FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

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

Department of Information Technology

B.E. (I.T.) (Semester VII) (2019-2020)

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

FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

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

Department of Information Technology

B.E. (I.T.) (Semester VII) (2019-2020)

Lecture Plan

Subject: Operations Research   **Credits: 03**

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.

FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

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

Department of Information Technology

B.E. (I.T.) (Semester VII) (2019-2020)

Lecture Plan

Subject: Operations Research   **Credits: 03**

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	2	2		2	2		2	1	1	2	3	2
CO2	3	3	2	2		2	2		2	1	1	2	3	2
CO3	3	3	2	2		2	2		2	1	1	2	3	2
CO4	3	3	2	2		2	2		2	1	1	2	3	2

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	University Theory Result	
CO1	75%		50%	100%
CO2		50%	20%	100%
CO3	25%		10%	100%
CO4		50%	20%	100%

FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

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

Department of Information Technology

B.E. (I.T.) (Semester VII) (2019-2020)

Lecture Plan

Subject: Operations Research   **Credits: 03**

Lecture Plan:

No of classes Planned:	34	No of Classes taken:	

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	03/07/2019		Board
2.	Linear Programming: Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP	05/07/2019		Board
3.	Graphical method	10/07/2019		Board
4.	Simplex Method	12/07/2019		Board
5.	Penalty Cost Method or Big M-method	16/07/2019		Board
6.	Two Phase Method, Revised simplex method	18/07/2019		Board
7.	Duality, Primal –Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem,	19/07/2019		Board
8.	Complimentary Slackness Theorem, Main Duality Theorem	23/07/2019		Board
9.	Dual Simplex Method, Sensitivity Analysis	25/07/2019		Board
10.	Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions –Northwest corner rule,	26/07/2019		Board
11.	Least cost method and Vogel's approximation method	30/07/2019		Board

FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

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

Department of Information Technology

B.E. (I.T.) (Semester VII) (2019-2020)
Lecture Plan

Subject: Operations Research   **Credits: 03**

12.	Optimality test: the stepping stone method	01/08/2019		Board
13.	MODI method	02/08/2019		Board
14.	Assignment Problem: Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm	06/08/2019		Board
15.	Processing of n Jobs Through Two Machines and m Machines	08/08/2019		Board
16.	Graphical Method of Two Jobs m Machines Problem	09/08/2019		Board
17.	Routing Problem, Travelling Salesman Problem	20/08/2019		Board
18.	Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm	22/08/2019		Board
19.	Branch and Bound Technique.	23/08/2019		Board
20.	Introduction to Decomposition algorithms	27/08/2019		Board
21.	Queuing models: queuing systems and structures, single server and multi-server models	29/08/2019		Board
22.	Poisson input, exponential service, constant rate service, finite and infinite population	30/08/2019		Board
23.	Simulation: Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation	13/09/2019		Board
24.	Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation	17/09/2019		Board
25.	Dynamic programming. Characteristics of dynamic programming.	19/09/2019		Board

FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

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

Department of Information Technology

B.E. (I.T.) (Semester VII) (2019-2020)

Lecture Plan

Subject: Operations Research   **Credits: 03**

26.	Dynamic programming approach for Priority Management employment smoothening	20/09/2019		Board
27.	Capital budgeting, Stage Coach/Shortest Path	24/09/2019		Board
28.	Cargo loading and Reliability problems	26/09/2019		Board
29.	Game Theory. Competitive games, rectangular game, saddle point	27/09/2019		Board
30.	Minimax (maximin) method of optimal strategies, value of the game.	01/10/2019		Board
31.	Solution of games with saddle points, Dominance principle. Rectangular games without saddle point –mixed strategy for 2 X 2 games	03/10/2019		Board
32.	Inventory Models: Classical EOQ Models	04/10/2019		Board
33.	EOQ Model with Price Breaks	10/10/2019		Board
34.	EOQ with Shortage, Probabilistic EOQ Model	11/10/2019		Board