CURRICULUM AND DETAILED SYLLABI

FOR

M.E DEGREE (Infrastructure Engineering and Management) PROGRAMME

I-IV SEMESTERS

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2014-2015 ONWARDS

THIAGARAJAR COLLEGE OF ENGINEERING
(A Government Aided ISO 9001-2008 certified
Autonomous Institution affiliated to Anna University)

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Passed in Board of Studies Meeting held on 18.04.2015 Approved in 50th Academic Council Meeting held on 30.05.2015

THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI – 625 015

DEPARTMENT OF CIVIL ENGINEERING

I) Vision

To establish process of learning to meet the global standards for sustainable built environment

II) Mission

We are committed to:

- Provide quality education through innovation in teaching and learning practices meeting the global standards
- Encourage faculty and students to carry out socially relevant and forward looking research
- Offer consultancy services using state of the art facilities fulfilling the needs of the industry and society
- Enable our students, faculty and staff to play leadership roles for the betterment of the society in a sustainable manner

III) Programme Educational Objectives (PEO) for M.E Infrastructure Engineering & Management programme:

PEO 1) Graduates will apply management and economic theories to formulate strategies to enable organizations to achieve their goals

PEO 2) Graduates of the programme will serve as project leaders with critical-thinking and analytical decision-making capabilities.

PEO 3) Graduates will be capable of integrating their knowledge of multi-disciplines of management to analyze construction industry problems and recommend action thereon

PEO 4) Graduates of the programme will contribute as team members adding value through innovation, customer focus, prudence, and professional responsibility, consistent with the objectives of the projects in which they are involved and the organizations they support

Programme Outcomes (POs) of M.E IEM

Graduating Students of M.E. Infrastructure Engg. & Management programme will:

Programme Outcomes (POs)		Graduate Attributes
PO1.	Acquire in-depth knowledge of specific discipline or professional area in infrastructure engineering and management, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.	Scholarship of Knowledge
PO2.	Analyze complex engineering problems of infrastructure engineering and management critically; apply independent judgement for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.	Critical Thinking

PO3.	Think laterally and originally, conceptualize and solve engineering problems of infrastructure engineering and management, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise	Problem Solving
PO4.	Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of infrastructure engineering and management	Research Skill
PO5.	Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.	Usage of modern tools
PO6.	Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.	Collaborative and Multidisciplinary work
PO7.	Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments of infrastructure engineering and management after consideration of economical and financial factors	Project Management and Finance
PO8.	Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.	Communication
PO9.	Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously	Life-long Learning
PO10.	Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.	Ethical Practices and Social Responsibility
PO11.	Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.	Independent and Reflective Learning

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
Department of Civil Engg. (Infrastructure Engineering and Management Programme)

COURSES OF STUDY
(For the candidates admitted from 2015-2016 onwards)

FIRST SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			Credits
			L	T	P	
THEORY						
14IM111	Applied Statistics and Optimization	BS	3	1	-	4
15IM120	Material Procurement and Management	PC	3	-	-	3
15IM130	Traffic Engineering and Management	PC	3	1	-	4
15IM140	Project Formulation and Implementation	PC	3	1	-	4
14IM150	Quantitative Methods in Management	PC	3	1	-	4
15IM160	Environmental Impact Assessment	PC	4	-	-	4
PRACTICAL						
15IM180	Traffic Engineering Lab	PC	-	-	2	1
Total			**19**	**4**	**2**	**24**

SECOND SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			Credits
			L	T	P	
THEORY						
14IM210	Contracts and Arbitration	PC	3	-	-	3
15IM220	Project Management	PC	3	1	-	4
14IMPX0	Elective I	PE	4	-	-	4
14IMPX0	Elective II	PE	4	-	-	4
14IMPX0	Elective III	PE	4	-	-	4
14IMPX0	Elective IV	PE	4	-	-	4
PRACTICAL						
14IM280	Seminar	PC	-	-	2	1
Total			**22**	**1**	**2**	**24**

THIRD SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			Credits
			L	T	P	
THEORY						
14IM310	Management of Human Resource, Safety and Quality	PC	4	-	-	4
14IMPX0	Elective V	PE	4	-	-	4
14IMPX0	Elective VI	PE	4	-	-	4
PRACTICAL						
14IM340	Project I	PC	-	-	8	4
Total			**12**	**-**	**8**	**16**

FOURTH SEMESTER

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
PRACTICAL						
14IM410	Project II	PC	-	-	24	12
Total			**-**	**-**	**24**	**12**

BS- Basic Sciences; HSS-Humanities and Social Sciences; ES-Engineering Sciences; PC-Programme Core; PE-Programme Elective; GE-General Elective; OC-One Credit Course; TC-Two Credit Course; SS-Self-Study Course (in the list of Programme Electives)

Note:

1 Hour Lecture/Tutorial is equivalent to 1 credit
2Hours Practical is equivalent to 1 credit

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
Department of Civil Engg. (Infrastructure Engineering and Management Programme)

SCHEME OF EXAMINATIONS

(For the candidates admitted from 2015-2016 onwards)

FIRST SEMESTER

S. No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	14IM111	Applied Statistics and Optimization	3	50	50	100	25	50
2	15IM120	Material Procurement and Management	3	50	50	100	25	50
3	15IM130	Traffic Engineering and Management	3	50	50	100	25	50
4	15IM140	Project Formulation and Implementation	3	50	50	100	25	50
5	14IM150	Quantitative Methods in Management	3	50	50	100	25	50
6	15IM160	Environmental Impact Assessment	3	50	50	100	25	50
PRACTICAL								
7	15IM180	Traffic Engineering Lab	3	50	50	100	25	50

SECOND SEMESTER

S. No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	14IM210	Contracts and Arbitration	3	50	50	100	25	50
2	15IM220	Project Management	3	50	50	100	25	50
3	14IMPX0	Elective I	3	50	50	100	25	50
4	14IMPX0	Elective II	3	50	50	100	25	50
5	14IMPX0	Elective III	3	50	50	100	25	50
6	14IMPX0	Elective IV	3	50	50	100	25	50
PRACTICAL								
7	14IM280	Seminar	-	50	50	100	25	50

THIRD SEMESTER

S. No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	14IM310	Management of Human Resource, Safety and Quality	3	50	50	100	25	50
2	14IMPX0	Elective V	3	50	50	100	25	50
3	14IMPX0	Elective VI	3	50	50	100	25	50
PRACTICAL								
4	14IM340	Project - I	-	150	150	300	75	150

FOURTH SEMESTER

S. No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	14IM410	Project - II	-	150	150	300	75	150

* Continuous Assessment evaluation pattern will differ from course to course and for different tests. This will be declared in advance to students.

** Terminal Examination will be conducted for maximum marks of 100 and subsequently reduced to 50 marks for the award of terminal examination marks.

LIST OF ELECTIVES

S. No.	Code	Electives
1.	14IMPA0	STRATEGIC PLANNING FOR INFRASTRUCTURE SECTORS
2.	14IMPB0	DISASTER MITIGATION AND MANAGEMENT
3.	14IMPC0	ENVIRONMENTAL IMPACT AND RISK ASSESSMENT
4.	14IMPD0	LARGE SCALE SYSTEMS PLANNING
5.	14IMPE0	ORGANIZATIONAL BEHAVIOUR
6.	15IMPF0	GEOTECHNIQUES FOR INFRASTRUCTURE
7.	14IMPG0	REMOTE SENSING AND GIS
8.	14IMPH1	SUSTAINABLE DEVELOPMENT
9.	14IMPJ1	URBAN PLANNING AND DESIGN
10.	14IMPK1	INFRASTRUCTURE FINANCE
11.	14IMPL0	TRANSPORTATION PLANNING
12.	15IMPM0	URBAN ENVIRONMENTAL MANAGEMENT
13.	14IMPN0	CONSTRUCTION EQUIPMENT MANAGEMENT
14.	14IMPP0	VALUE ENGINEERING
15.	15IMPQ0	CONSTRUCTION MATERIALS AND TECHNOLOGY

14IM111	APPLIED STATISTICS AND OPTIMIZATION	Category	L	T	P	Credit
		BS	3	1	0	4

Common to 14EN111

Preamble

The correlation refers to the techniques used in measuring the closeness of relationship between the variables. When three or more variables are studied, it is a problem of either multiple or partial correlation. Estimators refer to the problem of determining the functions of sample observations such that the distribution is concentrated as closely as possible near the true value of the parameter. A statistical hypothesis is a quantitative statement about the probability distribution characterizing a population which we want to verify on the basis of information available from a sample. Non-Parametric or distribution free methods that often assume no knowledge whatsoever about the distributions of the underlying populations, except perhaps that they are continuous. In design of experiments we consider some aspects of experimental design briefly and analysis of data from such experiments using analysis of variance techniques.

Prerequisite

Probability and Statistics

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Calculate the value which relates the dependent variable to one or more independent variables.	Apply
CO2	State a statistical inference from information contained in random samples about the populations from which the samples were obtained.	Understand
CO3	Estimate the characteristic of the population with degree of confidence from the random sample.	Apply
CO4	Determine the most reliable results of the population based on all the information available in a sample using non-parametric methods.	Apply
CO5	Calculate the experimental error and hence to control the extraneous variables involved in the experiment.	Apply
CO6	Determine the optimum values of unconstrained optimization problems using search methods.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	L	-	-	-	-	L	-	L	L	-
CO2.	M	L	L	-	-	-	L	-	L	L	S
CO3.	S	L	-	M	-	-	L	-	L	S	M
CO4.	S	L	M	M	-	-	L	-	L	S	-
CO5.	S	L	M	M	-	L	L	-	L	S	-
CO6.	S	L	-	M	-	L	L	-	L	L	-

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	20	20	10
Understand	30	20	20	20
Apply	60	60	60	70
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define Multiple Correlations.
2. If $x_1, x_2, \ldots x_n$ are random observations on a Bernoulli variable x taking the value 1 with probability θ and the value 0 with probability (1- θ), show that $\frac{\tau(\tau-1)}{n(n-1)}$ is an unbiased estimate of θ^2 where $\tau = \sum_{i=1}^{n} x_i$.
3. Calculate the M.L.E of the parameter α of the population having the density function $f(x,y) = \frac{2}{\alpha^2}(\alpha - x)$,0<x< α for a sample of unit size (single sample) and also Show that the estimate is biased.

Course Outcome 2 (CO2):

1. Define one tailed and two–tailed tests.
2. In a large city A, 20% of a random sample of 900 school boys had a slight physical defect. In another large city B, 18.5% of a random sample of 1600 school boys had the same defect. Identify whether the difference between the proportions is significant or not.

3. The following information was obtained in a sample of 40 small general shops:

	Shops in areas	
	Urban	Rural
Owned by Men	17	18
Owned by Women	3	12

Discuss is it possible to say that there are more women owners in rural areas than in urban areas? Use Yate's Correction for continuity.

Course Outcome 3 (CO3):

1. Examine whether the two samples for which the data are given in the following table could have been drawn from populations with the same SD.

	Size	S.D
Sample 1	100	5
Sample 2	200	7

2. The heights of 10 males of a given locality are found to be 175, 168, 155, 170, 152, 170, 175, 160, and 165 cm. Based on this sample, determine the 95% confidence limits for the height of males in that locality.

3. Identify whether the sample having the values 63, 63,64,55,66,69,70,70 and 71 has been chosen from a population with mean of 65 at 5% level of significance.

Course Outcome 4 (CO4):

1. The following are the number of minutes it took a sample of 15 men and 12 women to complete the application form for a position.

   Men: 16.5, 20.0, 17.0, 19.8, 18.5, 19.2, 19.0, 18.2, 20.8, 18.7, 16.7, 18.1, 17.9, 16.4, 18.9.

   Women: 18.6, 17.8, 18.3, 16.6, 20.5, 16.3, 19.3, 18.4, 19.7, 18.8, 19.9, 17.6. Apply the Mann-Whitney test at the level of significance $\alpha = 0.05$ to the null hypothesis that the two samples come from identical population.

2. The following are the number of misprints counted on pages selected at random from the Sunday editions of a newspaper:

   April 11: 4, 10, 2, 6, 4, 12

April 18: 8, 5, 13, 8, 8, 10

April 25: 7, 9, 11, 2, 14, 7

Apply Kruskal-Wallis test at the level of significance $\alpha = 0.05$ to test the null hypothesis that the three samples come from identical populations against the alternative that the compositors and/or proofreaders who worked on the three editions are not equally good.

3. The following arrangement indicates whether sixty consecutive care which went by the toll booth of a bridge had local plates,L,or out-of state plates O: L L O L L L L O O L L L L O L O O L L L L O L O O L L L L L O L L L O L O L L L L O O L O O O O L L L L O L O O L L L O. Illustrate whether this arrangement of 's and O's may be regarded as random by using the level of significance $\alpha = 0.05$.

Course Outcome 5 (CO5):

1. To determine optimum conditions for a plating bath, the effects of sulfone concentration and bath temperature on the reflectivity of the plated metal are studied in a 2x5 factorial experiment. The results of three replicates are as follows:

Concentration (grams/liter)	Temperature (degrees F)	Rep.1	Rep.2	Rep.3
5	75	35	39	36
5	100	31	37	36
5	125	30	31	33
5	150	28	20	23
5	175	19	18	22
10	75	38	46	41
10	100	36	44	39
10	125	39	32	38
10	150	35	47	40
10	175	30	38	31

Determine the bath condition or conditions that produce the highest reflectivity.

2. The following data resulted from an experiment to compare three burners B_1, B_2, B3. A latin square design was used as the tests were made on 3 engines and were spread over 3 days.

	Engine 1	Engine 2	Engine 3
Day 1	B_1-16	B_2-17	B_3-20
Day 2	B_2-16	B_2-21	B_1-15
Day 3	B_2-15	B_1-12	B_2-13

Test the hypothesis and determine whether there is any difference between the burners.

3. The following table shows the lives in hours of four brands of electric lamps brand.

A: 1610 1610 1650 1680 1700 1720 1720 1800

B: 1580 1640 1640 1700 1750

C: 1460 1550 1600 1620 1640 1660 1740 1820

D: 1510 1520 1530 1570 1600 1680.

Perform an analysis of variance to test the homogeneity of the mean lives of the four brands of lamps.

