm long. If the bar is subjected to an axial tensile load of 15 kN, find its total extension.	**L4**	**CO-I**	**[10M]**
		SECTION-II			
4	A	Explain the relationship between load intensity, shear force, and bending moment.	**L2**	**CO-II**	**[5M]**
	B	Draw the S.F. and B.M. diagrams for a cantilever beam subjected to a UDL.	**L4**	**CO-II**	**[5M]**

OR

5	A	A cantilever beam of length 3 m carries a point load of 10 kN at its free end. Determine the maximum bending moment and draw the diagram.	**L4**	**CO-II**	**[5M]**
	B	A simply supported beam of 4 m span carries a load of 20 kN at its center. Calculate the maximum bending moment and draw the diagrams.	**L4**	**CO-II**	**[5M]**

SECTION-III

6	A	Differentiate between flexural stress and shear stress in beams.	**L2**	**CO-III**	**[5M]**
	B	Derive the bending equation, $M/I = f/y = E/R$	**L4**	**CO-III**	**[5M]**

OR

7	A	A rectangular beam 200 mm wide and 400 mm deep carries a UDL of 5 kN/m over a span of 6 m. Calculate the maximum bending stress.	**L4**	**CO-III**	**[5M]**
	B	Derive a section modulus for a hollow circular section.	**L4**	**CO-III**	**[5M]**

SECTION-IV

8		A cantilever beam of length 3 m carries a point load of 20 kN at a distance of 2 m from the fixed end. Using Macaulay's method, calculate: a) The slope at the free end b) The deflection at the free end (Take EI=1.5×10^4 kNm^2)	**L4**	**CO-IV**	**[10M]**

OR

9		A simply supported beam of span 6 m carries a uniformly distributed load of 5 kN/m over the entire span. Using double integration method**,** determine: a) The slope at the supports b) The deflection at the center of the beam (Take EI=2×10^4 kNm^2)	**L4**	**CO-IV**	**[10M]**

SECTION-V

10		A hollow shaft is to transmit 500 kW at 150 rpm. The internal diameter is 60% of the external diameter. If the maximum shear stress is limited to 60 MPa, find: a) The external and internal diameters b) The polar moment of inertia c) The weight per meter length if the density of material is 7800 kg/m^3	**L4**	**CO-V**	**[10M]**

OR

11	A	A thick cylinder of internal diameter 200 mm and external diameter 300 mm is subjected to an internal pressure of 50 MPa. Calculate the radial and hoop stresses.	**L4**	**CO-V**	**[5M]**
	B	Describe polar moment of inertia and polar section modulus.	**L2**	**CO-V**	**[5M]**

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R22

R22

Code No: R22A0311

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester Supplementary Examinations, November 2025

Manufacturing Processes

(ME)

Roll No										

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B
Part A is compulsory which carries 10 marks and Answer all questions.
Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

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			BCLL	CO(s)	Marks
		PART-A (10 Marks)			
		(Write all answers of this part at one place)			
1	A	Write the requirements of good pattern.	**L1**	**CO-I**	**[1M]**
	B	What are the applications of casting.	**L1**	**CO-I**	**[1M]**
	C	What is the working principle of plasma arc welding?	**L1**	**CO-II**	**[1M]**
	D	List any four welding defects.	**L1**	**CO-II**	**[1M]**
	E	List out the types of open die forging.	**L1**	**CO-III**	**[1M]**
	F	Define upsetting and drawing down in forging operation.	**L1**	**CO-III**	**[1M]**
	G	What is strain hardening?	**L1**	**CO-IV**	**[1M]**
	H	List two advantages of electromagnetic forming.	**L1**	**CO-IV**	**[1M]**
	I	Define Photopolymerization.	**L1**	**CO-V**	**[1M]**
	J	Mention two applications of Additive Manufacturing.	**L1**	**CO-V**	**[1M]**
		PART-B (50 Marks)			
		SECTION-I			
2	A	Recommend the basic rules to be followed in good casting design.	**L5**	**CO-I**	**[5M]**
	B	Explain the different types of defects in casting with a neat sketch?	**L4**	**CO-I**	**[5M]**
		OR			
3	A	What are the types of moulding sand and explain any two type of moulding sand	**L4**	**CO-I**	**[5M]**
	B	Explain ceramic mould casting with a neat sketch.	**L4**	**CO-I**	**[5M]**
		SECTION-II			
4	A	Explain friction welding with a neat sketch?	**L4**	**CO-II**	**[5M]**
	B	Explain with neat sketch about the principle of resistance welding.	**L4**	**CO-II**	**[5M]**
		OR			
5	A	Evaluate the equipment and operation of GTAW process.	**L5**	**CO-II**	**[5M]**
	B	Explain about the advantages and disadvantages of GTAW	**L4**	**CO-II**	**[5M]**

