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Wandoor (PO), Pin 679328, Ph: 04931-249666
acaswandoor@gmail.com, Website: www.ambedkarcollegewdr.in

COURSE PLAN			
Course code and title	**MTS5 B08 LINEAR PROGRAMMING**		
Class	BSC Mathematics	**Semester**	5th Semester
Regulation	2019	**Academic year**	2023-24
Course prerequisites	Basic Algebra, Functions and Graphs, Set Theory and logic, Calculus and Optimization Concepts.		
Course objectives	• Formulate, model and Solve Linear programming models		
	• Understand duality and game theory.		
	• Solve transportation and assignment problems by algorithms		

COURSE OUTCOMES

At the end of the course the student would be able to…

CO1	**Understanding Linear Programming Basics**
CO2	**Formulation of Linear Programming Problems**
CO3	**Implementation of the Simplex Method**
CO4	**Application of Duality Theory**
CO5	**Evaluation and Application of Transportation & Assignment Problems**

MAPPING OF PROGRAM OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓		✓	✓					✓	
CO2	✓		✓		✓		✓			
CO3	✓	✓	✓		✓			✓	✓	
CO4	✓		✓	✓	✓			✓		
CO5	✓			✓	✓		✓	✓		

PO1	Knowledge Acquisition	PO6	Ethics & Social Responsibility
PO2	Communication & Leadership	PO7	Research, Innovation & Entrepreneurship

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PO3	**Professional Skills**	**PO8**	**Lifelong Learning**
PO4	**Digital Intelligence**	**PO9**	**Global Perspective**
PO5	**Scientific awareness & Critical Thinking**	**PO10**	**Democratic Co-existence**

PROGRAM SPECIFIC OUTCOMES

PSO1	**Theoretical and Applied Mathematics Competency**
PSO2	**Advanced Analytical and Computational Techniques**
PSO3	**Mathematical Modeling and Problem-Solving**

MAPPING OF COURSE OUTCOMES TO PROGRAM EDUCATIONAL OUTCOMES

PROGRAM EDUCATIONAL OUTCOMES	COURSE OUTCOMES				
	CO1	CO2	CO3	CO4	CO5
PEO1 Development of Leadership Qualities	✓		✓	✓	✓
PEO2 Lifelong Learning and Societal Contribution	✓	✓	✓		
PEO3 Entrepreneurial and Global Competence		✓		✓	✓

References

TEXT BOOKS:

1. Text -Linear Programming and Its Applications: James K. Strayer *Under- graduate Texts in Mathematics Springer (1989) ISBN: 978-1-4612-6982-3*

REFERENCES:

1. Robert J. Vanderbei: Linear Programming: Foundations and Extensions(2/e) Springer Science Business Media LLC (2001) ISBN: 978-1-4757- 5664-7

2. Frederick S Hiller, Gerald J Lieberman: Introduction to Operation Research(10/e) *McGraw-Hill Education, 2 Penn Plaza, New York (2015) ISBN: 978-0-07-352345-3*

3. Paul R. Thie, G. E. Keough: An Introduction to Linear Programming and Game Theory(3/e) *John Wiley and Sons, Ins. (2008) ISBN: 978-0-470-23286-6*

e-learning resources	**https://sites.math.washington.edu/~perkins/381AWin14/handouts**
Mode of Evaluation	Internal Examination (20%) End Semester Examination (80%)
Faculty	**Sharshad Ameera, Assistant Professor/ Department of Mathematics**
e-mail id	sharshadameera@gmail.com

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COURSE PLAN - MTS5 B08 LINEAR PROGRAMMING

No of lecture hours	Planned Date	Topics to be covered		Reference/ Teaching aids and methods	Actual date	Weekly review
	MODULE I - Geometric Linear Programming & The Simplex Algorithm					
1	02/06/23	Profit Maximization and Cost Minimization, *Typical motivating examples*		T1/WB	02/06/23	
2	06/06/23	*Mathematical formulation*, CanonicalForms for Linear Programming Problems		T1/WB	06/06/23	
3	08/06/23	*Objective functions, constraint set, feasible solution, optimal solution*		T1/WB	08/06/23	
4	09/06/23	Polyhedral Convex Sets, *convex set, extreme point,*		R1/WB	09/06/23	
5	13/06/23	*Theorems asserting existence of optimal solutions,* The Two Examples Revisited		T1/WB	13/06/23	
6	15/06/23	***graphical solutions to the problems***		T1/PPT	15/06/23	
7	16/06/23	A Geometric Method for Linear Programming, *the difficulty in the method,* Concluding Remarks		R2/PPT	16/06/23	
8	20/06/23	Canonical Slack Forms for Linear Programming Problems; Tucker Tableaus, *slack variables, Tucker tableaus ,independent variables* or *non- basic variables, dependent variables* or *basic variables.*		T1/PPT	~~20/06/23~~ 22/06/23	
9	22/06/23	An Example: Profit Maximization, *method of solving a typical canonical maximization problem*		T1/WB/PPT	22/06/23	
10	28/06/23	The Pivot Transformation, *The Pivot Transformation for Maximum and Minimum Tableaus*		T1/WB	28/06/23	
11	29/06/23	Cost Minimization		T1/WB	29/06/23	
12	30/06/23	*method of solving a typical canonical minimization problem*		T1/PPT	30/06/23	
13	4/07/23	The Simplex Algorithm for Maximum Basic Feasible Tableaus.		T1/WB/PPT	04/07/23	
14	06/07/23	The Simplex Algorithm for Maximum Tableaus, Negative Transposition.		T1/WB/PPT	06/07/23	
15	07/07/23	The Simplex Algorithm for Minimum Tableaus, Cycling, Simplex Algorithm Anti cycling Rules.		T1/WB/PPT	07/07/23	
16	10/07/23	Concluding Remarks		T1/WB	10/07/23	
Planned hours	**Actual hours**		**Sign of Faculty** / **Review by HoD**		**Review by Principal**	
	MODULE II - Noncanonical Linear Programming Problems and Duality Theory					
17	13/07/23	Unconstrained Variables		T1/WB	13/07/23	
	14/07/23	Equations of Constraint,		T1/WB	14/07/23	