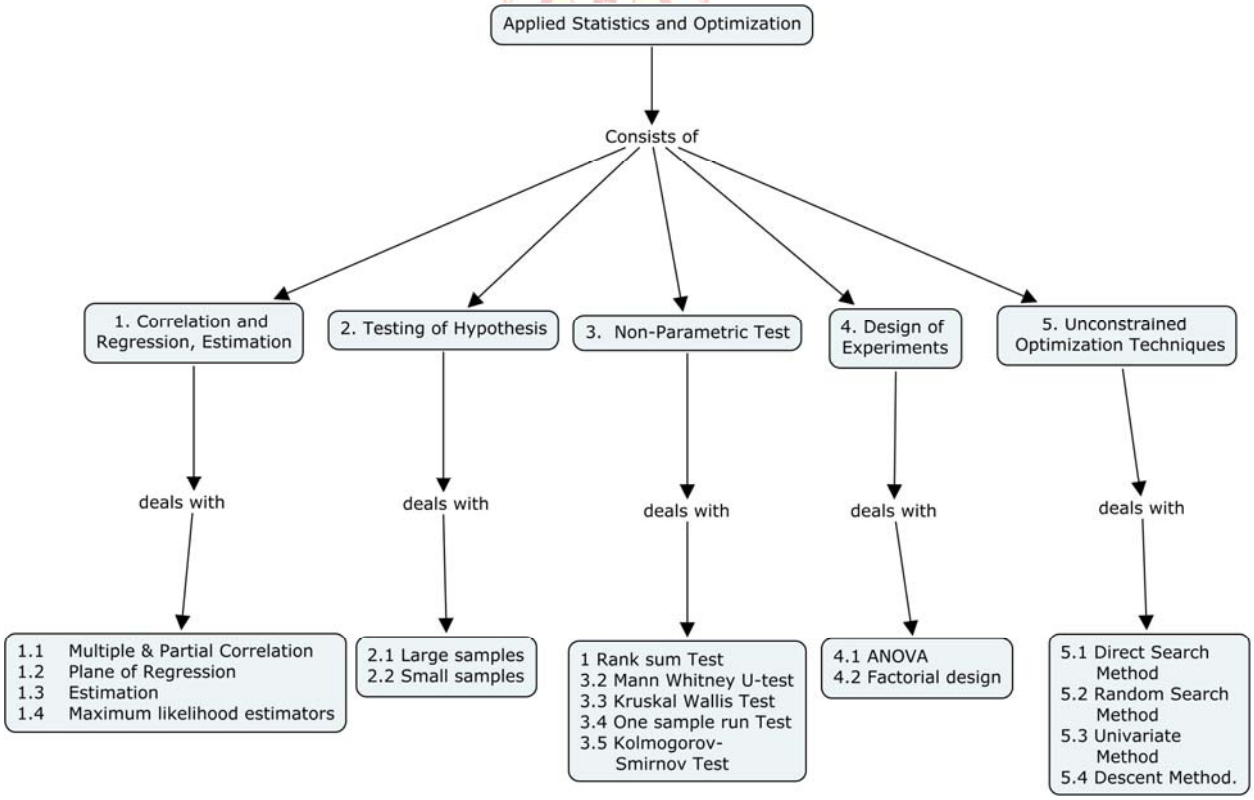
Course Outcome 6 (CO6):

1. Find the gradient of a function $f(x_1,x_2) = 6x_1^2-6x_1x_2+2x_2^2-x_1-2x_2$.

2. Minimize the function $f(x_1,x_2) = 6x_1^2+2x_2^2$ from the starting point (1,2) by univariate search method.

3. Minimize the function $f(x_1,x_2) = 2x_1^2+2x_1x_2+x_2^2+x_1-x_2$.

Concept Map



Syllabus

Correlation & Regression Analysis, Sampling Distribution & Estimation Multiple and Partial Correlation, Yules notation, plane of regression, Coefficient of partial and multiple correlation-properties, Sampling-distribution statistics, Standard error, point and interval estimation for population mean, variance, Maximum likelihood estimators. **Testing of Hypothesis** Testing of hypothesis-inferences concerning to means, variances and proportions, t-test, Chi-Square test, F-test. **Non Parametric Tests** Sign test of paired data**,**

Rank Sum test, Mann Whitney U-test, Kruskal Wallis test, One sample run test, Kolmogorov-Smirnov test. **Design of Experiments** Analysis of Variance-One way classification, Two way classification, Block randomized design, Latin Square design, Factorial design, Test of Significance of main and interaction effects. **Unconstrained Optimization Techniques** Direct Search Method, Random Search Method, Univariate Method, Pattern search Method, Descent Method, Steepest Descent Method.

Reference Books

1. Irwin Miller, John E.Freund "Probability and Statistics for Engineers" Prentice Hall of India Pvt. Ltd.; New Delhi, 1977.
2. S.S Rao "Optimization Techniques". Wiley Eastern Ltd.; 1992.
3. T.Veerarajan "Probability, Statistics and Random Processes" Tata McGraw-Hill, New Delhi, 2003.
4. Ronald E.Walpole, Sharon L.Myers "Probability and Statistics for Engineers and Scientists". Eighth Edition, Pearson education, New Delhi, 2007.

Course Contents and Lecture Schedule

Module No.	Topics	No.of Lectures
1.0	**Correlation & Regression Analysis, Sampling Distribution & Estimation**	
1.1	Multiple and Partial Correlation, Yules notation, plane of regression	1
1.2	Coefficient of partial and multiple correlation-properties	2
	Tutorial	1
1.3	Sampling-distribution statistics, Standard error	1
	Tutorial	1
1.4	Point and interval estimation for population mean & variance, Maximum likelihood estimators	2
	Tutorial	1
2.0	**Testing of Hypothesis**	
2.1	Testing of hypothesis-inferences concerning to means, variances and proportions	2
2.2	t-test	2
	Tutorial	1
2.3	Chi-Square test, F-test	2
	Tutorial	1
3.0	**Non Parametric Tests**	
3.1	Sign test of paired data	1
3.2	Rank Sum test	2
	Tutorial	1
3.3	Mann Whitney U-test, Kruskal Wallis test	1
	Tutorial	1
3.4	One sample run test, Kolmogorov-Smirnov test	2
	Tutorial	1
4.0	**Design of Experiments**	
4.1	Analysis of Variance-One way classification	2

4.2	Two way classification	2
	Tutorial	1
4.3	Block randomized design	2
4.4	Latin Square design	1
	Tutorial	2
4.5	Factorial design, Test of Significance of main and interaction effects	2
	Tutorial	1
5.0	**Unconstrained Optimization Techniques**	
5.1	Direct Search Method, Random Search Method	2
	Tutorial	1
5.2	Univariate Method, Pattern search Method	2
	Tutorial	1
5.3	Descent Method, Steepest Descent Method	2
	Tutorial	1
	Total	**48**

Course Designers:

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15IM120	MATERIAL PROCUREMENT AND MANAGEMENT	Category	L	T	P	Credit
		PC	3	0	0	3

Preamble

Upon successful completion of this course, the student will be able to understand the core principles of project procurement management, consistent with the PMBOK Guide; gain exposure to project evaluation, procurement planning, effective techniques for successfully delivering projects and allocating risks; and recognize and promote ethical practice in project acquisition and procurement.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1) Identify the need and role of material management	Understand
(CO2) Able to classify materials, identify sources of procurement, conduct vendor analysis	Apply
(CO3) Exercise control for effective management of inventory	Apply
(CO4) Manage stores and exercise quality control on materials	Apply
(CO5) Apply MMS in planning, procurement, inventory and cost control, evaluate projects and manage risks	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	L	-	-	-	-	-	L	-	L	-	-
CO2.	M	M	M	-	S	-	S	S	L	S	M
CO3	M	S	M	L	-	S	S	M	L	S	M
CO4	M	S	M	M	-	S	S	S	L	S	M
CO5	M	S	M	S	-	S	S	M	L	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	60	60	60	40
Analyse	0	0	0	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Write the need and significance of material management
2. Discuss the roles of a material manager
3. Write two objectives of management of materials

Course Outcome 2 (CO2):

1. Write the need for standardization/ codification of materials in construction industry
2. As a material manager of a firm discuss the procedure you would adopt for identification of selection of appropriate vendor for purchase of inventory. Give suitable justification
3. Discuss the principle of Just in time management in relation to inventory

Course Outcome 3 (CO3):

1. Mention the importance of selective inventory control in industry
2. As an inventory manager discuss the techniques you would adopt in your industry to control inventory so as to achieve economy. Give suitable reasons
3. Write a note on indices used for assessment of effectiveness of inventory management

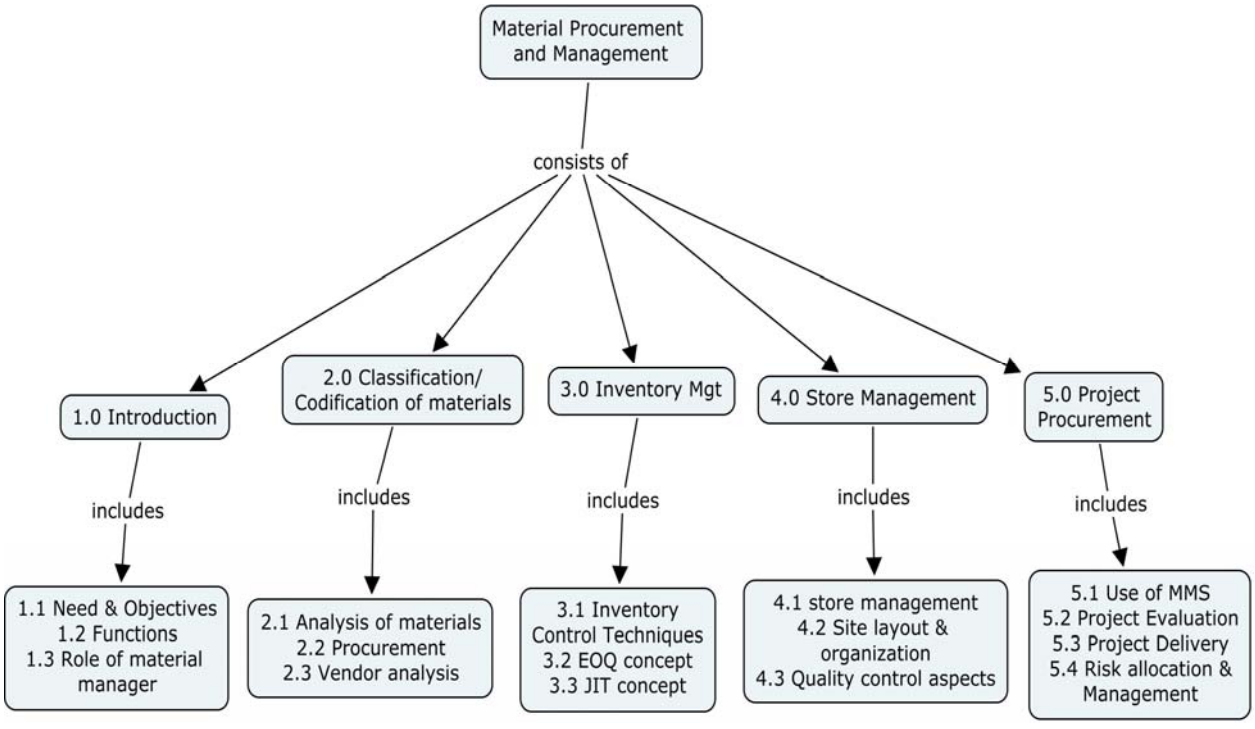
Course Outcome 4 (CO4):

1. Discuss the measures to be taken to maintain stores
2. Write a detailed note on scheduling of men, materials and equipments for projects
3. Identify and discuss the measures you would adopt to maintain quality in material management in your industry

Course Outcome 5 (CO5):

1. Discuss the merits of using MMS for management of materials in industry
2. As an infrastructure engineer suggest suitable measures of identification and management of risks in relation to material management taking a project of your choice
3. Write a note on project evaluation, its methods discussing its merits and limitations

Concept Map



Syllabus

Introduction: Importance of material management and its role in construction industry-scope, objectives and functions, Integrated approach to materials management, Role of materials manager. **Classification and Codification of materials of construction**: ABC, FSN, VED, SOS analysis- Procedure and its use, Standardization in materials and their management, Procurement, identification of sources of procurement, vendor analysis. Vendor analysis concept of (MRKP) Material requirement planning, planning, purchase procedure, legal aspects. **Inventory Management** – Store Purchase Manual, Contractors Obligation. Inventory Control techniques. EOQ, Advantages and limitation of use of EOQ, Periodic ordering, order point control, safety stock, stock outs, application of AC analysis in inventory control, concept of (JIT) - Just in time management, Indices used for assessment of effectiveness of inventory management. **Stores Management**: Receipt and inspection, care and safety in handling, loss on storage, wastage, Bulk purchasing, site layout and site organization, scheduling of men, materials and equipment. **Quality Control** – Conventional methods of quality control of Construction materials. Statistical method of quality control, sampling techniques quality control in process. Quality management and its economics. **Project procurement processes. Use of (MMS)** – Materials Management Systems in materials planning, procurement, inventory control, cost control etc. **Project evaluation**: Discounted Cash Flow, Real Options Theory. Project delivery methods, Competitive bidding. Risk allocation and management. Integrated project delivery. Contract negotiation.

References

1. "A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Fourth Edition, An American National Standard, ANSI/PMI 990001-2008"
2. Chitale A.K. and R.C. Gupta, “Material Management – Text and Cases”, Prentice Hall of India Pvt. Ltd., 2007
3. Denise Bower, “Management of Procurement”, Construction Management Series, Thomas Telford Publishing, 2003
4. Joseph Philips, PMP, Project Management and Professional (Certification Study Guides), McGraw Hill Publication, 2013
5. Jhamb L.C., “Inventory Management”, Everest Publishing house, 2005
6. Menon K.S., “Purchasing and Inventory Control”, Wheeler Publication, 1993
7. Ministry of Rural Development, GOI, “Procurement Manual”, National Rural Livelihoods Project, 2010
8. Peter Holm Andreasen, “Dynamics of Procurement Management – A Complexity Approach”, Copenhagen Business School, 2012
9. Peter Baily, David Farmer, Barry Crocker, David Jessop & David Jones, “Procurement Principles and Management”, FT Prentice Hall, 2010
10. Manual for Ministry of Roads, Transport and Highways (MoRTH), GOI, 2007, 4th Revision

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**Introduction to Material Procurement and Management**	
1.1	Need and Importance of material management and its role in construction industry	1
1.2	Scope, objectives and functions of material management, Integrated approach to materials management	2
1.3	Role of materials manager	
2.0	**Classification and Codification of Materials of Construction**	

2.1	ABC, FSN - Procedure and its use	1
	VED, SOS analysis - Procedure and its use	2
2.2	Standardization in materials and their management, Procurement, Identification of sources of procurement	2
2.3	Vendor analysis concept of (MRKP) Material requirement planning, planning, purchase procedure, legal aspects	2
3.0	**Inventory Management**	
3.1	Inventory Control techniques – principle and applications	2
3.2	EOQ, Advantages and limitation of use of EOQ, Periodic ordering, order point control,	2
	Safety stock, stock outs, application of AC analysis in inventory control	2
3.3	Concept of Just in time management(JIT), Indices used for assessment of effectiveness of inventory management	1
4.0	**Stores Management**	
4.1	Receipt and inspection, care and safety in handling, loss on storage, wastage, Bulk purchasing,	2
4.2	Site layout and site organization, scheduling of men, materials and equipment.	2
4.3	Quality Control – Conventional methods of quality control of Construction materials. Statistical method of quality control	2
	Sampling techniques quality control in process. Quality management and its economics	2
5.0	**Project procurement**	
5.1	Project procurement processes: Use of (MMS) – Materials Management Systems in materials planning,	2
	Procurement, inventory control, cost control	2
5.2	Project evaluation: Discounted Cash Flow, Real Options Theory. Project delivery methods, Project delivery methods. Competitive bidding	2
5.3	Project Delivery: Integrated project delivery	2
5.4	Risk allocation and management Contract negotiation and engineering	2
	Public private partnerships	1
	Total Hours	**36**

Course Designers:

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15IM130	TRAFFIC ENGINEERING AND MANAGEMENT	Category	L	T	P	Credit
		PC	3	1	0	4

Preamble

Reliable and efficient traffic engineering management is crucial in our daily lives. This course imparts the student's, importance of transportation, various traffic engineering studies and traffic flow characteristics. The students will also acquire proficiency in the design of traffic facilities and also in efficient traffic management techniques. Further, students will be exposed to road safety aspects and studies.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Identify various traffic engineering studies	Apply
CO2:	Explain traffic flow and its characteristics	Understand
CO3:	Design traffic facilities	Apply
CO4:	State principles of road signs, markings and street furnitures	Understand
CO5:	Identify road safety requirements	Apply
CO6:	Explore techniques for traffic management	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	M	S	S	-	M	-	L	M	S	-
CO2.	S	L	-	-	-	M	M	-	-	-	-
CO3.	S	M	S	S	-	M	M	L	M	S	-
CO4.	S	M	S	S	-	M	-	-	M	S	-
CO5.	S	L	-	-	-	M	M	-	M	-	M
CO6.	S	L	-	-	M	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	60	60	60	60
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain the significance and scope of traffic engineering.
2. Describe the different methods of conducting Traffic volume studies.
3. Mention the principle and application of Traffic Volume Studies.

Course Outcome 2 (CO2):

1. List the various human factors which are of importance to driver.
2. List out the different types of resistance offered by the vehicle while it is in motion.
3. Mention the various driver characteristics affecting traffic behaviour on roads

Course Outcome 3 (CO3):

1. The following data were obtained from the spot speed studies.
   Suggest i) Speed limit for regulation ii) Speed to check geometric design elements iii) Lower speed group causing congestion iv) Dispersion.

Speed range kmph	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of vehicles observed	20	45	75	95	290	420	210	155	85	40

2. Traffic flow in an urban section at the intersection of two highways in the design year is given below. The highways intersect at right angles and have a carriage way width of 16m.Design the rotary intersection using PCU value of car =1, commercial vehicle (com.v) =2.8 and scooter (SC)=0.75.