SECTION-III

6	A	Formulate the advantages and limitations of closed die forging.	**L6**	**CO-III**	**[5M]**
	B	Explain precision forging process.	**L4**	**CO-III**	**[5M]**
		OR			
7	A	Explain with neat sketches the process of tube drawing of metals.	**L4**	**CO-III**	**[5M]**
	B	Evaluate wire drawing.	**L5**	**CO-III**	**[5M]**

SECTION-IV

8	A	Describe coining and embossing with suitable diagrams.	**L2**	**CO-IV**	**[5M]**
	B	Discuss the Electro-Hydraulic Forming process with a neat sketch.	**L1**	**CO-IV**	**[5M]**
		OR			
9	A	Compare and contrast hot rolling and cold rolling processes.	**L5**	**CO-IV**	**[5M]**
	B	Explain Contour Roll Forming and how it differs from conventional rolling.	**L4**	**CO-IV**	**[5M]**

SECTION-V

10	A	Explain the process of Stereolithography (SLA) with a neat diagram and mention its applications.	**L3**	**CO-V**	**[5M]**
	B	Describe the Selective Laser Sintering (SLS) process and list its advantages and limitations.	**L3**	**CO-V**	**[5M]**
		OR			
11	A	Assess the advantages and disadvantages of Rapid Prototyping compared to conventional manufacturing.	**L5**	**CO-V**	**[5M]**
	B	Compare the accuracy, speed, and cost of different Additive Manufacturing techniques**.**	**L5**	**CO-V**	**[5M]**

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R22

Code No: R22A0026

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester Supplementary Examinations, November 2025

Probability, Statistics and Queueing Theory

(ME & AE)

Roll No										

Time: 3 hours **Max. Marks: 60**

Note: This question paper contains two parts A and B
Part A is compulsory which carries 10 marks and Answer all questions.
Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

***

			BCLL	CO(s)	Marks
		PART-A (10 Marks)			
		(Write all answers of this part at one place)			
1	A	If X is a continuous random variable with probability density function (PDF)$f_X(x)=3x^2$ for $0<x<10$, what is the probability that X is less than 0.5?	**L1**	**CO-I**	**[1M]**
	B	Determine the variance of the outcome when rolling a fair six-sided die.	**L1**	**CO-I**	**[1M]**
	C	Given a normal distribution with a mean of 100 and a standard deviation of 15, what is the z-score for a value of 130?	**L1**	**CO-II**	**[1M]**
	D	If a random variable Y follows a Poisson distribution with parameterλ (the average rate of occurrence), what are its mean and variance?	**L1**	**CO-II**	**[1M]**
	E	What is the significance of the Pearson correlation coefficient, and what does its value indicate?	**L1**	**CO-III**	**[1M]**
	F	What are the two lines of regression, and when are they used?	**L1**	**CO-III**	**[1M]**
	G	What is the difference between a one-tailed and a two-tailed test?	**L1**	**CO-IV**	**[1M]**
	H	What is the purpose of a large sample test for the difference of means, and which test statistic is used?	**L1**	**CO-IV**	**[1M]**
	I	Define traffic intensity.	**L1**	**CO-V**	**[1M]**
	J	Write infinite queue and a finite queue in queuing model.	**L4**	**CO-V**	**[1M]**
		PART-B (50 Marks)			
		SECTION-I			
2		A retail store tracks the number of purchases made by customers in a day (X), where XXX follows the discrete probability mass function (PMF) given below:	**L2,L3**	**CO-I**	**[10M]**

Number of Purchases (X)	Probability P(X)
0	0.1
1	0.3
2	0.4
3	0.2

Compute the expected number of purchases E(X). Find the variance Var(X) of the number of purchases. How does the expectation help the store in inventory management? What insights does the variance provide regarding customer behavior?