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19	17/07/23	Concluding Remarks				T1/WB/PPT	19/07/23
20	20/07/23	Duality in Canonical Tableaus				T1/WB/PPT	20/07/23
21	21/07/23	The Dual Simplex Algorithm				T1/WB/PPT	21/07/23
22	24/07/23	The Dual Simplex Algorithm for Minimum Tableaus				T1/WB	24/07/23
23	27/07/23	The Dual Simplex Algorithm for Minimum Tableaus - additional problems.				T1/WB	27/07/23
24	28/07/23	The Dual Simplex Algorithm for Maximum Tableaus.				T1/WB	27/07/23
25	01/08/23	The Dual Simplex Algorithm for Maximum Tableaus- Additional Problems				T1/WB	01/08/23
26	03/08/23	Matrix Formulation of Canonical Tableaus.				R2/WB	03/08/23
27	04/08/23	The Duality Equation.				T1/WB	04/08/23
28	08/08/23	Duality in Noncanonical Tableaus.				T1/WB	08/08/23
29	10/08/23	Duality in Noncanonical Tableaus- Additional Problems.				T1/WB/PPT	10/08/23
30	11/08/23	Concluding Remarks				T1/WB/PPT	11/08/23
Planned hours	**Actual hours**	**Date**	**Sign of Faculty**	**Review by HoD**		**Review by Principal**	
		UNIT III - Matrix Games, Transportation and Assignment problems.					
31	17/08/23	Two- Person Zero- Sum Matrix Games.				T1/WB/PPT	17/08/23
32	18/08/23	Domination in a Matrix Game.				T1/WB/PPT	18/08/23
33	05/09/23	Linear Programming Formulation of Matrix Games.				R1/WB	05/09/23
34	07/09/23	The Von Neumann Minimax Theorem.				T1/WB	07/09/23
35	08/09/23	The Example Revisited.				T1/WB/PPT	07/09/23
36	11/09/23	Two More Examples.				T1/WB/PPT	11/09/23
37	14/09/23	Concluding Remarks				T1/WB/PPT	14/09/23
38	15/09/23	The Balanced Transportation Problem.				R2/PPT	15/09/23
39	19/09/23	The Vogel Advanced- Start Method (VAM).				R2/PPT	19/09/23
40	21/09/23	The Transportation Algorithm.				R2/PPT	21/09/23
41	26/09/23	Another Example.				R1/PPT	26/09/23
42	29/09/23	Unbalanced Transportation Problems.				T1/WB/PPT	29/09/23
43	03/10/23	Unbalanced Transportation Problems- Additional Problems.				T1/WB/PPT	03/10/23
44	05/10/23	The Assignment Problem.				T1/WB/PPT	05/10/23
45	06/10/23	The Hungarian Algorithm.				R3/WB	06/10/23
46	10/10/23	The Minimum-Entry Method.				R1/WB	12/10/23
47	12/10/23	The Northwest-Corner Method				T1/WB	12/10/23
48	13/10/23	Concluding Remarks.				T1/WB/PPT	13/10/23
Planned hours	**Actual hours**	**Date**	**Sign of Faculty**	**Review by HoD**		**Review by Principal**	

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Course outcome –Program outcome Mapping Table

		Cognitive level	Program outcomes 1-Low Correlation 2-Moderate Correlation 3- High correlation											
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DIRECT METHOD														
CO1	Understanding of Linear Programming Basics	Remember	3		1	2					1			
CO2	Formulation of Linear Programming Problems	Apply	2		1		3		3					
CO3	Implementation of the Simplex Method	Apply & Analyze	2	1	3		2			2	1			
CO4	Application of Duality Theory	Create	3		2	1	3			2				
CO5	Evaluation and Application of Transportation & Assignment Problems	Innovate	2			1	3		2	1				
INDIRECT METHOD														
Class Room contests		Analyze & Create	1		2		3			2				

Course Faculty **IQAC Member** **Principal**

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COURSE PRE-ANALYSIS

Dear Students,

Welcome back to class, I would like to thank all of you for sparing your time in filling up this Course Pre-Analysis survey for the effective conduct of Computer Aided Design and Manufacturing Course. As you know that this survey is meant for knowing the knowledge level of the students with respect to this course, please fill it very carefully. At this juncture, I am glad to welcome the suggestions from you all (if any).

Rate your prior knowledge about the topics mentioned below

Course Outcomes	Description	Rate your prior knowledge about the topics			
		Excellent (4)	Good (3)	Moderate (2)	Fair (1)
CO1	Understanding of Linear Programming Basics	✓			
CO2	Formulation of Linear Programming Problems		✓		
CO3	Implementation of the Simplex Method		✓		
CO4	Application of Duality Theory			✓	
CO5	Evaluation and Sensitivity Analysis		✓		

Name of the student:

Ameera Thasni K.

Signature of the student

Ameera.

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Syllabus

FIFTH SEMESTER

MTS5 B08 LINEAR PROGRAMMING

3 hours/week **3 Credits** **75 Marks [Int:15+Ext:60]**

Aims, Objectives and Outcomes

Linear programming problems are having wide applications in mathematics, statistics, computerscience, economics, and in many social and managerial sciences. For mathematicians it is a sort of mathematical modelling process, for statisticians and economists it is useful for planning many economic activities such as transport of raw materials and finished products from one place to another with minimum cost and for military heads it is useful for scheduling the training activities and deployment of army personnel. The emphasis of this course is on nurturing the linear programming skills of students *via*. the algorithmic solution of small-scale problems, both in the general sense and in the specific applications where these problems naturally occur. On successful completion of this course, the students will be able to

- solve linear programming problems geometrically
- understand the drawbacks of geometric methods
    - solve LP problems more effectively using Simplex algorithm *via*. the use of condensedtableau of A.W. Tucker
    - convert certain related problems, not *directly* solvable by simplex method, into a form that can be attacked by simplex method.
    - understand duality theory, a theory that establishes relationships between linearprogramming problems of maximization and minimization
- understand game theory
    - solve transportation and assignment problems by algorithms that take advantage of thesimpler nature of these problems