Approach	Left turning			Straight Ahead			Right Turning		
	Car	Com.V	SC	Car	Com.V	SC	Car	Com.V	SC
N	200	50	100	250	40	160	150	50	80
E	175	60	80	210	60	120	150	60	120
S	245	70	100	120	50	80	160	55	80
W	210	40	120	190	45	100	180	75	100

3. Draw neatly a rotary intersection where four roads meet and indicate the directions of traffic flow.

Course Outcome 4 (CO4):

1. Mention the classification of road signs.
2. State the objectives in providing road markings and describe its effectiveness in traffic regulation.
3. List the benefits of providing street furnitures.

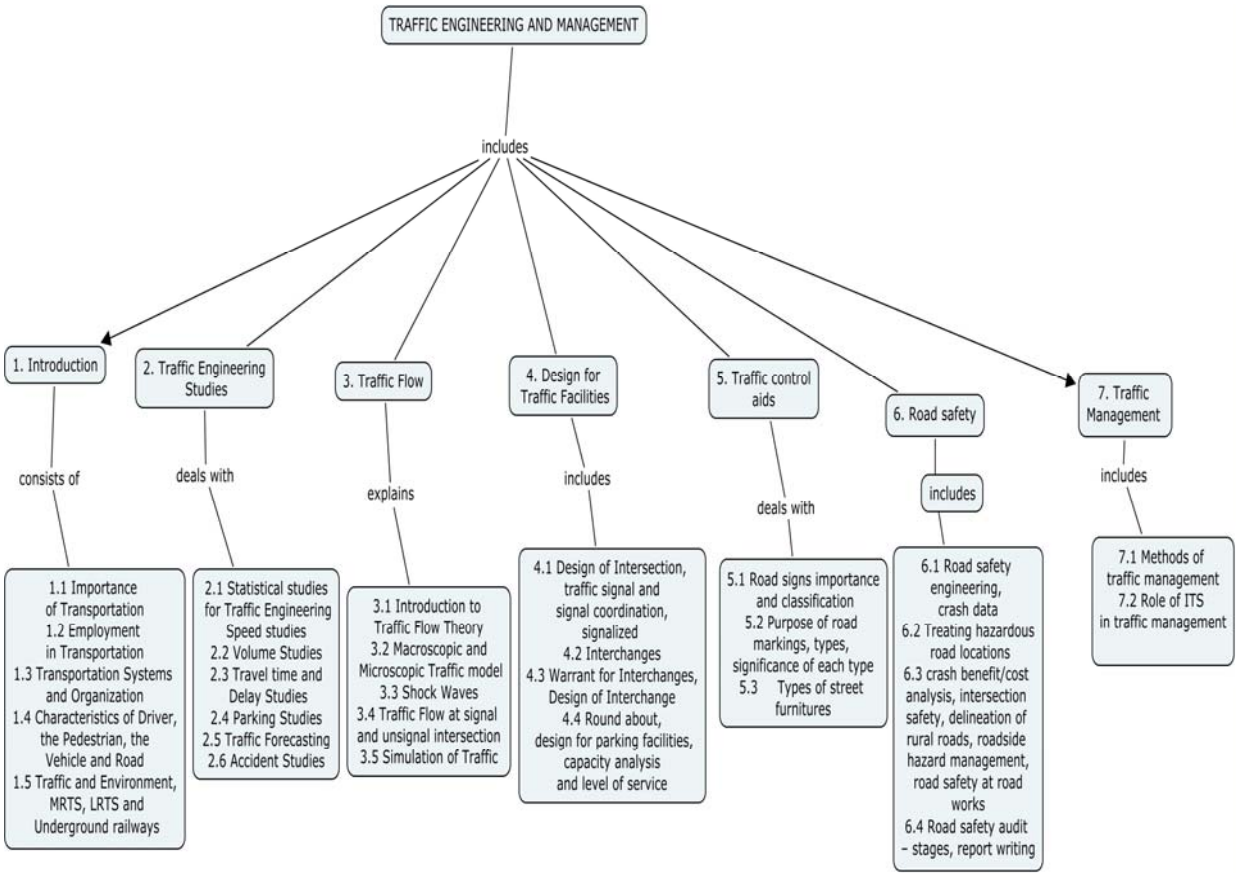
Course Outcome 5 (CO5):

1. Mention the importance of good crash data.
2. Explain roadside hazard management with suitable illustrations.
3. Discuss various stages of road safety audit.

Course Outcome 6 (CO6):

1. Recall various methods of traffic control in urban roads.
2. Explain traffic control aids.
3. Explain briefly computer applications in traffic regulations.

Concept Map



Syllabus

Introduction Importance of transportation, Transportation systems and organisation. Characteristics of Driver, the pedestrian, the vehicle and road. (problems). **Traffic Engineering Studies** Statistical studies for traffic engineering; speed studies – volume studies – travel time and delay studies – parking studies – traffic forecasting. Accident studies.(concepts and problems)**Traffic Flow** Introduction to traffic flow theory- Macroscopic and microscopic traffic model, shock waves, traffic flow at signalised and un-signalised intersection. Simulation of traffic. (concepts and problems) **Design For Traffic Facilities** Intersection design, Design of traffic signal and signal coordination. Intersection design, signalized design – Interchanges – Warrant for interchanges, design of interchange –round about, design for parking facilities, capacity analysis and level of service (concepts and problems).**Traffic Control aids -** road signs, road markings, street furnitures. **Road safety-** Road safety engineering, importance of good crash data, treating hazardous road locations (blackspots), crash benefit/cost analysis, intersection safety, delineation of rural roads, roadside hazard management, road safety at road works, Traffic management plan (TMP), Road Safety Audit – stages of audit, technical report writing. **Traffic management systems -** methods and techniques for traffic management **-** role of ITS in traffic management.

Reference Books

1. Kadiyali L.R, “Traffic Engineering and Transportation Planning” Khanna Publishers, Delhi, 2005.

2. Khanna SK and Justo CEG, “Highway Engineering”, Nem Chand & Bros, Roorkee, 2010.

3. Brase/Brase “Understandable Statistics 3rd edition”,D C Health and Company, Lexington, Massachusetts,Toronko,1987.

4. Jason C.yu, Transportation Engineering: Introduction to Planning, Design and Operations, Elsevier,1992.

5. Taylor M.A.P and Young W,Traffic Analysis-New Technology and New solutions, Hargreen Publishing Company,1998.

6. Nicholas J. Garben and Lester A Hoel,”Traffic and Highway Engineering”, PWS Publication,1999.

7. Partha Chakroborty and Animesh Das,” Principle of Traffic Engineering”,Prentice Hall of India,New Delhi,2003.

8. Flaherty,”Transportation Planning and Traffic Engineering”, Elesevier India Pvt Ltd.,2006.

9. Mike Slinn, Peter Guest and Paul Matthews “Traffic Engineering Design Principles and Practice”,Elesevier, 2006.

10. http://www.nptel.ac.in/downloads/105101008/

Course Contents and Lecture Schedule

Module No.	Topic	No.of Lectures
1.0	**Introduction**	
1.1	Importance of Transportation	1
1.2	Employment in Transportation	1
1.3	Transportation Systems and Organization	1
1.4	Characteristics of Driver, the Pedestrian, the Vehicle and Road(Problems)	2
	Tutorial	1
1.5	Traffic and Environment, MRTS, LRTS and Underground railways	1
2.0	**Traffic Engineering Studies**	
2.1	Statistical studies for Traffic Engineering, Speed studies	2
2.2	Volume Studies	1
2.3	Travel time and Delay Studies	1
	Tutorial	2
2.4	Parking Studies	1
2.5	Traffic Forecasting	1
2.6	Accident Studies(concepts and problems)	1
	Tutorial	2
3.0	**Traffic Flow**	
3.1	Introduction to Traffic Flow Theory	1
3.2	Macroscopic and Microscopic Traffic model	2
3.3	Shock Waves	1

3.4	Traffic Flow at signal and unsignal intersection	1
	Tutorial	2
3.5	Simulation of Traffic(Concepts and problems)	1
4.0	**Design for Traffic Facilities**	
4.1	Intersection Design, design of traffic signal and signal coordination, signalized design	3
	Tutorial	2
4.2	Interchanges	1
4.3	Warrant for Interchanges, Design of Interchange	2
	Tutorial	1
4.4	Round about, design for parking facilities, capacity analysis and level of service (concepts and problems).	2
5.0	**Traffic control aids**	
5.1	Road signs importance and classification	1
5.2	Purpose of road markings, types, significance of each type	1
5.3	Types of street furnitures	1
6.0	**Road safety**	
6.1	Road safety engineering, crash data	1
6.2	Treating hazardous road locations	1
6.3	crash benefit/cost analysis, intersection safety, delineation of rural roads, roadside hazard management, road safety at road works	2
6.4	Road safety audit – stages, report writing	1
	Tutorial	1
7.0	**Traffic Management**	
7.1	Methods of traffic management	1
7.2	Role of ITS in traffic management	1
	TOTAL HOURS	**48**

Course Designers:

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15IM140	PROJECT FORMULATION AND IMPLEMENTATION	Category	L	T	P	Credit
		PC	3	1	0	4

Preamble

This course addresses the overall idea of project formulation and implementation of infrastructure projects

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1) Plan and Schedule Projects	Apply
(CO2) Estimate the project cost	Apply
(CO3) Enumerate the JNNURM vision	Understand
(CO4) Explain the essential qualities of a successful contractor/ consultant and Suggest solutions to possible contractual problems	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	S	---	---	---	M	S	M	---	S	L
CO2.	S	S	---	---	---	---	S	M	---	S	---
CO3	S	---	---	---	---	---	---	---	---	---	---
CO4	S	---	M	---	---	M	S	M	---	S	---

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	60	60	60	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1(CO1):

1. As a Civil Engineer what do you think are essential for the development of Infrastructure Management System (IMS) for a construction industry? Discuss
2. Define planning and mention its need in infrastructure projects
3. Discuss the parameters to be considered in prefeasibility report of projects

Course Outcome 2 (CO2):

1. Differentiate between NPV and BCR methods of assessment of projects

2. Discuss your understanding of profitability of a project in terms of capital investment and capital employed

3. Consider a socio-economic project of your choice; what measures would you take to arrange for the finance for the project? Discuss

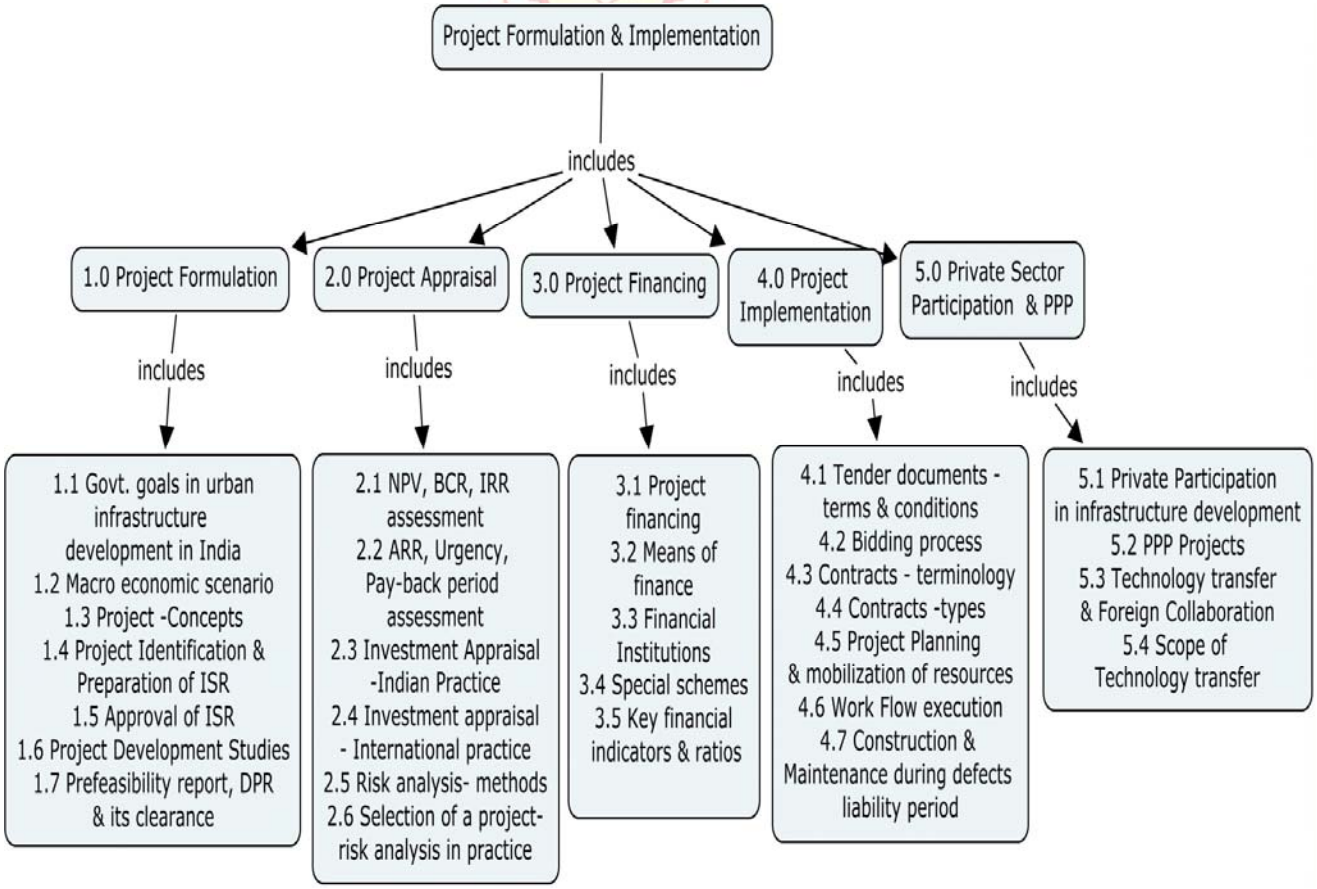
Course Outcome 3(CO3):

1. Mention the objectives of JnNURM
2. Prepare a Detailed Project Report for a Municipal Solid Waste Project for your own city, which has to be funded by JnNuRM
3. Write the definition of infrastructure
4. Define the term risk in projects and discuss the various methods of analyzing it

Course Outcome 4 (CO4):

1. As a project manager you are vested with the responsibility of bidding for an infrastructure project. What bidding strategies would you consider? Discuss with justification.
2. A highway project is proposed to be constructed for Rs. 200 crores; as a safety manager of the project what would you consider as the risks involved in the project and what measures would you adopt to analyze the risks involved? Discuss with proper justification
3. A rail over bridge project costing 50 crores of rupees is proposed to be constructed in Madurai city; as a civil engineer in the project what type of contract would you recommend for the execution of the project? Discuss giving reasons

Concept Map



Syllabus

Project Formulation: Government Goals & Targets in Urban and Infrastructure Development in India – Country Macro Economic Scenario - Project – Concepts – Project

identification – Preparation of Initial Screening Report (ISR) – Approval of ISR and Project by Government / Owner / Statutory Authorities – Project Development Studies - Preliminary Analysis, SWOT analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required. **Project Performance and Appraisal:** Economic evaluation**,** NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice.**Project Financing:** Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators and Ratios. **Project Implementation:** Tender Document – Terms and Conditions – Bidding Process – Contracts – Terminology in Contracts – Types of Contracts – BOO, BOT, DBOT, DBOOT, BOOT, EPC & Turnkey – Project Planning – Mobilization of resources - Work Flow Execution – Construction & Maintenance during Defect Liability Period. **Private Sector Participation & PPP:** Private Sector participation in Infrastructure Development Projects – Public Private Partnership Projects - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.

