FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

Father Agnel Ashram, Bandstand, Bandra-West, Mumbai-50.

Department of Information Technology

B.E. (I.T.) (Semester VII) (2020-2021)

Lecture Plan

Subject: Operations Research   **Credits: 03**

Syllabus:

Course Code	Course Name	Credits
ILO7015	Operations Research	03

Module	Detailed Contents	Hrs
01	**Introduction to Operations Research**: Introduction, Structure of the Mathematical Model, Limitations of Operations Research **Linear Programming**: Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method Penalty Cost Method or Big M-method, Two Phase Method, Revised simplex method, **Duality**, Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis **Transportation Problem**: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. **Assignment Problem**: Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem, Travelling Salesman Problem **Integer Programming Problem**: Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.	14
02	**Queuing models**: queuing systems and structures, single server and multi-server models, Poisson input, exponential service, constant rate service, finite and infinite population	05
03	**Simulation**: Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation	05
04	**Dynamic programming**. Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.	05
05	**Game Theory**. Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.	05

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06	**Inventory Models**: Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model	05

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

REFERENCES:

1. Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002.
2. Ravindran, A, Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2009.
3. Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2002.
4. Operations Research, S. D. Sharma, KedarNath Ram Nath-Meerut.
5. Operations Research, KantiSwarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons.

Outcomes:

CO1	Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.
CO2	Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
CO3	Solve specialized linear programming problems like the transportation and assignment problems; solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
CO4	Understand the applications of integer programming and a queuing model and compute important performance measures.

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CO-PO and CO-PSO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3	3		3	3		3			3	3	3
CO2	3	3	3	3		3	3		3			3	3	3
CO3	3	3	3	3		3	3		3			3	3	3
CO4	3	3	3	3		3	3		3			3	3	3

1-Low correlation (Low), 2-Medium correlation (Medium), 3-High correlation (High)

CO Assessment tools with target

Course Outcome	Direct Methods				Indirect Method
	Test 1	Test 2	Quiz	University Theory Result	
CO1	25%		25%	50%	100%
CO2		25%	25%	50%	100%
CO3	25%		25%	50%	100%
CO4	25%		25%	50%	100%

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Lecture Plan:

No of classes Planned:	34		No of Classes taken:	37	

Sr. No.	Topic Planned	Planned Date	Actual Date	Delivery Mechanisms
1.	Introduction to Operations Research: Introduction, Structure of the Mathematical Model, Limitations of Operations Research	10/07/20	10/07/20	Board
2.	Linear Programming: Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP	14/07/20	14/07/20	Board
3.	Graphical method	15/07/20	15/07/20	Board
4.	Simplex Method	17/07/20	17/07/20	Board
5.	Penalty Cost Method or Big M-method	21/07/20	21/07/20	Board
6.	Two Phase Method, Revised simplex method	22/07/20	22/07/20	Board
7.	Duality, Primal –Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem,	24/07/20	24/07/20	Board
8.	Complimentary Slackness Theorem, Main Duality Theorem	28/07/20	28/07/20	Board
9.	Dual Simplex Method, Sensitivity Analysis	29/07/20	29/07/20	Board
10.	Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions –Northwest corner rule,	31/07/20	31/07/20	Board
11.	Least cost method and Vogel's approximation method	04/08/20	04/08/20	Board

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12.	Optimality test: the stepping stone method	05/08/20	05/08/20	Board
13.	MODI method	07/08/20	07/08/20	Board
14.	Assignment Problem: Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm	11/08/20	11/08/20	Board
15.	Processing of n Jobs Through Two Machines and m Machines	12/08/20	12/08/20	Board
16.	Graphical Method of Two Jobs m Machines Problem	14/08/20	14/08/20	Board
17.	Routing Problem, Travelling Salesman Problem	18/08/20	18/08/20	Board
18.	Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm	19/08/20	19/08/20	Board
19.	Branch and Bound Technique.	21/08/20	21/08/20	Board
20.	Introduction to Decomposition algorithms	01/09/20	01/09/20	Board
21.	Queuing models: queuing systems and structures, single server and multi-server models	02/09/20	02/09/20	Board
22.	Poisson input, exponential service, constant rate service, finite and infinite population	04/09/20	04/09/20	Board
23.	Simulation: Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation	08/09/20	08/09/20	Board
24.	Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation	09/09/20	09/09/20	Board
25.	Dynamic programming. Characteristics of dynamic programming.	11/09/20	11/09/20	Board

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26.	Dynamic programming approach for Priority Management employment smoothening	22/09/20	22/09/20	Board
27.	Capital budgeting, Stage Coach/Shortest Path	23/09/20	23/09/20	Board
28.	Cargo loading and Reliability problems	25/09/20	25/09/20	Board
29.	Game Theory. Competitive games, rectangular game, saddle point	30/09/20	30/09/20	Board
30.	Minimax (maximin) method of optimal strategies, value of the game.	06/10/20	06/10/20	Board
31.	Solution of games with saddle points, Dominance principle. Rectangular games without saddle point –mixed strategy for 2 X 2 games	07/10/20	07/10/20	Board
32.	Inventory Models: Classical EOQ Models	09/10/20	09/10/20	Board
33.	EOQ Model with Price Breaks	13/10/20	13/10/20	Board
34.	EOQ with Shortage, Probabilistic EOQ Model	14/10/20	14/10/20	Board
35.	Revision	-	15/10/20	Board
36.	Revision	-	10/11/20	Board
37.	Revision	-	11/11/20	Board