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Syllabus

Text -Linear Programming and Its Applications: James K. Strayer *Under- graduate Texts in Mathematics Springer (1989) ISBN: 978-1-4612-6982-3*

Module-I (18 hrs)

Chapter1 ***Geometric Linear Programming:***

Profit Maximization and Cost Minimization, typical motivating examples, mathematical formulation, Canonical Forms for Linear Programming Problems, objective functions, constraint set, feasible solution, optimal solution, Polyhedral Convex Sets, convex set, extreme point, theorems asserting existence of optimal solutions, The Two Examples Revisited, graphical solutions to the problems, A Geometric Method for Linear Programming, the difficulty in the method, Concluding Remarks

Chapter2 The Simplex Algorithm:- Canonical Slack Forms for Linear Programming Problems; Tucker Tableaus, *slack variables, Tucker tableaus, independent variables* or *non- basic variables, dependent variables,* or *basic variables.* An Example: Profit Maximization, *method of solving a typical canonical maximization problem*, The Pivot Transformation, *The Pivot Transformation for Maximum and Minimum Tableaus,* An Example: Cost Minimization, *method of solving a typical canonical minimization problem*, The Simplex Algorithm for Maximum Basic Feasible Tableaus, The Simplex Algorithm for Maximum Tableaus, Negative Transposition; The Simplex Algorithm for Minimum Tableaus, Cycling, Simplex Algorithm Anti cycling Rules, Concluding Remarks

Module-II (14 hrs)

Chapter3 ***Noncanonical Linear Programming Problems:- Unconstrained Variables, Equations of Constraint, Concluding Remarks***

Chapter 4: Duality Theory:- Duality in Canonical Tableaus, The Dual Simplex Algorithm, *The Dual Simplex Algorithm for Minimum Tableaus, TheDual Simplex Algorithm for Maximum Tableaus,* Matrix Formulation of Canonical Tableaus, The Duality Equation, Duality in Noncanonical Tableaus, Concluding Remarks

Module-III (18 hrs)

Chapter 5 Matrix Games:- An Example; Two- Person Zero- Sum Matrix Games, Domination in a Matrix Game, Linear Programming Formulation of Matrix Games, The Von Neumann Minimax Theorem, The ExampleRevisited, Two More Examples, Concluding Remark

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Chapter 6 Transportation and Assignment Problems:- The Balanced Transportation Problem, The Vogel Advanced Start Method (VAM), The Transportation Algorithm, Another Example, Unbalanced Transportation Problems, The Assignment Problem, *The Hungarian Algorithm,* ConcludingRemarks, *The Minimum Entry Method*, *The Northwest Corner Method*

References:

1	RobertJ.Vanderbei:LinearProgramming:Foundations and Extensions (2/e) Springer Science+Business Media LLC(2001) ISBN: 978-1-4757-5664-7
2	Frederick S Hiller, Gerald J Lieberman: Introduction to Operation Research(10/e) *McGraw-Hill Education, 2 Penn Plaza, New York(2015)ISBN: 978-0-07-352345-3*
3	Paul R. Thie, G. E. Keough : An Introduction to Linear Programming andGame Theory(3/e) *John Wiley and Sons,Ins.(2008)ISBN: 978-0-470-23286-6*
4	Louis Brickman: Mathematical Introduction to Linear Programmingand Game Theory *UTM,Springer Verlag,NY(1989)ISBN:0-387-96931-4*
5	Jiri Matoušek, Bernd Gartner: Understanding and Using Linear Programming *Universitext, Springer-Verlag Berlin Heidelberg (2007)ISBN: 978-3-540-30697-9*

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Course outcome –Program Specific outcome Mapping Table

Course outcomes	Program Specific outcomes		
	PSO1- Theoretical and Applied Mathematics Competency	PSO2- Advanced Analytical and Computational Techniques	PSO3- Mathematical Modeling and Problem-Solving
CO1	2	1	3
CO2	2	1	2
CO3	1	2	2
CO4	2	2	3
CO5	1	1	2

Course Faculty **IQAC Member** **HoD**

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FIFTH SEMESTER B.Sc DEGREE INTERNAL EXAMINATION 2023

MTS5B08 – LINEAR PROGRAMMING

Time : 1 Hour | Maximum : 30 Marks

Part A

Answer any 5 questions. Each question carries 2 marks

1. Convert the following linear programming problem into canonical form :
   Maximize $f(x,y) = -x - 2y$
   subject to
   $$2x - y \geq -1$$
   $$-x + 3y \leq 8$$
   $$x, y \geq 0.$$
2. Show that intersection of two convex set is also a convex set.
3. State difference between transportation problem and assignment problem.
4. Pivot on 4 in the canonical maximum tableau given below :

x	y	-1	
9	2	3	$=t_1$
4	5	6	$=t_2$
7	8	9	$=f$

5. State Duality theorem.
6. Verify the Mini-max theorem for the function $f(x) = \{10,8,5,2,1\}$.

Part B

Answer any 2 questions. Each question carries 5 marks.

7. Solve non-canonical linear programming problem given below :
   Maximize $f(x,y) = x + 3y$
   subject to
   $$x + 2y \leq 10$$
   $$3x + y \leq 15$$
   $$x \geq 0.$$
8. State and prove *'Mini-max Theorem'*.
9. Write the dual simplex algorithm for minimum tableaus.