References

1. Raina V.K, “Construction Management Practice – The inside Story”, Tata McGraw Hill Publishing Limited, 2005
2. Leslie Feigenbaum, “Construction Scheduling With Primavera Project Planner”, Prentice Hall, 2002
3. W.Ronald Hudson, Ralph Haas, Waheed Uddin, “Infrastructure Management: Integrating, Design, Construction, Maintenance, Rehabilitation and renovation” , McGraw Hill Publisher, 2013
4. Prasanna Chandra, “Projects – Planning, Analysis, Selection, Implementation Review”, Tata McGraw Hill Publishing Company Ltd., New Delhi. 2006.
5. Joy P.K., “Total Project Management - The Indian Context”, Macmillan India Ltd., 1992
6. Report on Indian Urban Infrastructure and Services – The High Powered Expert Committee for estimating the Investment Requirements for Urban Infrastructure Services, March 2011
7. Urban Water Development in India 2011 – Published and Distributed by India Infrastructure Research
8. Manual on sewerage and sewage treatment, CPHEEO, ministry of urban affairs & employment, Govt.of India, New Delhi, 2012
9. Manual of National Highway Authority of India, 1988
10. International Guide for Reconstruction and Development, 1992

Course Contents and Lecture Schedule

Module No.	Topics	Periods
1.0	**Project Formulation**	
1.1	Government Goals & Targets in Urban & Infra Structure Development in India	1
1.2	Country Macro Economic Scenario	1
1.3	Project – Concepts, types of projects based on nature	1
1.4	Project identification – Preparation of Initial Screening Report (ISR)	2
1.5	Approval of ISR and Project by Government / Owner / Statutory Authorities	2

1.6	Project Development Studies- Preliminary Analysis, Market, Technical, Financial, Economic and Ecological	2
1.7	Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required, Case studies	2
2.0	**Project Appraisal**	
2.1	Net Present Value, Benefit Cost Ratio & Internal Rate of Return methods of assessment	2
2.2	ARR, Urgency & Pay Back Period methods of assessment	2
2.3	Investment appraisal- Indian practice	1
2.4	Investment appraisal- International practice	1
2.5	Analysis of Risk – Different Methods	1
2.6	Selection of a Project and Risk Analysis in Practice, Case studies	2
3.0	**Project Financing**	
3.1	Project Financing	2
3.2	Means of Finance	1
3.3	Financial Institutions	1
3.4	Special Schemes, Government Subsidies- Leverage	2
3.5	Key Financial Indicators and Ratios, Case studies	2
4.0	**Project Implementation**	
4.1	Tender Document – Terms and Conditions	2
4.2	Bidding Process	1
4.3	Contracts – Terminology in Contracts	2
4.4	Types of Contracts – BOO, BOT, DBOT, DBOOT, BOOT, EPC & Turnkey	2
4.4.1	Toll based projects – Anuity based projects	2
4.5	Project Planning and Mobilization of resources	2
4.6	Work Flow Execution	1
4.7	Construction & Maintenance during Defect Liability Period, Case studies	2
5.0	**Public/Private Partnership**	
5.1	Private sector participation in Infrastructure Development Projects	2
5.2	Public Private Partnership in Projects, Viability Gap funding (VGF)	1
5.3	Technology Transfer and Foreign Collaboration	1
5.4	Scope of Technology Transfer, IPR- Intellectual Property rights, Case studies	2
	Total Periods	**48**

Course Designers:

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14IM150	QUANTITATIVE METHODS IN MANAGEMENT	Category	L	T	P	Credit
		PC	3	1	0	4

Preamble

Decision making in today's social and business environment has become a complex task. The uncertainty of the future and the nature of competition and social interaction greatly increase the difficulty of managerial decision making. This course work on quantitative methods is an aid to decision making which offers the decision-maker a method of evaluating every possible alternative by using various techniques to know the potential outcomes.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1) Formulate problems mathematically using the concept of Linear Programming (LP) — Apply

(CO2) Solve LP problems by graphical, Simplex methods, Duality concept and identify the special cases in obtained solution — Apply

(CO3) Solve transportation, assignment and traveling salesman problems — Apply

(CO4) Apply Dynamic Programming to shortest route problems, capital budgeting problems and LPP — Apply

(CO5) Apply game and decision theories to problems and understand the principle of Monte-Carlo simulation — Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	S	M	S	---	---	M	---	---	M	M
CO2.	S	S	S	S	---	L	S	---	---	M	L
CO3	M	M	S	M	---	M	S	---	---	S	L
CO4	M	M	S	M	---	M	S	---	---	S	L
CO5	M	M	S	L	L	M	S	---	---	S	L

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	60	60	60	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. A construction company has alternatives of building 2, 3 and 4 bedroom houses. The company wishes to establish the number of each type if any that will maximize the profit subject to the following conditions:
   i) the total budget is limited to Rs. $40x\ 10^7$
   ii) the total number of units must be atleast 300 for the venture to be economically feasible
   iii) the maximum % of each type based on market analysis is as follows:
   - 2 bedroom houses = 55% of total
   - 3 bedroom houses = 30% of total
   - 3 bedroom houses = 15% of total

   iv) the building costs and profits by sales are as follows:

Unit	Cost (Rs.)	Profit (Rs.)
2 bedroom houses	8,00,000	80,000
3 bedroom houses	10,00,000	1,25,000
3 bedroom houses	12,00,000	1,50,000

   Formulate the problem as a LPP

2. A tile manufacturing company manufactures two types of flooring tiles, regular and deluxe. The product is prepared in two plants, regular tiles are manufactured in Plant A and deluxe in plant B. Due to limitations in production capacities of A and B, the daily production is limited to not more than 900 regular tiles and 600 deluxe tiles. The product of both the types of tiles requires chips of a particular variety which is in short supply and limited to 525 units/day. The production of a regular tile requires 5 units of chips and deluxe tiles require 8 units of chips. Company has 160 hours of labour. To manufacture 10 regular tiles it requires 2.5 hours and 20 deluxe tiles 10 hours of labour. The profit for 100 regular tiles is Rs.50/- and 25 deluxe tiles is Rs.75/-. Formulate the LPP.

3. Discuss the various types of OR model. Write the principles of modeling OR problems

Course Outcome 2 (CO2):

1. Discuss the special cases in Simplex method of solution of LPP
2. Solve the following LPP by 2–phase technique.
   Minimize $Z = -3X1+X2$
   Subject to: $2X1 + X2 \geq 2$; $X1 + 3X2 \leq 2$; $X2 \leq 4$; & $X1, X2 \geq 0$
3. Using Simplex Method
   Maximize $Z= X1+2X2-X3$
   Subject to: $2X1+X2+X3 \leq 14$, $4X1+2X2+3X3 \leq 28$, $2X1+5X2+5X3 \leq 30$,
   $X1 \geq 0$; $X2 \geq 0$; X3 is unrestricted in sign

Course Outcome 3 (CO3):

1. Write the aim of traveling salesman problem

2. Identify under what circumstances assignment problems are considered as a special case of transportation problem

3. A construction company has 4 jobs and 4 labourers to do it. Each labourers can handle any job. The service in hours of each job when manned by each labourer is given below. How should the labourers be allocated to appropriate jobs so as to minimize the service time? Each labourers must handle only one job.

Labourers → Jobs ↓	A	B	C	D
W	41	72	39	52
X	22	29	49	65
Y	27	39	60	51
Z	45	5	48	52

Course Outcome 4 (CO4):

1. Use Dynamic Programming (DP) and solve the following short route problem and determine the shortest distance between cities 1 and 10

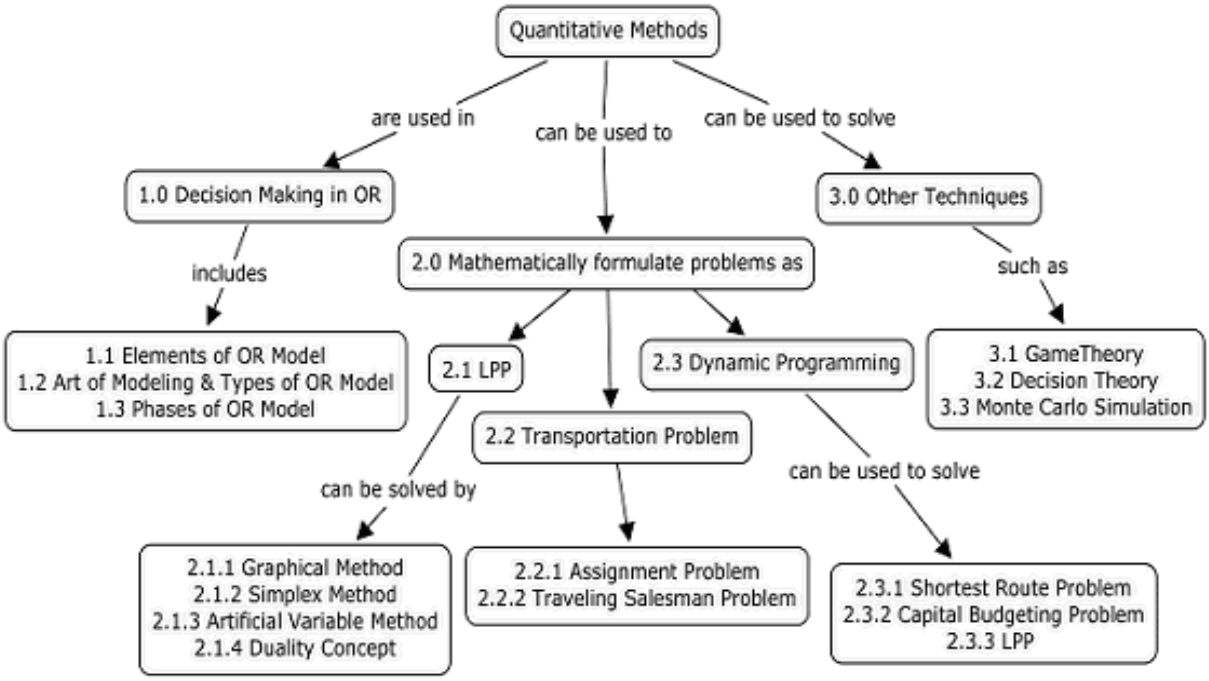
City (i –j)	1-2	1-3	2-4	3-4	2-5	3-6	4-8	4-9	4-7	5-7	6-7	6-9	7-10	5-8	8-10	9-10
Dist. miles	2	2	3	5	2	4	7	8	2	1	9	2	6	7	2	3

2. Discuss with an example why DP is called multistage decision process
3. Differentiate the terms state and stage in DP

Course Outcome 5 (CO5):

1. Distinguish between the solutions derived from Simulation models and that derived from analytical models
2. Discuss the implication of two person zero sum game with an application
3. Enumerate the principle of Monte Carlo simulation with an application

Concept Map



Syllabus

Mathematical Modeling in OR: Decision Making in Operations Research. The art and science of Operations Research- Elements of a decision model- art of modeling- Types of models- effect of data available on modeling- computations in OR- Phases of OR study.

Systems Design: Problem formulation- conversion of statement problems into LPP standard format. **Linear Programming Problem:** Definition and properties of Linear Programming Problem, Standard form- Graphical solution of two variable problems, special cases. Simplex method - computational procedure & problems. Artificial variables - Big M and two phase Techniques, Special cases in Simplex method. **Linear Programming Applications:** Duality concept, primal & dual properties. Transportation problems - Vogel's Approximation method, Determination of optimum solution. Assignment Problem- Hungarian method of solution, Traveling salesman problem. Applications to Civil Engineering problems. **Dynamic Programming:** Multistage decision process, Bellman's principle of optimality – Computational procedure – Illustrating Tabular method of solution – Computational procedure- Shortest route problem, Capital budgeting problem – Solution of Linear Programming Problem by Dynamic Programming. **Other Techniques:** Game theory – procedure and problems, Decision theory- procedure and problems. Simulation – Monte Carlo simulation – brief concept

References

1. Charbra P.D., "Computer Oriented Optimization Techniques for Traffic and Transportation systems", Khanna, 2014
2. Hamdy A. Taha, "Operations Research, An Introduction", Prentice Hall of India Pvt. Ltd., New Delhi-2009
3. Krishna Raju N. and Muthu K.U., "Numerical Methods in Engineering Problems", McMilan India Ltd., 1996
4. Rao S.S., "Optimization- Theory and Applications", New Age International (P) Ltd., Publishers, 2008

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**Decision Making in OR**	
1.1	Optimization – meaning. Elements of OR Model	1
1.2	Art of modeling and types of OR models	1
1.3	Phases of OR model	1
2.0	**Mathematical Formulation of OR**	
2.1	**Linear Programming Problem-** Definition and properties of Linear Programming Problem, Standard form	2
2.1.1	Graphical solution of two variable problems- Special cases	2
2.1.2	Simplex method - computational procedure & Problems	2
	Tutorial	2
2.1.3	Artificial variable Technique– M technique- procedure & problems	2
2.1.3	Artificial variable Technique -Two phase technique- procedure & problems	2
	Tutorial	2
2.1.4	Duality concept- Primal & dual properties, Conversion of primal to dual problems	2
2.1.5	Special cases in Simplex method – Degeneracy, Alternative optima, Un-bonded solution, infeasible solution	2
	Tutorial	2
2.2	**Transportation problems**	

2.2	Transportation problems- objectives- Vogel's Approximation method, Determination of optimum solution	2
2.2.1	Assignment Problem- objective, Hungarian method of solution – problems	2
2.2.2	Traveling salesman problem- concept and procedure- Problems	2
	Tutorial	2
2.3	**Dynamic Programming**	
2.3.1	Multistage decision process– Bellman's principle of optimality - Computational procedure – Illustrating Tabular method of solution Shortest route problem – computational procedure - Problems	3
2.3.2	Capital budgeting problem – Computational procedure – Problems	2
2.3.3	Solution of Linear Programming Problem by Dynamic Programming – problem	2
	Tutorial	2
3.0	**Other techniques**	
3.1	Game theory – procedure and problems	2
3.2	Decision Theory - procedure and problems	2
3.3	Simulation – Monte Carlo simulation – brief concept	2
	Tutorial	2
	Total Periods	**48**

Course Designers:

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15IM160	ENVIRONMENTAL IMPACT ASSESSMENT	Category	L	T	P	Credit
		PC	4	0	0	4

Preamble

To impart the knowledge and skills required for understanding the various impacts of infrastructure projects on the environment and expose the students to the various methodologies available to assess and predict the impacts, and to develop the skill to prepare Environmental Impact Assessment report.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the necessity to study the impacts that will be caused by projects or industries and the methods to assess these impacts	Understand
CO2	Describe the legal requirements of environmental impact assessment for projects	Understand
CO3	Prepare terms of reference for environmental impact and socio-economic impact for any developmental project	Apply
CO4	Prepare environmental management plan and mitigation measures by considering environmental aspects, impacts and potential hazards respectively for any project	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	M	M	---	---	M	M	M	---	---
CO2.	S	---	L	---	---	---	---	S	---	---	---
CO3.	S	S	M	L	M	M	---	S	---	S	L
CO4.	S	S	M	M	---	M	S	S	M	M	---

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	10	0
Understand	50	50	50	60
Apply	40	40	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Discuss the role of Public Participation in Environmental Decision Making.
2. EIA is an effective management tool : comment

3. Explain the various methodologies adapted for prediction of impacts for EIA report

Course Outcome 2 (CO2)**:**

1. Explain the legal framework for getting environment clearance for new projects.
2. Describe the procedure for conducting the public hearing as per EIA notification 2006.
3. Explain the legal framework for handling hazardous waste generated from any industry.