OR

3 A study examines the relationship between students' scores in Mathematics (X) and Science (Y). The joint probability distribution $f_{X,Y}(x,y)$ is given in the table below: **L2,L3,L4 CO-I [10M]**

Mathematics Score (X)	Science Score (Y)	Joint Probability P(X,Y)
80	85	0.2
85	90	0.3
90	95	0.25
95	100	0.25

Find the marginal probability density functions of Mathematics and Science scores. Compute the conditional probability P(X|Y=90). Interpret the results in terms of student performance.

SECTION-II

4 A A factory produces bolts, and it is known that 5% of them are defective. A quality inspector selects a random sample of 20 bolts. Let Y represent the number of defective bolts in the sample. **L3,L4,L5 CO-II [5M]**

(a) Compute the probability that exactly 2 bolts in the sample are defective.

(b) Find the probability that at most 3 bolts are defective in the sample.

B A factory produces metal rods, and it is observed that defects occur at an average rate of 2 per 100 meters. **L3,L4,L5 CO-II [5M]**

(a) Determine the probability that exactly 3 defects are found in a 50 meter section.

(b) What is the probability of finding no defects in a 75 meter section?

OR

5 The scores on a university entrance exam are normally distributed with a mean(μ) of 75 and a standard deviation (σ) of 10. **L1, L4,L5 CO-II [10 M]**

a) What is the probability that a randomly selected student scores above 85?

b) What is the probability that a student scores between

65 and 85?

c) What score corresponds to the 90th percentile?

d) If the top 5% of students are awarded scholarships, what is the minimum score required to receive a scholarship?

SECTION-III

6 A group of students recorded the number of hours they studied for a final exam and their corresponding exam scores **L3,L4, L5** **CO-III** **[10M]**

Study Hours	2	4	6	8	10	12	14	16
Exam Scores	55	60	65	70	75	80	85	90

Calculate the correlation coefficient between study hours and exam scores. Additionally, determine the equation of the regression line to predict exam scores based on study hours.

OR

7 A real estate agency collects data on house prices (X1), house size in square feet (X2), and the number of bedrooms (X3). Given the data set below, find the multiple linear regression equation. **L3,L4,L5** **CO-III** **[10M]**

House	Price (X1) in $10000s	Size (X2) in sq. ft.	Bedrooms (X3)
1	25	18	3
2	30	22	4
3	27	20	3
4	32	25	5
5	28	21	4

SECTION-IV

8 An educator wants to compare the effectiveness of two teaching methods. Two groups of students are taught using different methods. Group A (n=15) has an average test score of 78 with a standard deviation of 5, while Group B (n=15) has an average test score of 83 with a standard deviation of 6. Test at the 5% significance level whether there is a significant difference between the mean test scores of the two groups. **L3,L4, L5** **CO-IV** **[10M]**

OR

9 A six-sided die is rolled 120 times, yielding the following outcomes: **L3,L4,L5** **CO-IV** **[10M]**

Face Value	1	2	3	4	5	6
Frequency	15	18	22	20	25	20

At the 5% significance level, test whether the die is fair.

SECTION-V

10	A	Customers arrive at a bank's service counter in a Poisson manner at an average rate of 5 per hour. The cashier can serve customers at an average rate of 7 per hour, and the service time follows an exponential distribution. (a) Find the average number of customers waiting in the queue. (b) Calculate the average time a customer spends in the bank.	**L3,L4,L5**	**CO-V**	**[5M]**
	B	A car mechanic services vehicles in the order they arrive. The service time follows an exponential distribution with a mean of 1 hour per vehicle. Cars arrive randomly at a rate of 5 vehicles per 10-hour workday. (a) Find the mechanic's idle time per day. (b) Calculate the average number of vehicles in the system.	**L3,L4,L5**	**CO-V**	**[5M]**
		OR			
11		A computer support desk can handle up to 4 customer issues at a time (including one currently being resolved). Customers arrive following a Poisson process at a rate of 6 per hour, and the average service time is 0.1 hours. (a) Determine the steady-state probability distribution of the number of customers in the system. (b) Compute the expected number of customers in the system.	**L2,L3**	**CO-V**	**[10M]**

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