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Part C

Answer any one question. Each question carries 10 marks

10. Write transportation algorithm. Using this algorithm solve the following transportation problem :

5	12	8	50	26
11	4	10	8	20
14	50	1	9	30
15	20	26	15	

11. Solve the LPP by simplex method :
Maximize $z = 15x_1 + 6x_2 + 9x_3 + 2x_4$
Subject to the constraints:

$$2x_1 + x_2 + 5x_3 + 6x_4 \leq 20$$
$$3x_1 + x_2 + 3x_3 + 25x_4 \leq 24$$
$$7x_1 + x_4 \leq 70$$
$$x_1, x_2, x_3, x_4 \geq 0.$$

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Name of Examination: Fifth Semester BSc Degree Internal Examination 2023
Class: | Date of Examination: | | | | | | | | |
Name: Ameera Thasni | Roll No: 221
Subject: Linear programming

Part C

26+1/30

10) Transportation algorithm :-

1) Apply VAM in balanced transportation tableau for basic feasible solution
2) let $b_1 = 0$ then find $a_1, a_2 \ldots$ and $b_1, b_2 \ldots$ where $a_i + b_j = c_{ij}$
3) replace all cells by $c_{ij} - a_i - b_j$
4) if $c_{ij} \geq 0 \ \forall i, j$ then stop. Otherwise continue
5) Choose $c_{ij} < 0$ and label as getter cell (+) then find a cycle in the table and label the cells alternatively as getter cell and giver cell (-).
6) remove the chosen given cell and add amount of goods given by this given cell to all amount of goods of getter cell. Then subtract the amount of goods given by the giver cell from all amount of goods of giver cells in the table.

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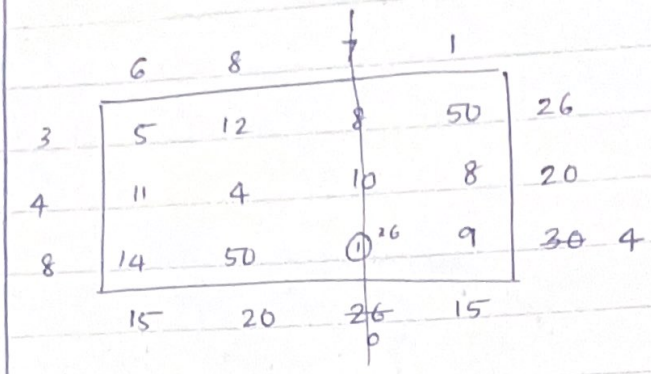
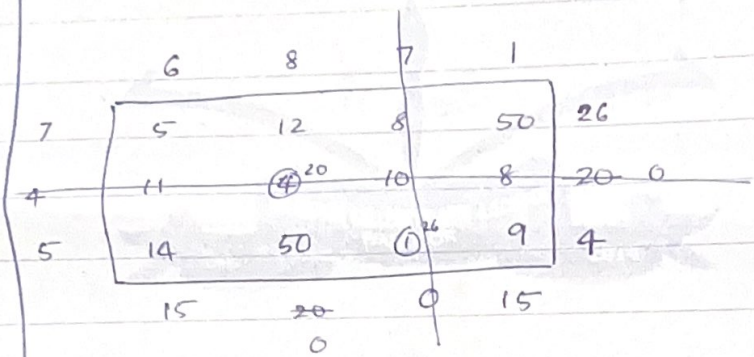
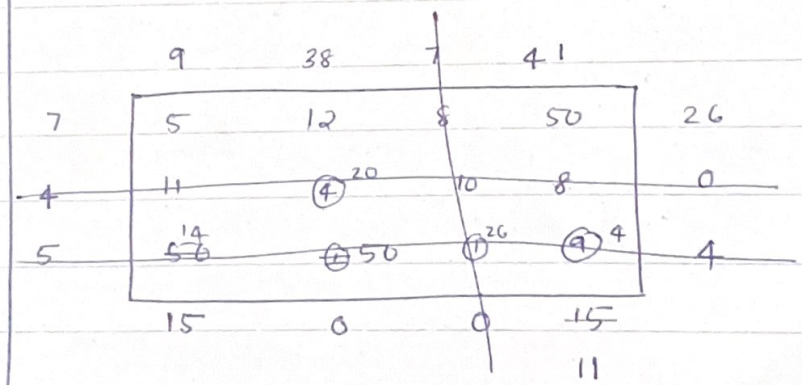
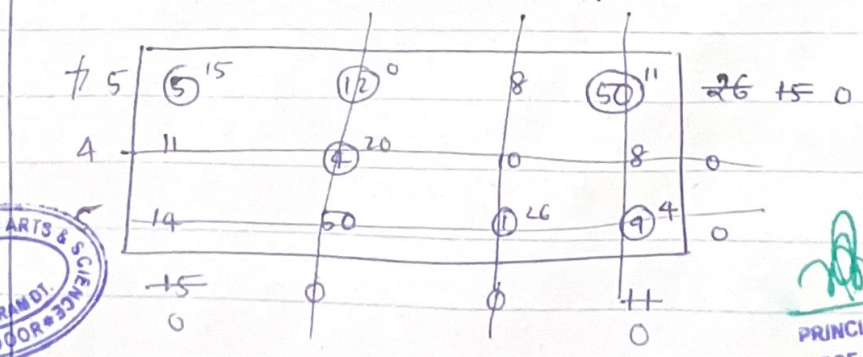
	M_1	M_2	M_3	M_4	
W_1	5	12	8	50	26
W_2	11	4	10	8	20
W_3	14	50	1	9	30
	15	20	26	15	76









(5)^{15}	(12)^{0}	8	(50)^{11}	26
11	(4)^{20}	10	8	20
14	50	(1)^{26}	(9)^{4}	30
15	20	26	15	

Let $b_1 = 0$, then

	0	7	37	45
5	(5)^{15}	(12)^{0}	8	(50)^{11}
−3	11	(4)^{20}	10	8
−36	14	50	(1)^{26}	(9)^{4}

(0)^{15}	(0)^{0}	−34	(0)^{11}
14	(0)^{20}	−24	−34
50	79	(0)^{26}	(0)^{4}

(0)^{15}	(0)^{0} +	−34	(0)^{11} −
14	−(0)^{20}	−24	−34 +
50	79	(0)^{26}	(0)^{4}

(0)^{15}	(0)^{11}	−34	0
14	(0)^{9}	−24	(−34)^{11}
50	79	(0)^{26}	(0)^{4}

	0	0	−34	−34
0	(0)^{15}	(0)^{11}	−34	0
	14	(0)^{9}	−24	(−34)^{11}
	50	79	(0)^{26}	(0)^{4}