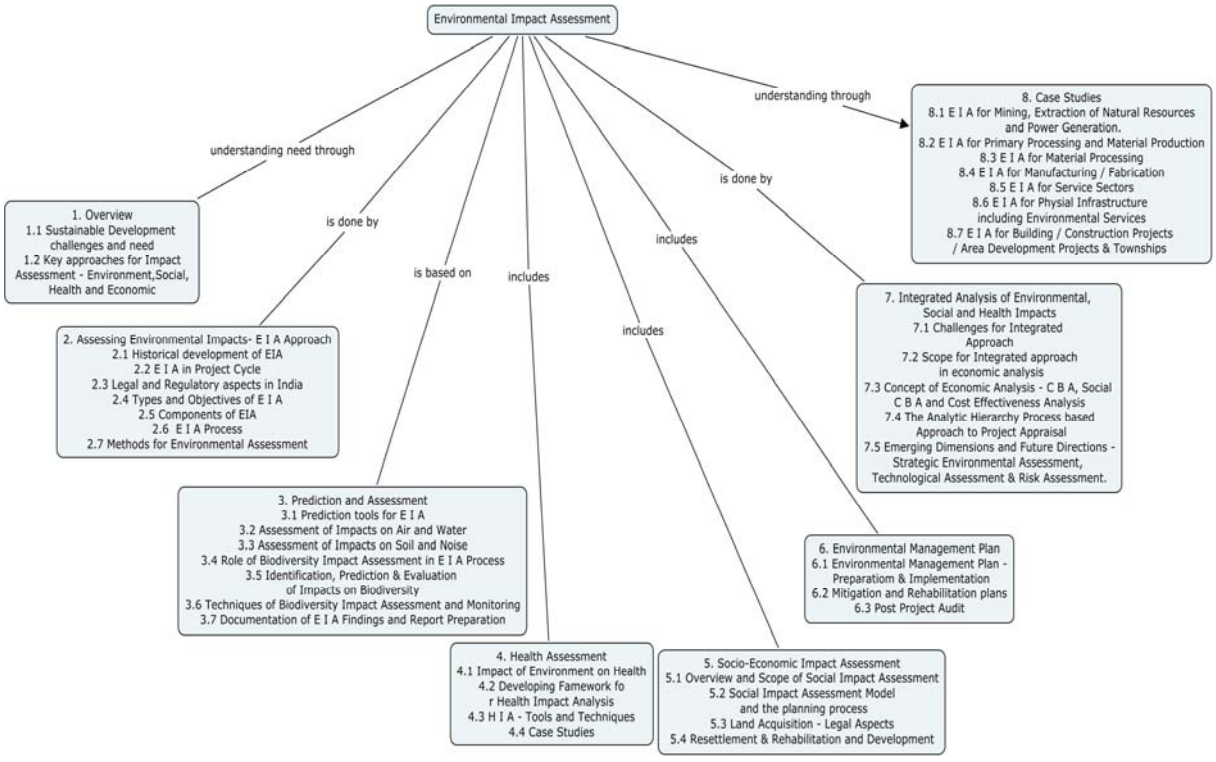
Course Outcome 3 (CO3):

1. Prepare terms of reference for coal based Thermal Power Plant having a capacity of 2x330 MW which is located at Nagapattinam district.
2. To control the air pollution caused by city share autos the collector of Madurai wanted to ban the use of Share Autos and develop a new metro rail network project between ThiruNagar and Melur. Prepare terms of reference for this metro rail project.
3. It is proposed to construct a large hydro-electric power project at the foot hills of Varusanaadu. Prepare terms of reference for the socio-economic impacts.

Course Outcome 4 (CO4):

1. Pudur is a town located along the OMR road. It is proposed to construct 6000 No. of residential houses in that area. Identify the potential impacts of the project and suggest a management plan to mitigate them.
2. Sabarimalai is a pilgrimage town located in Kerala state. It is proposed to develop a Greenfield airport project for the capacity to handle six new generation large aircraft. Identify the potential impacts of the project and suggest a management plan to mitigate them.
3. State the possible structural and non-structural mitigation measures for a large scale dam construction project.

Concept Map



Syllabus

OVER VIEW**:** Sustainable Development challenges and need- Key approaches for Impact Assessment ASSESSING ENVIRONMENTAL IMPACTS-E I A APPROACH: Historical development, Legal and Regulatory aspects in India, Types and Objectives, Components, Process of E I A , Prediction and Assessment: tools,impact on air ,water,soil & Noise, Role of Biodiversity impact Assessment, Identification ,Prediction &Evaluation of Impacts on Biodiversity, Techniques of Biodiversity impact assessment, E I A Report Preparation, HEALTH ASSESSMENT**:** Impact of Environment on Health, Developing framework for Health impact analysis, tools and techniques, Case studies. SOCIO-ECONOMIC IMPACT ASSESSMENT: Overview and Scope of Social Impact Assessment, S I A model and the planning process, Land acquisition –Legal aspects, Resettlement & Rehabilitation and Development. ENVIRONMENTAL MANAGEMENT PLAN: Preparation and implementation, Mitigation and Rehabilitation plans, Post Project Audit. INTEGRATED ANALYSIS OF ENVIRONMENTAL,SOCIAL AND HEALTH IMPACTS: Challenges for Integrated Approach, Scope for Integrated approach in economic analysis- C B A , Social C B A ,and Cost effectiveness Analysis, the Analytic Hierarchy process based approach to project appraisal, Emerging Dimensions and future Directions-Strategic Environmental Assessment, Technological Assessment and Risk Assessment. CASE STUDIES: EIA for Mining,extraction of natural resourcesand power generation, Primary Processing and Material production, Material Processing, Manufacturing/Fabrication, Service Sectors, Physical Infrastructure including Environmental Services, Building/Construction Projects/Area Development Projects & townships.

References

1. Canter, L.W., “Environmental Impact Assessment”, McGraw Hill, New York, 1996.
2. Anjaneyulu, Yerramilli, and Valli Manickam, “Environmental impact assessment methodologies”, Hyderabad: BS Publications, 2007.
3. Lawrence, D.P., “Environmental Impact Assessment – Practical Solutions to recurrent problems”, Wiley-Interscience, New Jersey, 2003.
4. Petts, J., “Handbook of Environmental Impact Assessment’, Vol., I and II, Blackwell science, London, 1999.
5. World Bank – Source Book on Environmental Impact Assessment, 2010
6. www.envfor.nic.in

Course Contents and Lecture Schedule

S.No	Topics	Periods
1.0 OVER VIEW		
1.1	Sustainable Development challenges and need	2
1.2	Key approaches for Impact Assessment –Environment, Social, health and Economic.	1
2.0ASSESSING ENVIRONMENTAL IMPACTS-E I A APPROACH		
2.1	Historical development of E I A	1
2.2	E I A in Project Cycle	1
2.3	Legal and Regulatory aspects in India	1
2.4	Types and Objectives of E I A	1
2.5	Components of E I A	2
2.6	E I A Process	2
2.7	Methods for Environmental Assessment	2

3.0 Prediction and Assessment		
3.1	Prediction tools for E I A	2
3.2	Assessment of Impacts on Air and Water	1
3.3	Assessment of Impacts on Soil and Noise	1
3.4	Role of Biodiversity impact Assessment in E I A Process	1
3.5	Identification ,Prediction &Evaluation of Impacts on Biodiversity	1
3.6	Techniques of Biodiversity impact assessment and monitoring	2
3.7	Documentation of E I A Findings and Report Preparation	1
4.0 HEALTH ASSESSMENT		
4.1	Impact of Environment on Health	1
4.2	Developing framework for Health impact analysis	1
4.3	H I A –tools and techniques	1
4.4	Case studies	1
5.0 SOCIO-ECONOMIC IMPACT ASSESSMENT		
5.1	Overview and Scope of Social Impact Assessment	1
5.2	Social Impact Assessment model and the planning process	1
5.3	Land acquisition –Legal aspects	1
5.4	Resettlement & Rehabilitation and Development	1
6.0 ENVIRONMENTAL MANAGEMENT PLAN		
6.1	Environmental Management Plan – Preparation and implementation	1
6.2	Mitigation and Rehabilitation plans	1
6.3	Post Project Audit	1
7.0 INTEGRATED ANALYSIS OF ENVIRONMENTAL,SOCIAL AND HEALTH IMPACTS		
7.1	Challenges for Integrated Approach	1
7.2	Scope for Integrated approach in economic analysis	1
7.3	Concept of Economic Analysis-C B A , Social C B A ,and Cost effectiveness Analysis	2
7.4	The Analytic Hierarchy process based approach to project appraisal	2
7.5	Emerging Dimensions and future Directions-Strategic Environmental Assessment, Technological Assessment and Risk Assessment	2
8.0 CASE STUDIES		
8.1	EIA for Mining, extraction of natural resources and power generation	1
8.2	EIA for Primary Processing and Material production	1
8.3	EIA for Material Processing	1
8.4	EIA for Manufacturing/Fabrication	1
8.5	EIA for Service Sectors	1
8.6	EIA for Physical Infrastructure including Environmental Services	1
8.7	EIA for Building/Construction Projects/Area Development Projects & townships.	1
	TOTAL HOURS	48

Course Designer:

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Passed in Board of Studies Meeting held on 18.04.2015 Approved in 50th Academic Council Meeting held on 30.05.2015

15IM180	TRAFFIC ENGINEERING LAB	Category	L	T	P	Credit
		PC	0	0	1	1

Preamble

The objective of this laboratory course is to impart knowledge on traffic volume count studies, speed and delay studies, origin and destination study, accident analysis and parking studies. Students will be acquiring knowledge on pedestrian facilities, road safety audit and technical report writing.

Prerequisite

Knowledge in traffic engineering

Course Outcomes

On the successful completion of the course, students will be able to

(CO1) Conduct traffic volume count study	Analyze
(CO2) Conduct test on spot speed and interpret the results	Analyze
(CO3) Perform on-street and off-street parking studies and analyze the collected data	Analyze
(CO4) Determine journey speed, running speed and delay on the given route	Apply
(CO5) Perform OD survey for demand assessment	Apply
(CO6) Analyze crash data and recommend suitable measures	Analyze
(CO7) Conduct road safety audit	Apply
(CO8) Prepare questionnaire and perform household survey for data analysis for given project	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	M	M	---	---	M	M	---	---	M	M
CO2.	S	S	M	---	---	M	M	---	---	M	M
CO3	S	S	S	S	---	M	M	---	---	M	M
CO4	S	M	M	---	M	M	---	---	---	M	M
CO5	S	S	M	---	---	M	---	S	---	M	M
CO6	S	S	S	S	---	M	---	S	---	M	M
CO7	S	S	M	M	M	M	M	---	---	M	M
CO8	S	S	S	S	S	M	---	---	---	M	M

S- Strong; M-Medium; L-Low

List of Experiments

1. Conduct classified volume count on link roads.
2. Conduct turning movement and classified volume count study on the intersection.
3. Perform Spot speed study of classified vehicle and interpret the results with codal provisions.
4. Conduct Speed and Delay study on the given route by Moving Car Observer method.

5. Perform on-street parking survey using cardon count method.
6. Perform off-street parking survey and analyze parking data.
7. Perform Origin – Destination survey for traffic demand assessment by registration number method.
8. Analyze accident records for past years on the road stretch and identify suitable measures for blackspots.
9. Conduct road safety audit for the given link road and prepare technical audit report.
10. Conduct Pedestrian study and analyze the data.
11. Prepare questionnaire and perform household survey for data analysis for the given project.

References

1. Kadiyali L.R, “Traffic Engineering and Transportation Planning” Khanna Publishers, Delhi, 2005.
2. Taylor M.A.P and Young W,Traffic Analysis-New Technology and New solutions, Hargreen Publishing Company,1998.
3. Partha Chakroborty and Animesh Das,” Principle of Traffic Engineering”,Prentice Hall of India, New Delhi,2003.
4. Mike Slinn, Peter Guest and Paul Matthews “Traffic Engineering Design Principles and Practice”, Elesevier, 2006.
5. IRC SP 019: Manual for Survey, Investigation and Preparation of Road Projects, 2001
6. IRC 103 Guidelines for Pedestrian Facilities
7. http://www.nptel.ac.in/downloads/105101008/
8. http://www.nptel.ac.in/downloads/105101008/

Course Designers:

. 1. Ms. D. Srividya dsciv@tce.edu
2. Ms. M.Surya mscivil@tce.edu

14IM210	CONTRACTS AND ARBITRATION	Category	L	T	P	Credit
		PC	3	0	0	3

Preamble

This course will create awareness on contracts for construction industry, impart knowledge on tender preparation, tendering process, laws on arbitration, arbitration procedure and laws on dispute resolution in India.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Understand the laws on contracts for construction industry in India	Understand
CO2: Apply knowledge of contracts in preparation of contract document and tendering process	Apply
CO3: Apply appropriate methods to assess the critical factors in contracts leading to arbitration and disputes between the parties	Apply
CO4: Suggest suitable type of arbitration or dispute resolution for the situation of problem	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	---	---	---	---	---	M	---	S	---
CO2.	S	L	---	---	---	M	S	S	---	S	M
CO3	S	S	M	---	---	M	---	S	---	S	M
CO4	S	M	M	---	---	M	---	S	---	S	---

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	30	30	30	30
Understand	40	40	40	40
Apply	30	30	30	30
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1 Discuss the salient features of laws related to construction industry.

2 For a major project involving huge sum of money suggest a suitable type of contract. Give justifications for your choice
3 Explain briefly the content of Indian Contract Act.

Course Outcome 2 (CO2)

1 Explain the procedure of tendering and selection of successful contractor for projects
2 Discuss issues related to e-tendering process.
3 The highway department of government is planning to construct a new highway line in a city, as a chief engineer of the department you are vested with the responsibility of preparing tender documents for calling for tenders to invite prospective bidders to take up the work. Identify the items to be included in the tender documents and discuss them

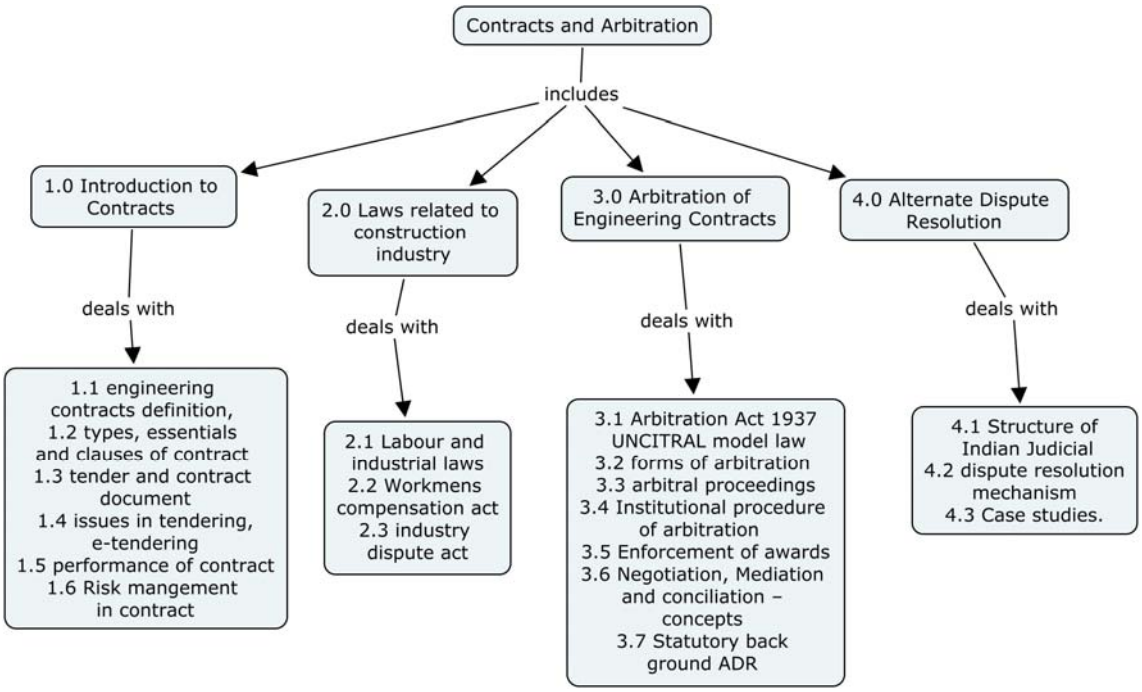
Course Outcome 3 (CO3)

1 As an arbitrator discuss the procedural difference between a judge and an arbitrator. Who is more powerful in what situation? Discuss
2 As an infrastructure manager, the knowledge on contracts and arbitration is it essential? Justify

Course Outcome 4 (CO4)

1 As a project manager of a infrastructure company you have a major task of managing work force, identify and discuss the aspects contributing to increased performance level of labour.
2 As a contract manager identify the method to select a project based on contract document and issues

Concept Map



Syllabus

Introduction to contracts in construction industry: Brief details of engineering contracts – definition, types and essentials of contracts and clauses for contracts – Preparation of tender documents and Contract documents – Issues related to tendering process- Awarding

contract, e-tendering process. Time of performance – provisions of contract law – Breach of contract. Performance of Contracts – Discharge of a contract- Indian Contract Act 1872 – Extracts and variations in Engineering Contracts. Risk management in contracts. **Laws related to construction Industry –** Labour and industrial laws - payment of wages act, contract labour. Workmen's compensation act – Insurance, industrial dispute act. **Arbitration of Engineering Contracts** – Background of Arbitration in India, Indian Arbitration Act 1937, UNCITRAL model law, forms of arbitration – arbitration agreement, Commencement of arbitral proceedings, Constitution of arbitral tribunal, Institutional procedure of arbitration, Impartiality and independence of arbitrators jurisdiction of arbitral tribunal, Interim measures, Enforcement of awards. **Negotiation, Mediation and conciliation** – concepts and purpose, statutory back ground ADR and mediation rules, Duty of mediator and disclose facts, Power of Court in mediation. **Alternate Dispute resolution** - Structure of Indian Judicial, The arbitration and reconciliation ordinance 1996, dispute resolution mechanism under the Indian judicial System, Litigation in Indian courts, case studies.