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(0) 15	(0) 11	0	34
14	(0) 9	10	(0) 11
16	45	(0) 26	(0) 4

Since all $c_{ij} \geq 0$ we stop.
replace by original cost, then

(5) 15	(12) 11	8	50
11	(4) 9	10	(8) 11
14	50	(1) 26	(9) 4

∴ optimal solu is,

$x_{11} = 15$, $x_{12} = 11$ $x_{13} = 0$ $x_{14} = 0$
$x_{21} = 0$ $x_{22} = 9$ $x_{23} = 0$ $x_{24} = 11$
$x_{31} = 0$ $x_{32} = 0$ $x_{33} = 26$ $x_{34} = 4$

∴ min $C = 5 \times 15 + 12 \cdot 11 + 4 \cdot 9 + 8 \cdot 11 + 26 + 9 \cdot 4$
$= \underline{\underline{393}}$

Part B

9) Dual Simplex algorithm for minimum tableau :-

(i) The table is of the form,

a_{11}	a_{12} . . .	a_{1n}	b_1
a_{21}			.
.			.
a_{m1}	. . . .	a_{mn}	b_m
c_1	. . .	c_n	d

$= q$

(2) if $c_1 \ldots c_n \leq 0$ then if $b_1 \ldots b_m \geq 0$ Otherwise then stop, since the cminimum tableau is now optimal. Otherwise continue.

(3) Chose $c_j > 0$ ∴ j is maximal

(4) if $a_{ij} \ldots a_{mj} \leq 0$ then stop. because the minimization problem is infeasible. Otherwise continue.

(5) if $j = n$, chose $a_{in} > 0$, pivot on a_{in} if $j < n$ chose $a_{ij} > 0$. compute

$$\min_{k>j} \left\{ \frac{c_i}{a_{ij}} \right\} \cup \left\{ \frac{c_k}{a_{ik}} ; a_{ik} < 0 \right\} = \frac{c_p}{a_{ip}}$$

pivot on a_{ip} then go to (1).

(6) the table is now minimum basic feasible. where $c_1 \ldots c_n \leq 0$

(7) if $b_1 \ldots b_m \geq 0$, stop ∵ basic soln of minimum tableau is optimal. Otherwise continue

(8) Chose $b_i < 0$.

(9) if $a_{i1} \ldots a_{in} \geq 0$ then stop. ∵ the minimiza problem is unbdd. Otherwise continue.

10) Compute $\min \left\{ \frac{c_i}{a_{ij}} \right\} = \frac{c_p}{a_{ip}}$

pivot on a_{ip} and go to (6).

8) Minimax Theorem

Let $A = [a_{ij}]_{m \times n}$ be an $m \times n$ matrix game Then ∃ optimal mixed stratagies P^* and Q^* for the row player and column player. Also,

PAGE NO DATE

$\min_{1\le j\le n} E_j(P^*) = \max_{P} \min_{1\le j\le n} E_j(P) = \min_{Q} \max_{1\le i\le m} F_i(Q) = \max_{1\le i\le m} F_i(Q^*)$.

This common value is said to be then von Neumann value of the game.

Part A

5) Duality Theorem

For a dual canonical LPP exactly one of the following is true.

(i) both problems have optimal solutions, for these solutions $f=g$

(ii) the maximization problem is unbdd and minimization problem is infeasible.

(iii) minimization problem is unbdd and maximization pblm is infeasible.

(iv) both are infeasible.

3) Difference b/w transportation problem and assignment problem :-

(i) In transportation problem number of sources and destinations need to not be equal. But in assignment problem number of sources and destinations should be equal.

(ii) In transportation problem the problem is unbalanced if total supply and total demand are not equal. But in assignment problem the problem is unbalanced if the cost matrix is not a square matrix

1) $\max f(x,y) = -x - 2y$ subject to

$-2x + y \leq 1$

$-x + 3y \leq 8$

$x, y \geq 0.$

2) Let S is a subset of R^n. S is said to be convex if $(x_1 \cdots x_n)(y_1 \cdots y_n) \in S$ then $tx + (1-t)y \in S$ where $0 \leq t \leq 1$.
ie, if a line segment connecting ~~to~~ 2 points in the subset also lines in the subset then it is convex.

4)

x	y	-1	
9	2	3	$= -t_1$
4*	5	6	$= -t_2$
7	8	9	$= f$

t_2	y	-1	
9	2	3	$= -t_1$
4*	5	6	$= -x$
7	8	9	$= f$

t_2	y	-1	
r=9	s=2	3	$= -t_1$
p=4	q=5	1=6	$= -x$
7=r	8	9	$= f$

$p \to 1/p = 1/4$

$q \to q/p = 5/4$

$r \to -r/p = -9/4$

$s \to \frac{ps - qr}{p} = \frac{4 \cdot 2 - 5 \cdot 9}{4} =$

t_2	y	-1	
$-9/4$	$-37/4$	$-92/4$	$= -t_1$
	$5/4$	$6/4$	$= -x$
$1/4$	$-3/4$	$-3/2$	$= f$
$-7/4$			

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DEPARTMENT OF MATHEMATICS

CO ATTAINMENT - ASSIGNEMENT(ODD SEM. 2023-2024)

Sem.: V

Course:MTS5B08 LINEAR PROGRAMMING

Name of the faculty member: SHARSHAD AMEERA

Sl. No.	Name of the student	REG NO	ASSIGNMENT	SEMINAR	ATTENDANCE	COURSE OUTCOMES				ATTENDANCE	
			CO1 to CO5	CO4 to CO5		CO1 - 5		CO4 - 5			
		Max. Marks	3	3	3	%age	Y/N	%age	Y/N	%age	Y/N
1	AMEERA THASNI K	UFAVSMT00	3	3	3	100	Y	100	Y	100	Y
2	ASNA P P	UFAVSMT00	3	3	2	100	Y	100	Y	66.6667	Y
3	BABY NASLA P	UFAVSMT00	3	3	3	100	Y	100	Y	100	Y
4	FASNA K	UFAVSMT00	3	3	3	100	Y	100	Y	100	Y
5	FATHIMA LANA K	UFAVSMT00	3	3	3	100	Y	100	Y	100	Y
6	FATHIMA NISHVA A	UFAVSMT00	3	3	3	100	Y	100	Y	100	Y
7	HIBA NASRIN V	UFAVSMT00	3	3	3	100	Y	100	Y	100	Y
8	JAMSHIYA E	UFAVSMT00	3	3	3	100	Y	100	Y	100	Y
9	MISAANA C K	UFAVSMT01	3	3	3	100	Y	100	Y	100	Y
10	RINSHA MUNDASSERI	UFAVSMT01	3	3	3	100	Y	100	Y	100	Y
11	SAFVANA PARVIN T P	UFAVSMT01	3	3	3	100	Y	100	Y	100	Y
12	THASNEEM P	UFAVSMT01	3	3	3	100	Y	100	Y	100	Y
13	FAYAS KURIKKAL	UFAVSMT01	3	3	2	100	Y	100	Y	66.6667	Y
14	MOHAMMED FAVAS P	UFAVSMT01	3	3	3	100	Y	100	Y	100	Y
15	MUHAMMED FATHAH K	UFAVSMT01	3	3	1	100	Y	100	Y	33.3333	Y
16	MUHAMMED SAHAL V P	UFAVSMT01	3	3	3	100	Y	100	Y	100	Y

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17	NEJIL KALLARA	UFAVSMT01	3	3	3	100	Y	100	Y	100	Y
18	SHAMEEM P	UFAVSMT02	3	3	3	100	Y	100	Y	100	Y
19	REEFA MOHAMMED K	UFAVSMT02 1	3	3	3	100	Y	100	Y	100	Y
20	VARSHA K	UFAVSMT02	3	3	3	100	Y	100	Y	100	Y
21	ANEENA M	UFAVSMT02	3	3	3	100	Y	100	Y	100	Y
22	ASHJILA V	UFAVSMT02	3	3	3	100	Y	100	Y	100	Y
23	HAFEEFA P	UFAVSMT02	3	3	2	100	Y	100	Y	66.6667	Y
24	HUDA P	UFAVSMT02	3	3	3	100	Y	100	Y	100	Y
25	JUMANA P	UFAVSMT02	3	3	3	100	Y	100	Y	100	Y
26	JYOTHI A P	UFAVSMT02	3	3	3	100	Y	100	Y	100	Y
27	JYOTHIKA V	UFAVSMT03	3	3	3	100	Y	100	Y	100	Y
28	SANDRA M	UFAVSMT03	3	3	3	100	Y	100	Y	100	Y
29	SHAHMA C T	UFAVSMT03	3	3	3	100	Y	100	Y	100	Y
30	SHEFIN K P	UFAVSMT03	3	3	3	100	Y	100	Y	100	Y
31	NAFIA V	UFAVSMT03	3	3	3	100	Y	100	Y	100	Y
						31		31		31	
						81.58		**81.58**		**81.58**	

FOR LAL (MTS5B08)	CO1 TO 3	CO4 TO 5	ATTENDANCE
	81.58	**81.58**	**81.58**

TARGET: 1) 90% OF STUDENTS WILL SCORE 35% OF MARKS IN ASSIGNMENT

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DEPARTMENT OF MATHEMATICS

CO ATTAINMENT - IA TEST MARKS (ODD SEM. 2023-2024)

Sem.: V Course:MTS5B08 LINEAR PROGRAMMING

Name of the faculty member: SHARSHAD AMEERA

Sl. No.	Name of the student	REG NO	IA TEST	COURSE OUTCOMES	
			Q1 TO Q14	IA TEST	
			CO1 TO CO5	CO1 TO CO5	
		Max. Marks	30	%age	Y/N
1	AMEERA THASNI K	UFAVSMT001	27	90	Y
2	ASNA P P	UFAVSMT002	26	87	Y
3	BABY NASLA P	UFAVSMT003	27	90	Y
4	FASNA K	UFAVSMT004	26	87	Y
5	FATHIMA LANA K	UFAVSMT005	27	90	Y
6	FATHIMA NISHVA A	UFAVSMT006	17	57	Y
7	HIBA NASRIN V	UFAVSMT007	14	47	Y
8	JAMSHIYA E	UFAVSMT008	28	93	Y
9	MISAANA C K	UFAVSMT010	27	90	Y
10	RINSHA MUNDASSERI	UFAVSMT011	29	97	Y
11	SAFVANA PARVIN T P	UFAVSMT013	AB	0	N
12	THASNEEM P	UFAVSMT014	26	87	Y
13	FAYAS KURIKKAL	UFAVSMT015	20	67	Y
14	MOHAMMED FAVAS P	UFAVSMT016	21	70	Y
15	MUHAMMED FATHAH K	UFAVSMT017	AB	0	N
16	MUHAMMED SAHAL V P	UFAVSMT018	14	47	Y
17	NEJIL KALLARA	UFAVSMT019	27	90	Y
18	SHAMEEM P	UFAVSMT020	12	40	Y
19	REEFA MOHAMMED K	UFAVSMT021	27	90	Y
20	VARSHA K	UFAVSMT022	28	93	Y
21	ANEENA M	UFAVSMT023	29	97	Y
22	ASHJILA V	UFAVSMT024	23	77	Y
23	HAFEEFA P	UFAVSMT026	21	70	Y
24	HUDA P	UFAVSMT027	15	50	Y

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25	JUMANA P	UFAVSMT028	17	57	Y
26	JYOTHI A P	UFAVSMT029	21	70	Y
27	JYOTHIKA V	UFAVSMT030	9	30	N
28	SANDRA M	UFAVSMT031	20	67	Y
29	SHAHMA C T	UFAVSMT032	28	93	Y
30	SHEFIN K P	UFAVSMT033	21	70	Y
31	NAFIA V	UFAVSMT034	28	93	Y
				28	
	FOR LAL (MAT5B08)			**96.55**	
			CO1 to CO5		
	TARGET: 50% C		**96.6**		

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CO ATTAINMENT - FINAL EXAM MARKS (ODD SEM . 2023-2024)