References

1. American Arbitration Association, "Construction industry arbitration rules and mediation procedures", 2007
2. Case study of Southern Railway Arbitration Cases- wiki.iricen.gov.in/doku/lib/exe/fetch.php
3. Collex.K, "Managing Construction Contracts", Reston publishing company, Virginia, 1982
4. Eastern Book Company "Arbitration and Conciliation Act 1996", June 2008
5. International Federation of Consulting Engineers (FIDIC) documents, Geneva, 2009 (http://www.fidic.org)
6. Gajaria. G.T., " Laws relating to building and Engineer's Contracts", M.M. Tripathi Pvt Ltd., Mumbai, 1985
7. Horgon.M.O and Roulstion F.R., "Project Control of Engineering Contracts" E and FN, SPON, Norway, 1988
8. Krishna Sharma, Momota Oinam and Angshuman Kaushik, "Development and Practice of Arbitration in India- Has it evolved as an effective legal Institution", CDDRL, Stanford, 103, Oct 2009
9. Park.W.B., "Construction Bidding for Projects", John Wiley, Norway, 1978
10. Roshan Namavati, "Professional Practice", Anuphai Publications, Lakhani Book Depot, 2013
11. Vasavada.B.J. "Engineering Contracts and Arbitration" , March 1996

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.	**Introduction to contracts**	
1.1	Brief details of engineering contracts	1
1.2	types and essentials of contracts, clauses of contract	1
1.3	Preparation of tender documents and Contract documents –	2
1.4	Issues related to tendering process- Awarding contract, e-tendering process.	2
1.5	Time of performance – provisions of contract law – Breach of contract	2
1.6	Performance of Contracts – Discharge of a contract- Indian Contract Act 1872	3
1.7	Extracts and variations in Engineering Contracts. Risk management in contracts.	2
2.0	**Laws related to construction Industry**	

Module No.	Topic	No. of Lectures
2.1	Labour and industrial laws - payment of wages act, contract labour.	2
2.2	Workmen's compensation act – Insurance	2
2.3	Industrial dispute act.	1
3.0	**Arbitration of Engineering Contracts**	
3.1	Background of Arbitration in India, Indian Arbitration Act 1937, UNCITRAL model law,	2
3.2	forms of arbitration – arbitration agreement	1
3.3	Commencement of arbitral proceedings, Constitution of arbitral tribunal,	2
3.4	Institutional procedure of arbitration	2
3.5	independence of arbitrators jurisdiction of arbitral tribunal, Interim measures, Enforcement of awards	1
3.6	**Negotiation, Mediation and conciliation** – concepts and purpose	1
3.7	Statutory back ground ADR and mediation rules, Duty of mediator and disclose facts, Power of Court in mediation.	2
4.0	**Alternate Dispute resolution**	
4.1	Structure of Indian Judicial, The arbitration and reconciliation ordinance 1996,	2
4.2	dispute resolution mechanism under the Indian judicial System, Litigation in Indian courts,	2
4.3	Case studies.	3
	TOTAL	**36**

Course Designers:

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15IM220	PROJECT MANAGEMENT	Category	L	T	P	Credit
		PC	3	1	0	4

Preamble

Complex research and development projects can be managed effectively if the project managers have the means to plan and control the schedules and costs of the work required to achieve their technical performance objectives. When planning of a project is undertaken aspects such as resources needed for its accomplishment, its cost, its duration should be determined. The answers to all these questions can be found by adopting the modern techniques of project management.

Prerequisite

Nil

Course Outcomes:

On successful completion of the course the students will be able to:

(CO1) Explain the concept of projects, its process, objectives and functions of project management	Understand
(CO2) Analyze and Manage time in projects through Gantt charts, CPM and PERT techniques	Apply
(CO3) Balance resource requirements of projects so as to avoid idling of resources	Apply
(CO4) Update projects and determine revised schedule of activities and critical path if any	Apply
(CO5) Crash projects to determine its optimum time- minimum cost relationships	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	M	---	---	---	---	M	S	S	---	M	---
CO2.	S	S	S	M	M	M	---	---	---	---	---
CO3	S	S	S	M	M	M	---	---	---	---	---
CO4	S	S	S	M	M	M	---	---	---	---	---
CO5	S	S	S	M	M	M	---	---	---	---	---

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	10	10	10
Understand	30	40	30	30
Apply	50	50	60	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1(CO1):

1. Discuss the functions of project management
2. Discuss the essential conditions to be satisfied for sanction of projects
3. Explain the meaning and significance of Statement of Work in relation to projects

Course Outcome 2 (CO2):

1. A project consists of 12 activities. The time required for each activity is given in the table below. Use the following logical relationships and draw a network diagram for the project and determine the critical path and duration required for completion of the project.

- Activity A,D and H can be performed concurrently and represent the start of the project
- B succeeds A; C and G follow H; D,C and B precede F; L follows A
- M comes after G; K is preceded by L; X cannot start until K, F and M are completed
- Z succeeds G; X and Z are last operations

Activity	A	B	C	D	F	G	H	K	L	M	X	Z
Duration (days)	4	3	2	4	7	3	2	4	8	3	2	1

2. Discuss the merits and limitations of bar-chart technique
3. A project consists of 5 activities with the following relationship. Draw a bar chart assuming that the project commences on 15th April, wednesday with five working days a week. Determine the project completion day and date. What is the total duration of the project?
   A is the initial activity with duration of 7 days for completion
   A is followed by B and D with duration of 2 days and 5 days respectively
   E can start after half the work of B is over and it takes 9 days for completion
   D and B precede F which takes 5 days for completion

Course Outcome 3 (CO3):

1. List the resources for a project
2. The following table gives the manpower requirements for each activity in a project:

i) Draw the network diagram of the project
ii) Rearrange the activities suitably for reducing the existing total manpower requirement
iii) Also determine the % reduction in peak demand for the resources

Activity (i-j)	0-1	1-2	1-3	2-4	3-5	3-6	4-7	5-7	6-8	7-9	8-9
Duration (days)	2	3	4	2	4	5	6	5	3	4	4
Manpower demand	4	3	2	5	3	4	4	6	2	2	8

3. Balance the resource demand for the following project so as to meet the availability of only 7 men/day

Activity (i-j)	0-1	0-3	0-6	1-2	3-4	3-7	6-7	2-5	4-5	7-8	5-8
Duration (days)	2	2	1	4	5	8	3	1	4	5	3
Manpower	3	6	4	2	2	4	5	4	2	2	5

Course Outcome 4 (CO4)

1. A project consists of 5 activities with the following relationship. Draw a bar chart. Determine the project completion day and date. What is the total duration of the project?

A is the initial activity with duration 7 days for completion
A is followed by B and D with duration of 5 days and 4 days respectively
E can start after half the work of B is over and it takes 9 days for completion
D and B precede F which takes 5 days for completion
If on the 11th day of commencement the following status occurs, update the project and determine the revised completion time if any?
A is completed as per schedule
B is in progress and requires 2 more days for completion
D is delayed by 7 days and it requires 8 more days for its completion
E is in progress and the original time will hold good; F is yet to start

2. Define updating of projects mentioning its significance

3. The following table shows the activities of a project with their durations of completion. The following conditions exist at the end of 11 days.

Activity (i-j)	1-2	1-3	1-4	2-5	4-6	3-5	3-6	3-7	5-7	6-7
Duration (days)	2	3	5	3	3	5	4	3	2	7

Activities 1-2,1-3 and 1-4 have been completed as originally planned
Activity 3-5 is in progress and will require two more days for completion
Activity 3-6 is in progress and will require three more days for completion
Activity 4-6 is in progress and will be completed in five days
All other activity are yet to start and their predicted durations will hold good except 6-7 which will require only 5 days instead of 7 days originally planned
Update the project and determine the critical path of the updated network. What is the revised project completion time? Also show the details on a bar chart.

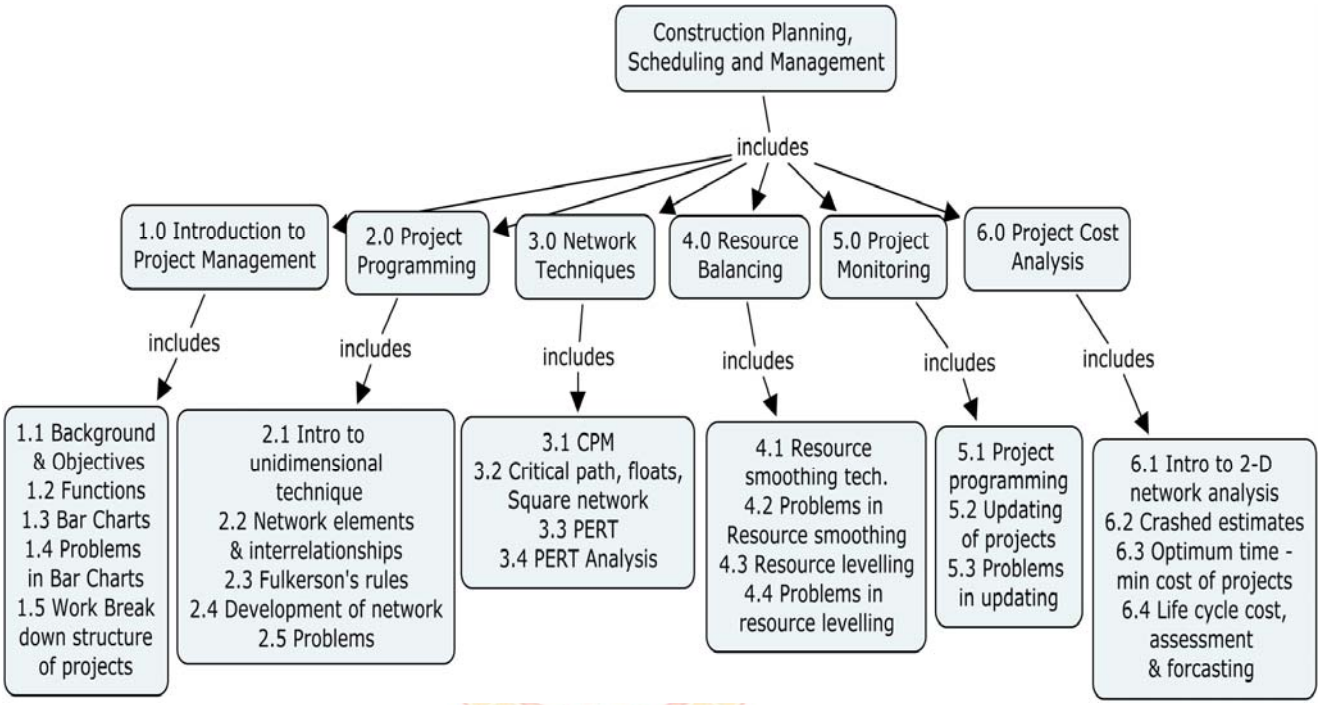
Course Outcome 5(CO5):

1. The following table gives data related to activities in a project. Crash the project to minimum project duration and determine the minimum cost and optimum time of completion. Assume indirect cost as Rs.1400/ week.

Activity	Normal		Crash	
	Time (days)	Cost (Rs.)	Time (days)	Cost (Rs.)
0-1	1	5000	1	5000
1-2	3	5000	2	12000
1-3	7	11000	4	17000
2-3	5	10000	3	12000
2-4	8	8500	6	12500
3-4	4	8600	2	16500
4-5	1	5000	1	5000

2. List the benefits and limitations of latest tools in project management
3. Compare the behaviour of direct and indirect cost of a project with respect to time and draw its relationship. If there is a loss encountered in a project during its execution, what would be it's impact on the total cost of the project?

Concept Map



Syllabus

Project and its process- Define project and process, boundaries of project, Objectives and functions of Project management, characteristics and types of projects, organization structure / styles, roles of project management group, project management office and its role, project knowledge area, project integration- process group interaction. Project flow, project life cycle- influencing factors. - Case study. **Project Time Management:** Project Scope Management - Work break down structure- Activity/ Task- Events- Case study. Project planning tools- Rolling wave planning. Gantt Charts, Milestone chart, Program Progress chart- Creating milestone plan. Project Network- Fulkerson's rules – A-O-A and A-O-N networks. Analyze project time- Critical path method (deterministic approach- activity oriented network analysis- 80-20 rule- Case study, type of time estimates & Square network diagram. Project updating and monitoring- Case study. Estimate time- Program Evaluation & Review Technique (Probabilistic Approach)- Event oriented network analysis- Optimistic, Pessimistic and Most likely time, Degree of variability in average time, Probabilistic estimate, % utilization of resources. **Resource Management:** Types of resource- Time, Men, Material, Machinery, Money, Space. Balancing of resource- Resource Smoothing technique- Time constraint. Resource leveling technique- Resource constraint- Case study. **Resource optimization:** Types of cost – Direct, Indirect and Total Cost. Variation of Cost with time. Schedule Compression Techniques- Crashing, Fast Tracking & Re-estimation- Crash time and crash cost. Optimize project cost for time and resource. CPM Cost model. Life cycle assessment- impacts and economical assessment, Life cycle cost- maintenance and operation, life cycle forecasting – concept and applications. **Emerging trends in project management:** Agile Project management and Project Management using latest tools- Case study.