Sem.: V Course:MTS5B08 LINEAR PROGRAMMING

S+A 9+A 6:F	Name of the student	REG NO	COURSE OUTCOM O 1 TO CO	CO ATTAINMENT CO 1 TO CO5	
		Max. Marks	75	%age	Y/N
1	AMEERA THASNI K	UFAVSMT001	63	84	Y
2	ASNA P P	UFAVSMT002	41	54.66666667	Y
3	BABY NASLA P	UFAVSMT003	48	64	Y
4	FASNA K	UFAVSMT004	48.75	65	Y
5	FATHIMA LANA K	UFAVSMT005	56	74.66666667	Y
6	FATHIMA NISHVA A	UFAVSMT006	33	44	Y
7	HIBA NASRIN V	UFAVSMT007	24	32	N
8	JAMSHIYA E	UFAVSMT008	71	94.66666667	Y
9	MISAANA C K	UFAVSMT010	63	84	Y
10	RINSHA MUNDASSERI	UFAVSMT011	63	84	Y
11	SAFVANA PARVIN T P	UFAVSMT013	AB	0	N
12	THASNEEM P	UFAVSMT014	48	64	Y
13	FAYAS KURIKKAL	UFAVSMT015	41	54.66666667	Y
14	MOHAMMED FAVAS P	UFAVSMT016	24	32	N
15	MUHAMMED FATHAH K	UFAVSMT017	AB	0	N
16	MUHAMMED SAHAL V P	UFAVSMT018	41	54.66666667	Y
17	NEJIL KALLARA	UFAVSMT019	41	54.66666667	Y
18	SHAMEEM P	UFAVSMT020	25	33.33333333	N
19	REEFA MOHAMMED K	UFAVSMT021	56	74.66666667	Y
20	VARSHA K	UFAVSMT022	63	84	Y
21	ANEENA M	UFAVSMT023	63.75	85	Y
22	ASHJILA V	UFAVSMT024	41	54.66666667	Y
23	HAFEEFA P	UFAVSMT026	33	44	Y
24	HUDA P	UFAVSMT027	41	54.66666667	Y
25	JUMANA P	UFAVSMT028	41	54.66666667	Y
26	JYOTHI A P	UFAVSMT029	41	54.66666667	Y
27	JYOTHIKA V	UFAVSMT030	41	54.66666667	Y
28	SANDRA M	UFAVSMT031	24	32	N
29	SHAHMA C T	UFAVSMT032	56	74.66666667	Y
30	SHEFIN K P	UFAVSMT033	41	54.66666667	Y
31	NAFIA V	UFAVSMT034	63.75	85	Y

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				25	
				86.21	
		FOR L&L (MTS5B08)	CO1 to CO5		
			86.21		
		TARGET: 75% OF STUDENTS WILL SCORE 35% OF MARKS			

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DEPARTMENT OF MATHEMATICS

COURSE EXIT SURVEY RESPONSES (ODD SEM , 2023-2024)

Semester: V

Course:MTS5B08 LINEAR PROGRAMMING

Name of the faculty member: SHARSHAD AMEERA

Sl. No.	NAME OF THE STUDENT	REG NO	Are you able to Understand Linear Programming Basics	Are you able to Formulate Linear Programming Problems	Are you able to Implement the Simplex Method	Are you able to Apply Duality Theory	Are you able to Evaluate and Apply Transportation & Assignment Problems
	COURSE OUTCOMES		CO1	CO2	CO3	CO4	CO5
1	AMEERA THASNI K	UFAVSMT00	5 (EXCELLENT)	5 (EXCELLENT)	5 (EXCELLENT)	4 (Very Good)	5 (Excellent)
2	ASNA P P	UFAVSMT00	4 (Very Good)	4 (Very Good)	4 (Very Good)	5 (Excellent)	4 (Very Good)
3	BABY NASLA P	UFAVSMT00	4 (Very Good)	4 (Very Good)	3 (Good)	1 (Fair)	3 (Good)
4	FASNA K	UFAVSMT00	4 (Very Good)	4 (Very Good)	4 (Very Good)	5 (EXCELLENT)	4 (Very Good)
5	FATHIMA LANA K	UFAVSMT00	4 (Very Good)	3 (Good)	4 (Very Good)	5 (EXCELLENT)	3 (Good)
6	FATHIMA NISHVA A	UFAVSMT00	3 (Good)	3 (Good)	3 (Good)	3 (Good)	3 (Good)
7	HIBA NASRIN V	UFAVSMT00	3 (Good)	4 (Very Good)	3 (Good)	5 (EXCELLENT)	5 (EXCELLENT)
8	JAMSHIYA E	UFAVSMT00	5 (EXCELLENT)	3 (Good)	4 (Very Good)	3 (Good)	5 (EXCELLENT)
9	MISAANA C K	UFAVSMT01	5 (EXCELLENT)	5 (EXCELLENT)	5 (EXCELLENT)	4 (Very Good)	5 (EXCELLENT)
10	RINSHA MUNDASSERI	UFAVSMT01	5 (EXCELLENT)	4 (Very Good)	4 (Very Good)	4 (Very Good)	4 (Very Good)
11	SAFVANA PARVIN T P	UFAVSMT01					
12	THASNEEM P	UFAVSMT01	4 (Very Good)	4 (Very Good)	4 (Very Good)	4 (Very Good)	4 (Very Good)
13	FAYAS KURIKKAL	UFAVSMT01	4 (Very Good)	3 (Good)	5 (EXCELLENT)	3 (Good)	3 (Good)

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14	MOHAMMED FAVAS P	UFAVSMT01	4 (Very Good)	4 (Very Good)	4 (Very Good)	5 (EXCELLENT)	5 (EXCELLENT)
15	MUHAMMED FATHAH K	UFAVSMT01	4 (Very Good)	4 (Very Good)	4 (Very Good)	5 (EXCELLENT)	4 (Very Good)
16	MUHAMMED SAHAL V P	UFAVSMT01	5 (EXCELLENT)	4 (Very Good)	3 (Good)	3 (Good)	1 (Fair)
17	NEJIL KALLARA	UFAVSMT01	4 (Very Good)	3 (Good)	4 (Very Good)	4 (Very Good)	4 (Very Good)
18	SHAMEEM P	UFAVSMT02	3 (Good)	3 (Good)	4 (Very Good)	3 (Good)	3 (Good)
19	REEFA MOHAMMED K	UFAVSMT02	3 (Good)	4 (Very Good)	5 (EXCELLENT)	4 (Very Good)	4 (Very Good)
20	VARSHA K	UFAVSMT02	4 (Very Good)	4 (Very Good)	3 (Good)	3 (Good)	4 (Very Good)
21	ANEENA M	UFAVSMT02	4 (Very Good)	5 (EXCELLENT)	5 (EXCELLENT)	4 (Very Good)	5 (EXCELLENT)
22	ASHJILA V	UFAVSMT02	4 (Very Good)	2 (Very Fair)	4 (Very Good)	4 (Very Good)	4 (Very Good)
23	HAFEEFA P	UFAVSMT02	4 (Very Good)	4 (Very Good)	3 (Good)	3 (Good)	5 (EXCELLENT)
24	HUDA P	UFAVSMT02	3 (Good)	4 (Very Good)	4 (Very Good)	3 (Good)	5 (EXCELLENT)
25	JUMANA P	UFAVSMT02	5 (EXCELLENT)	5 (EXCELLENT)	5 (EXCELLENT)	5 (EXCELLENT)	3 (Good)
26	JYOTHI A P	UFAVSMT02	3 (Good)	3 (Good)	4 (Very Good)	3 (Good)	5 (EXCELLENT)
27	JYOTHIKA V	UFAVSMT03	4 (Very Good)	4 (Very Good)	4 (Very Good)	5 (EXCELLENT)	4 (Very Good)
28	SANDRA M	UFAVSMT03	5 (EXCELLENT)	4 (Very Good)	5 (EXCELLENT)	3 (Good)	3 (Good)
29	SHAHMA C T	UFAVSMT03	4 (Very Good)	4 (Very Good)	3 (Good)	4 (Very Good)	4 (Very Good)
30	SHEFIN K P	UFAVSMT03	5 (EXCELLENT)	5 (EXCELLENT)	5 (EXCELLENT)	4 (Very Good)	5 (EXCELLENT)
31	NAFIA V	UFAVSMT03	4 (Very Good)	4 (Very Good)	4 (Very Good)	4 (Very Good)	5 (EXCELLENT)
		No. of graded "0"	0	0	0	0	0
		No. of graded "1"	0	0	0	1	1
		No. of graded "2"	0	1	0	0	0
		No. of graded "3"	6	7	7	10	7
		No. of graded "4"	16	17	15	11	11

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No. of graded "5"	8	5	8	8	11

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DEPARTMENT OF MATHEMATICS

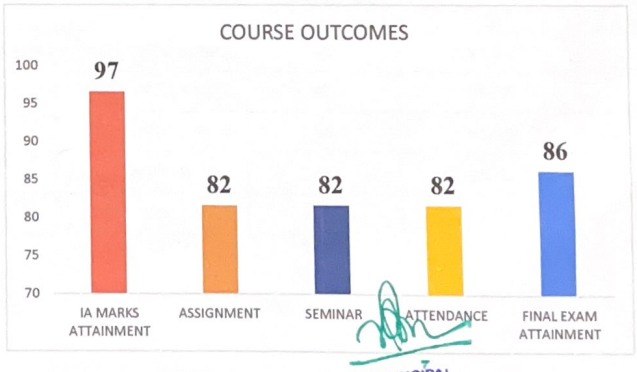
DIRECT ASSESSMENT METHOD - CO ATTAINMENT (ODD SEM . 2023-2024)

Semester: V Course:MTS5B08 LINEAR PROGRAMMING

Name of the faculty member: SHARSHAD AMEERA

TARGET: 60% ATTAINMENT

COs	CO1 to CO5
IA MARKS ATTAINMENT	97
ASSIGNMENT	82
SEMINAR	82
ATTENDANCE	82
FINAL EXAM ATTAINMENT	86
AVERAGE	**85**



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DEPARTMENT OF CIVIL ENGINEERING

CO-PO-PSO MAPPING (ODD SEM . 2023-2024)

Semester: V

Course:MTS5B08 LINEAR PROGRAMMING

Name of the faculty member: SHARSHAD AMEERA

(I) CO Attainment

A: Direct assessment (80%)-Tests, Assignment, Examination

B: Indirect assessment (20%)-Course end survey

COs	Mapping of POs	Mapping of PSOs	Direct Assessment	Indirect Assessment	Overall Attainment	Target (%)	Attainment
			(a)	(b)	0.8 (a) + 0.2(b)		
CO1	PO1, PO3, PO4 & PO9	PSO1, PSO2 & PSO3	85	64.21	81	75	YES
CO2	PO1, PO3, PO5 & PO7	PSO1, PSO2 & PSO3	85	61.05	81		
CO3	PO1, PO2, PO3, PO5 & PO9	PSO1, PSO2 & PSO3	85	63.68	81		
CO4	PO1, PO3, PO4, PO5& PO8	PSO1, PSO2 & PSO3	85	60.53	81		
CO5	PO1, PO4, PO5, PO7 & PO8	PSO1, PSO2 & PSO3	85	63.68	81		

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Attainment Levels of COs

Course Name: ENG5B09- Language and Linguistics			Attainement
Assessment Methods	Target-Attainment Levels		
Internal Assessment	Level 1	50% of students scoring more than 35% marks in internal assessment tools	**LEVEL 03**
	Level 2	60% of students scoring more than 35% marks in internal assessment tools	
	Level 3	70% of students scoring more than 35% marks in internal assessment tools	
Assessment Methods	**Target-Attainment Levels**		Attainement
University Assessment	Level 1	50% of students scoring more than 35% marks in UE assessment tools	**LEVEL 03**
	Level 2	60% of students scoring more than 35% marks in UE assessment tools	
	Level 3	70% of students scoring more than 35% marks in UE assessment tools	

Thanuja

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