References

1. "A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Fourth Edition, An American National Standard, ANSI/PMI 990001-2008"
2. A Risk Management Standard, AIRMIC Publishers, ALARM, IRM: 2002
3. Gene Dixon, "Service Learning and Integrated Collaborative Project Management", Project Management Journal, DOI:10.1002/pmi, February 2011, pp.42-58
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7. Sengupta. B and Guha. H, "Construction Management and Planning", Tata McGraw Hill, New Delhi, 1995
8. SangaReddi. S and Meiyappan. PL, "Construction Management", Kumaran Publications, Coimbatore, 1999

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**Introduction to Project Management**	
1.1	Define project and process, boundaries of project Introduction to project management concept, background of management, purpose, objectives, Characteristics of projects, Organization structure / styles of project and Functions of management	2
1.2	Roles of project management group, project management office and its role, Project knowledge area, project integration- process group interaction, Project flow, project life cycle- influencing factors, Case study	2
1.3	Traditional management systems – Gantt approach, progress-chart, Bar-chart- Merits and limitations	2
1.4	Problems in Bar-chart	2
1.5	Work study, work break down structure, time estimate	2
	Tutorial	1
2.0	**Project Programming**	
2.1	Introduction to modern management concepts, uni-dimensional management techniques	1
2.2	Introduction to network concepts, network elements and inter-relationships	1
2.3	Network techniques, network logic- inter- relationships activity information, data sheets	1
2.4	Development of network based on Fulkerson's rules	2
2.5	Problems in development of network	2
	Tutorial	2
3.0	**Network Techniques**	
3.1	Critical Path Method (CPM) for management, CPM network analysis	2
3.2	Identification of critical path, floats, square network diagrams-problems	2
3.3	Programme Evaluation and Review Technique (PERT) network-introduction to theory of probability and statistics, probabilistic time estimation for activities	1

3.4	Analysis of PERT network – problems, Delta Charts – concept and applications	1
	Tutorial	2
4.0	**Resource Balancing**	
4.1	Resource balancing- objectives, resource smoothing technique – concept and procedure	1
4.2	Problems using resource smoothing technique	2
4.3	Resource Levelling technique - concept and procedure	2
4.4	Problems using Resource Levelling technique	1
	Tutorial	2
5.0	**Project Control and Monitoring**	
5.1	Project programming, phasing of activities programmes, scheduling project control	1
5.2	Reviewing, updating and monitoring – concept	1
5.3	Problems in updating of projects – determination of revised critical path	2
	Tutorial	2
6.0	**Project Cost**	
6.1	Introduction to two-dimensional network analysis – activity cost information, cost –time relationship	1
6.2	Crashed estimates for the activities, compression potential, cost slope, utility data sheet, project direct and indirect cost	1
6.3	Crashed programmes, network compression, least cost solution, least time solution and optimum time solution-Problems	1
	Tutorial	2
6.4	Life cycle assessment- impacts and economical assessment, Life cycle cost- maintenance and operation, life cycle forecasting – concept and applications, Time value of money. Emerging trends in project management: Project Management using latest tools- Case study	1
	Total Periods	**48**

Course Designers:

Dr. G.Chitra gcciv@tce.edu
Dr. S. Chandran schandran@tce.edu

14IM310	MANAGEMENT OF HUMAN RESOURCES, SAFETY AND QUALITY	Category	L	T	P	Credit
		PC	4	0	0	4

Preamble

To impart knowledge on management of human resources, labour legislation, safety and quality aspects in construction

Course Outcomes

On the successful completion of the course, students will be able to

(CO1) Identify the need and importance of human resource management, labour laws relating to construction industry	Understand
(CO2) Identify the need and measures to improve safety in construction industry and safety audit	Apply
(CO3) Identify the need for applying ergonomics to construction industry	Apply
(CO4) Enumerate the need, importance, elements of quality and significance of quality assurance in industry	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	M		L				S	M		S	M
CO2.	M	M	M			M	S	M	M	S	M
CO3	M	M	M			M	S	L	M	S	M
CO4	M	M	M			M	S	M	M	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	50	50	40	40
Apply	30	30	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. With more women in the work force, what would be the major changes introduced into our society? Discuss
2. Discuss the challenges faced by modern personnel management
3. With the educational level of the nation's work force steadily increasing, discuss the problems and opportunities created for the personnel manager

Course Outcome 2 (CO2):

1. As a safety inspector, discuss the parameters you would look for, while auditing an industry for safety. Justify
2. Mention two measures by which fire at sites can be prevented
3. Discuss the various causes mentioning its effects and measures to minimize accidents in infrastructure industry

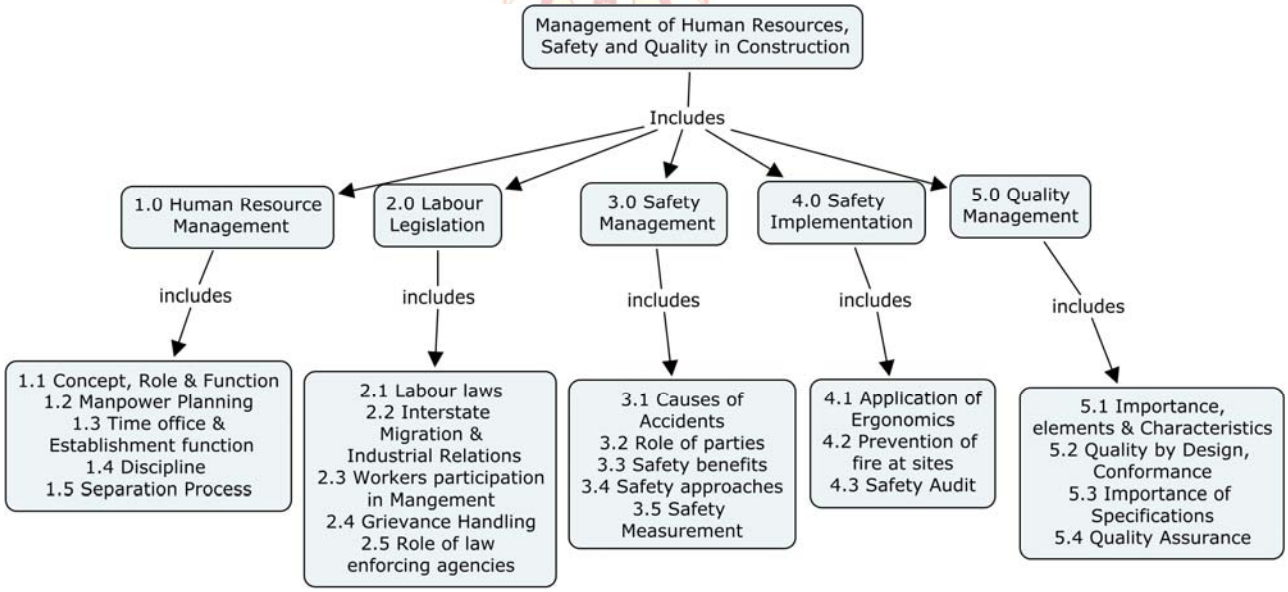
Course Outcome 3 (CO3):

1. Define the term ergonomics
2. Discuss the best practices of ergonomics in construction industry
3. As a HR manager of a firm discuss the schemes you would implement for your labour to work in harmony

Course Outcome 4 (CO4):

1. "Quality improves performance of an industry". Discuss and comment on this statement
2. Define quality assurance. Discuss its various components
3. Define the term quality and mention its need in infrastructure industry

Concept Map



Syllabus

Human Resources Management- Introduction – Concept- Growth – Role and function. Manpower Planning for Construction Companies – Line and Staff function. Recruitment, selection, placement, induction and training; over staffing; Time office and establishment functions; wage and salary administration – Discipline- Separation Process. **Labour Legislation**- Labour laws- labour law relating to construction industry- Interstate migration- Industrial relations- Collective bargaining- Worker's participation in management. Grievance handling- discipline-role of law enforcing agencies and judiciary – women in construction industry. **Safety Management-** importance of safety- causes of accidents – responsibility for safety –Role of various parties in safety management – safety benefits- approaches to improve safety in construction for different works- measuring safety. **Safety Implementation -** Application of Ergonomics to the construction industry- prevention of fires at construction site- Safety audit. **Quality Management in Construction**- Importance of quality; Elements

of quality- quality characteristics- quality by design - quality conformance, contractor quality control- identification and traceability, Continuous Chain Management – brief concept and application. Importance of specifications- Incentives and penalties in specifications – Workmanship as a mark of quality – Final Inspection. Quality assurance techniques – Inspection, testing, sampling. Documentation – Organization for quality control, Cost of quality. Introduction to TQM, Six Sigma Concept

Reference Books

1. Arya Ashok, "Human Resources Management – Human Dimensions in Management" March 24-26, 2011, Organizational Development Programme Division – New Delhi
2. Arya Ashok, "Essence of Labour Laws"- www.odiindia.in/about-the-books.pdf
3. Arya Ashok "Discipline & Disciplinary procedure" Organisation Development Institute, 1998
4. Arya Ashok, "Management case studies – An analytical and Developmental Tool" Organisation Development Institute, New Delhi, 1999
5. Corlecton Coulter, Jill Justice Coulter, The Complete Standard Hand Book of Construction Management", Prentice Hall, (1989)
6. Dwivedi R.S., "Human Relations and Organisational Behaviour", (BH – 1987)
7. Grant E.L., and Leavens worth, "Statistical Quality Control", Mc Graw Hill, 1984.
8. James J Obrien, "Construction Inspection Hand Book – Quality Assurance and Quality Control", Van NOstrand, New York, 1989
9. Josy J. Farrilaro, "Hand Book of Human Resources Administration" Mc.Graw Hill (International Edition) 1987.
10. Juran Frank, J.M. and Gryna F.M. "Quality Planning and Analysis", Tata Mc Graw Hill, 1982.
11. Malik, P.L., "Handbook of Labour & Industrial Law", Eastern book company, Lalbagh, Lucknow, 2010
12. Manoria C.B., "Personnel Management", Himalaya Publishing House, 1992.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**Human Resources Management**	
1.1	Introduction – Concept- Growth – Role and function	2
1.2	Manpower Planning for Construction Companies– Line and Staff function. Recruitment, selection, placement, induction and training; over staffing	2
1.3	Time office and establishment functions; wage and salary administration	2
1.4	HRM - Discipline	2
1.5	HRM - Separation Process	2
2.0	**Labour Legislation**	
2.1	Labour laws- labour law relating to construction industry	2
2.2	Interstate migration- Industrial relations -Collective bargaining	2
2.3	Worker's participation in management	2
2.4	Grievance handling - discipline	2
2.5	Role of law enforcing agencies and judiciary – women in construction industry	2
3.0	**Safety Management**	
3.1	Importance of safety- causes of accidents – responsibility for safety	2
3.2	Role of various parties in safety management	2
3.3	Safety benefits	2
3.4	Approaches to improve safety in construction for different works	3

3.5	Safety Measurement, Safety standards	2
4.0	**Safety Implementation**	
4.1	Application of Ergonomics to the construction industry	3
4.2	Prevention of fires at construction site, Site safety planning	2
4.3	Safety audit	2
5.0	**Quality Management in Construction**	
5.1	Importance of quality; Elements of quality- quality characteristics, Quality control in construction- identification and traceability, Continuous Chain Management – brief concept and application	3
5.2	Quality by design- quality conformance, contractor quality control	3
5.3	Importance of specifications- Incentives and penalties in specifications – Workmanship as a mark of quality – Final Inspection	2
5.4	Quality assurance techniques – Inspection, testing, sampling Documentation – Organization for quality control, Cost of quality, Introduction to TQM, Six Sigma Concept	2
	Total Periods	**48**

Course Designers:

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14IMPA0	STRATEGIC PLANNING FOR INFRASTRUCTURE SECTORS	Category	L	T	P	Credit
		PE	4	0	0	4

Preamble

This course gives an exposure to the students on the concepts and principles of planning and management applied to infrastructure industry

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1)Explain the basic concepts related to infrastructure management	Understand
(CO2) Explain the benefits and problems with infrastructure privatization	Understand
(CO3) Identify the challenges and strategies for successful planning and implementation of infrastructure	Apply
(CO4) Apply the above concepts to various infrastructure domains	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	---	---	---	---	---	S	---	M	---
CO2.	S	M	L	---	---	---	L	L	---	---	---
CO3	S	S	S	L	M	L	M	S	L	S	M
CO4	S	M	L	L	M	L	M	S	L	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	50	50	50	50
Apply	30	30	30	30
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1(CO1):

1. Write a note on economic and demand risks related to infrastructure projects
2. Write two risks involved in successful implementation of infrastructure projects
3. Give an overview of the power sector in India
4. List the stakeholders of infrastructure projects

Course Outcome 2 (CO2):

1. A National highway in Chennai city is to be privatized. Discuss the benefits and problems that are likely to occur by this process.
2. Mention two benefits of privatization of infrastructure projects
3. Enumerate the challenges in the privatization of power with the light of a case study for a metropolitan city in India
4. Discuss the problems with infrastructure privatization

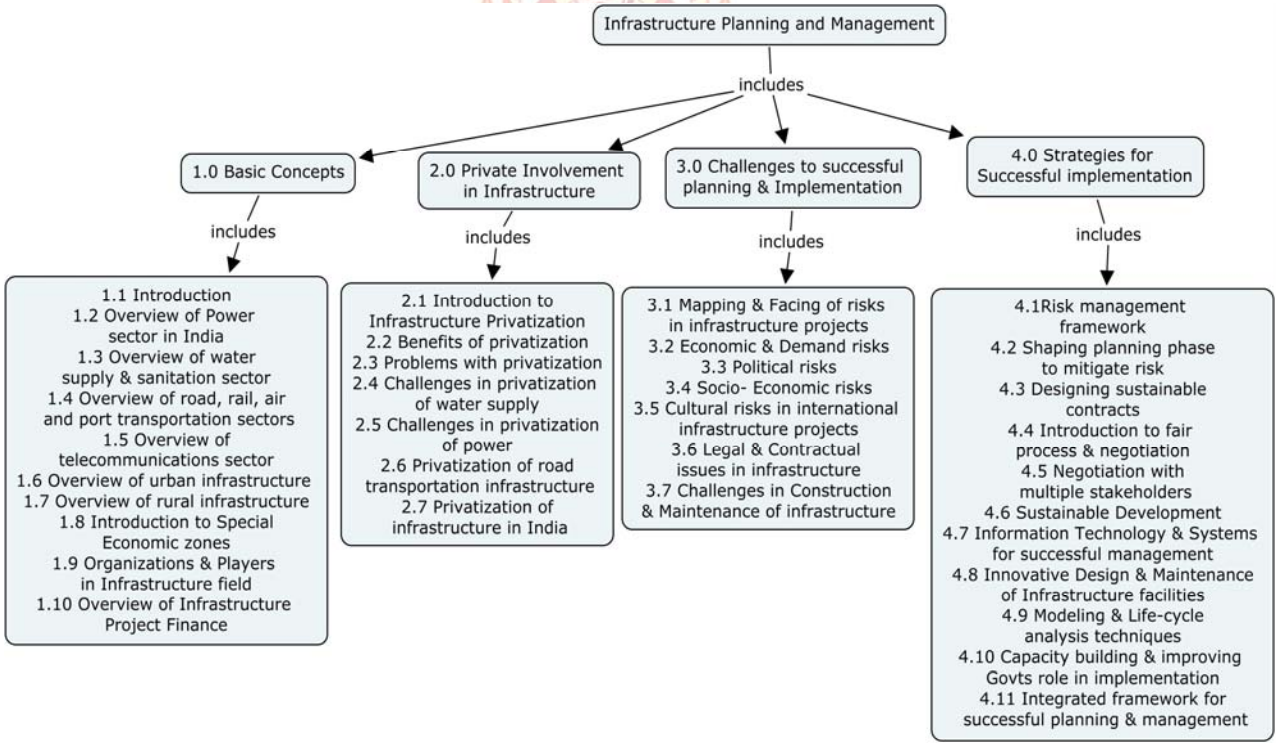
Course Outcome 3 (CO3):

1. Discuss the strategies to be followed for innovative design and maintenance of infrastructure facilities
2. A new nuclear reactor plant is to be constructed in a State. Discuss the challenges encountering the successful planning and implementation of the project in relation to the construction and maintenance aspects
3. Mention two contractual issues affecting infrastructure projects
4. Write the meaning of sustainable development of infrastructure
5. Discuss the cultural risks related to international infrastructure projects

Course Outcome 4 (CO4):

1. In the background of the present energy scenario of Tamil Nadu, propose a thermal power plant (2x660 MW) at the coastal area of Nagapattinam. Discuss the challenges to be faced for implementation of the project.
2. A private airport catering the needs of the tourists for the Sabari Malai holy town is proposed to be implemented. Discuss the viability and issues relating to the formulation of the project
3. A waste water treatment plant at Madurai city is to be developed by PPP for a capacity of 125ml/d. Enumerate the challenges in the implementation of the project
4. Write the importance of finance related to projects and give an overview of infrastructure project finance

Concept Map



Syllabus

An overview of basic concepts related to infrastructure: Introduction to infrastructure- Definition and types ,An overview of the Power sector- Water supply and Sanitation sector- Road, rail, air and port transportation sectors- telecommunications sector- urban infrastructure- rural infrastructure in India. An introduction to special economic zones. Organizations and players in the field of infrastructure. An overview of infrastructure project finance – procurement process, concession- design and award, financial risk analysis, management and mitigation. Credit rating of infrastructure projects, credit allocation framework for infrastructure projects. **Private involvement in infrastructure:** Infrastructure

privatization- benefits of infrastructure privatization- problems with infrastructure privatization-challenges in privatization of water supply- challenges in privatization of power- privatization of infrastructure in India- Privatization of road transportation infrastructure in India. **Challenges to successful infrastructure planning and implementation:** Mapping and facing the landscape of risks in infrastructure projects- Economic and Demand risks- Political risks- Socio- Environmental risks- Cultural risks in international infrastructure projects- Legal and contractual issues in infrastructure- Challenges in construction and maintenance of infrastructure. **Strategies for successful infrastructure project implementation:** risk management framework for infrastructure projects- shaping the planning phase of infrastructure projects to mitigate risks- Designing sustainable contracts- Introduction to fair process and negotiation- Negotiation with multiple stakeholders on infrastructure projects- Sustainable development of infrastructure- Information technology and systems for successful infrastructure management- Innovative design and maintenance of infrastructure facilities- infrastructure modelling and life cycle analysis techniques- Capacity building and improving the Governments role in infrastructure implementation. An integrated framework for successful infrastructure planning and management.

References

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2. Jeffrey L. Beard, Edward C. Wundran, Michael C. Loulakis, “Design, Build: Planning through development”, McGraw Hill Series, 2001
3. Richard Lambeck, John Eschemuller, “Urban Construction Project Management”, McGraw Hill Series, 2009
4. Sidney Levy, “Project Management in Construction”, McGraw Hill Series, 5th edition, 2006
5. Twelth five year plan (2012-2015) Document.
6. VISION –TAMILNADU 2023-Strategic plan for Infrastructure Development in Tamilnadu

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**An overview of basic concepts related to infrastructure**	
1.1	Introduction to infrastructure-definition and types of infrastructure	2
1.2	An overview of the Power sector, Health care and food processing aspects – smart concept	2
1.3	An overview of Water supply and Sanitation sector in India -smart concept	1
1.4	An overview of Road, rail, air and port transportation sectors in India-smart concept	1
1.4.1	Green Building infrastructure, Solar energy concept for power generation, Green filled airport- helipad -smart concept	1
1.5	An overview of telecommunications sector in India	1
1.6	An overview of urban infrastructure in India	1
1.7	An overview of rural infrastructure in India	1
1.7.1	Special characteristics of urban and rural infrastructure, Urban and rural divide in infrastructure	1
1.8	An introduction to special economic zones	1
1.9	Organizations and players in the field of infrastructure	1

1.10	An overview of infrastructure project finance.	2
1.10.1	Case studies of infrastructure projects from abroad	2
2.0	**Private involvement in infrastructure**	
2.1	Introduction to Infrastructure privatization	1
2.2	Benefits of infrastructure privatization	1
2.3	Problems with infrastructure privatization	1
2.4	Challenges in privatization of water supply	1
2.5	Challenges in privatization of power	1
2.6	Privatization of infrastructure in India	1
2.7	Privatization of road transportation infrastructure in India	1
3.0	**Challenges to successful infrastructure planning and implementation**	
3.1	Mapping and facing the landscape of risks in infrastructure projects	1
3.2	Economic and Demand risks	1
3.3	Political risks	2
3.4	Socio- Environmental risks	2
3.5	Cultural risks in international infrastructure projects	1
3.6	Legal and contractual issues in infrastructure	1
3.7	Challenges in construction and maintenance of infrastructure	2
4.0	**Strategies for successful infrastructure project implementation**	
4.1	Risk management framework for infrastructure projects	1
4.2	Shaping the planning phase of infrastructure projects to mitigate risks	2
4.3	Designing sustainable contracts	1
4.4	Introduction to fair process and negotiation	1
4.5	Negotiation with multiple stakeholders on infrastructure projects	1
4.6	Sustainable development of infrastructure	2
4.7	Information technology and systems for successful infrastructure management	1
4.8	Innovative design and maintenance of infrastructure facilities	1
4.9	Infrastructure modelling and life cycle analysis techniques	1
4.10	Capacity building and improving the Governments role in infrastructure implementation	2
4.11	An integrated framework for successful infrastructure planning and management	1
	Total Periods	**48**

Course Designer:

Mr. V. Ravisankar environmentengr@tce.edu

14IMPB0	DISASTER MITIGATION AND MANAGEMENT	Category	L	T	P	Credit
		PE	4	0	0	4

Preamble

This course deals with the various disasters and to expose the students about the measures, its effect against built structures, and Hazard Assessment procedure in India. This course also deals with the methods of mitigating various hazards such that their impact on communities is reduced.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand the various types of disaster viz Hydrological, Coastal and Marine Disasters, Atmospheric Disasters, Geological, Mass Movement and Land Disasters, Wind and Water Driven Disasters.	Understand
CO2:	To identify the potential deficiencies of existing buildings for EQ disaster and suggest suitable remedial measures.	Apply
CO3:	Derive the guide lines for the precautionary measures and rehabilitation measures for EQ disaster.	Apply
CO4:	Understand the effects of disasters on built structures	Understand
CO5:	Derive the protection measures against floods, cyclone, land slides	Apply
CO6:	Understand the hazard Assessment procedure	Understand
CO7:	Get the awareness regarding Landuse Zoning Regulations & Quality control	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	M	---	---	---	M	---	M	---	M	---
CO2.	S	S	S	---	---	S	M	---	L	S	M
CO3	S	S	S	L	---	S	---	---	L	S	M
CO4	S	M	---	---	---	---	---	---	---	M	---
CO5	S	S	S	---	---	S	---	---	---	S	M
CO6	S	M	---	---	---	M	---	---	---	M	---
CO7	S	M	---	---	---	S	---	---	L	M	---

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	80	60	60	60
Apply	0	20	20	20
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Write the meaning of Richter Magnitude
2. Mention the significance of Peak ground Acceleration
3. Discuss how does the site soil affect the EQ response of structures

Course Outcome 2 (CO2):

1. Explain the plan, Mass and Geometric irregularities in the RC buildings. How these irregularities adversely affect the performance of the RC buildings during Earthquake
2. Discuss the various types of natural disasters and highlight the specific efforts to mitigate disasters in India.

Course Outcome 3(CO3):

1. If you were the relief commissioner of the state of Assam which is affected by floods every year list out five departments that you need to contact.
2. Identify four different task forces and list out two responsibilities of each of the task forces
3. Briefly explain the components of follow-up activities in psychological rehabilitation of disaster affected people.

Course Outcome 4(CO4):

1. Describe various types of hazards and impacts associated with earthquakes and highlight the lessons learnt.
2. Discuss the effect on tsunami on off shore structures

Course Outcome 5(CO5):

1. Which areas are more prone to heat and cold waves in India? Discuss the preventive and preparedness measures that are mostly adopted for protection from heat and cold waves
2. Explain the classification and causes of landslides indicating the places where they could occur in India.
3. List the different types of droughts and highlight its various causes.

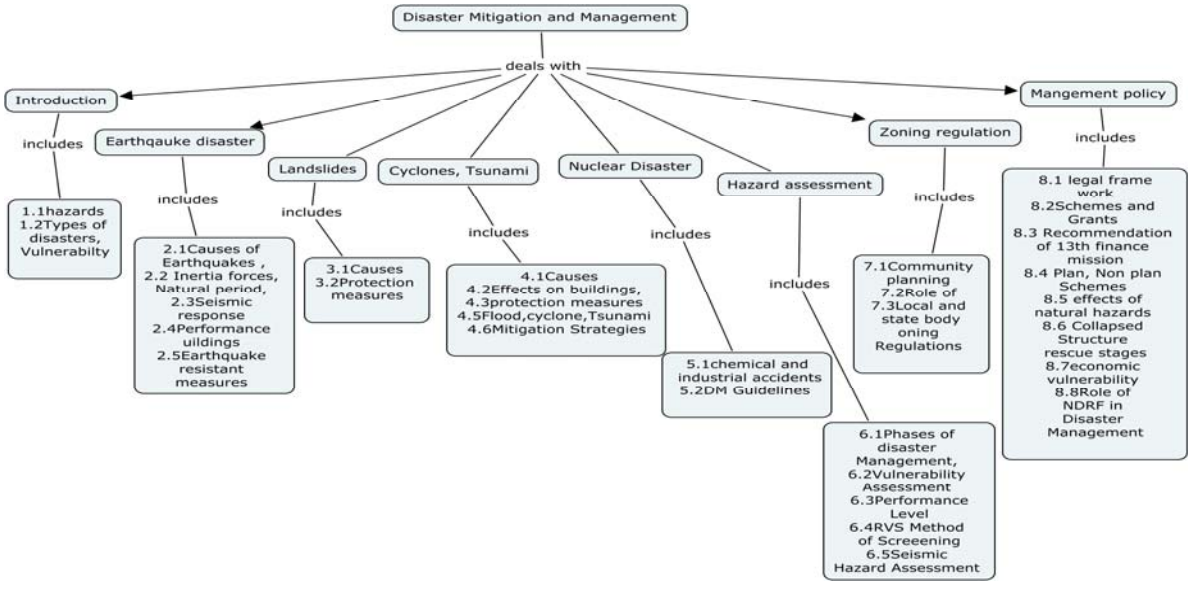
Course Outcome 6(CO6):

1. Briefly explain the components of follow-up activities in psychological rehabilitation of disaster affected people.

Course Outcome 7(CO7):

1. Do you think disaster risk can be reduced through community participation? Discuss
2. Explain the role of central Government in responding to disasters
3. Describe suitable mitigation and preparedness measures that the community should take in advance to guard a EQ disaster occurring again

Concept Map



Syllabus

Introduction Difference between hazards and disaster –Types of disasters-Phases of disaster Management -Hazards -Classification of Hazards - Hazards affecting buildings - Building safety against hazards –Floods – Cyclone – Landslides –Tsunami Fire **Earthquake Disaster -** Earthquake Hazard Map -Causes of Earthquakes -Classification of Earthquakes - -Seismic waves -Energy release - Inertia forces, Natural period -Resonance, Damping -Seismic response of free vibration -Seismic response of damped vibration -Performance of ground and buildings in past Earthquakes-Earthquake resistant measures in RC and Masonry buildings -Potential deficiencies of RC and Masonry buildings. **Land slides –** Landslide zoning map **-** Causes – Protection measures **Floods –** Flood zone map **-** Effects on buildings – protection measures from damage to buildings – Mitigation Strategies. **Tropical cyclones** - Effects on buildings – protection measures from damage to buildings **Tsunami -** Tsunami magnitude and intensity - Tsunami wave characteristics -Peculiarities of tsunami deposits -Tsunami impact on coastal lines -Effects of Tsunami on built structures **Nuclear disaster** – chemical and industrial accidents - Mitigation strategies **Hazard Assessment** Vulnerability Assessment and seismic strengthening of buildings -Vulnerability Assessment of Buildings procedure -Hazard Assessment-Visual Inspection and Study of Available Documents-Detailed In - situ Investigation Planning and Interpretation of Results-Foundation Capability -Non- structural Components -Seismic Strengthening of Buildings-Repairs Restoration Strengthening of Existing Buildings Strengthening Materials-Retrofitting of Load Bearing Wall Buildings Retrofitting of RC Buildings-RVS Method of Screening – RC and Masonry Structures -Seismic Hazard Assessment – Deterministic Seismic Hazard Analysis –PSHA. **Landuse Zoning Regulations & Quality control** Introduction-Community planning Community Contingency plan –Report building and initial awareness- Recommendations For Land use Zoning Regulations - -Construction Quality Control -Evolution of Quality Management -Reasons for poor construction -Construction of Quality control in Masonry Structures. **Disaster Management Policy and Procedure –** legal frame work – Institutional Mechanism –Schemes and Grants on DM – Recommendation of 13th finance commission – plan schemes – Non plan Schemes – Externally Aided Schemes Role of NDRF in Disaster Management Medical First Responder Flood Rescue &Relief Management.

References

1. Annual Report, Ministry of Home Affairs, Government of India, 2009-10
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3. Berg.GV, “Seismic Design codes and procedures”, EERI, CA,1982
4. Booth, Edmund, “Concrete Structures in earthquake regions; Design and Analysis”, Longman, 1994
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6. Ghosh G.K. “Disaster Management”, A.P.H. Publishing Corporation, 2006
7. Goel, S. L. “Encyclopaedia of Disaster Management”, Deep & Deep Publications Pvt Ltd., 2006
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9. Singh R.B, “Disaster Management”, Rawat Publications, 2008
10. Thirteenth Finance Commision Report,Ministry of Finance, Government of India, 2010-15

IS Codes:

1. IS: 4326-1984, “Indian Std Code of practice for Earthquake Resistant Design and Construction of Buildings”.
2. IS: 1893 (Part I)-2002 “Code of practice for Earthquake Resistant Design of Structures
3. IRC: 56 “Recommended practice for treatment of embankment slopes for erosion control, 1974

Course Contents and Lecture Schedule

Module.No.	Topics	Hours
1.0	**Introduction - Disaster**	
1.1	Hazards and disaster, phases of Disaster Management	1
1.2	Types of disasters, Vulnerabilty, Risk	2
2.0	**Earthquake Disaster**	
2.1	Causes of Earthquakes, Earthquake Size Seismic waves	2
2.2	Inertia forces, Natural period, Damping, Types of damping	1
2.3	Seismic response of free and damped vibration	1
2.4	Performance of ground and buildings in past Earthquakes	1
2.5	Earthquake resistant measures in RC and Masonry buildings	2
3.0	**Land slide**	
3.1	Introduction ,Causes ,Landslide zoning map	2
3.2	Protection measures	2
4.0	**Floods ,Tropical cyclones, Tsunami**	
4.1	Introduction- Causes	2
4.2	Effects on buildings, protection measures from damage to buildings	2
4.3	Flood, cyclone, Tsunami zone map	2
4.4	Mitigation Strategies	2
5.0	**Nuclear disaster**	
5.1	Chemical and industrial accidents	2
5.2	DM Guidelines for Biological disaster, chemical disaster	1
6.0	**Hazard Assessment Procedure**	
6.1	Phases of disaster Management, Alternate communication systems	2
6.2	Vulnerability Assessment and seismic strengthening of buildings	1
6.3	Performance Level	1
6.4	RVS Method of Screeening – RC and Masonry Structures	2
6.5	Seismic Hazard Assessment – Deterministic Seismic Hazard	2
7.0	**Landuse Zoning Regulations & Quality control**	
7.1	Community planning Community Contingency plan	1
7.2	Role of Local and state bodies	1
7.3	Recommendations For Land use Zoning Regulations For natural	1
8.0	**Disaster Management Policy and Procedure**	
8.1	Legal frame work ,Institutional mechanism of Disaster Management	2
8.2	Schemes and Grants on Disaster Management	1
8.3	Recommendation of 13th finance commission	1
8.4	Plan, Non plan Schemes – Externally Aided schemes	1
8.5	Effects of natural hazards on economy & Development	1
8.6	Collapsed Structure rescue stages	1
8.7	Economic vulnerability – Role of Policy makers in disaster risk	1
8.8	Role of NDRF in Disaster Management	1
8.9	Medical First Responder	1
8.1	Collapsed structure Search & Rescue	1
8.11	Flood Rescue &Relief Management	1
	Total Hours	**48**

Course Designer:

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14IMPC0	ENVIRONMENTAL IMPACT AND RISK ASSESSMENT	Category	L	T	P	Credit
		PE	4	0	0	4

Common to 14EN310

Preamble

To expose the students to the need, methodology, documentation and application of Environmental Impact Assessment and to develop the skill to prepare Environmental Impact Assessment report and also exposed to the field of environmental risk assessment.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the necessity to study the impacts and risks that will be caused by projects or industries and the methods to overcome these impacts	Understand
CO2	Describe the legal requirements of environmental and risk assessment for projects	Understand
CO3	Prepare terms of reference for environmental impact and socio-economic impact for any developmental project	Apply
CO4	Prepare environmental management plan and risk mitigation plan by considering environmental aspects, impacts and potential hazards respectively for any project	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	M	M	---	---	M	M	M	---	---
CO2.	S	---	L	---	---	---	---	S	---	---	---
CO3.	S	S	M	L	M	M	---	S	---	S	L
CO4.	S	S	M	M	---	M	S	S	M	M	---

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	10	0
Understand	50	50	50	60
Apply	40	40	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1)**:**

1. Discuss the role of Public Participation in Environmental Decision Making.
2. EIA is an effective management tool : comment

3. Explain the various methodologies adapted for prediction of impacts for EIA report

Course Outcome 2 (CO2)**:**

1. Explain the legal framework for getting environment clearance for new projects.
2. Describe the procedure for conducting the public hearing as per EIA notification 2006.
3. Explain the legal framework for handling hazardous waste generated from any industry.

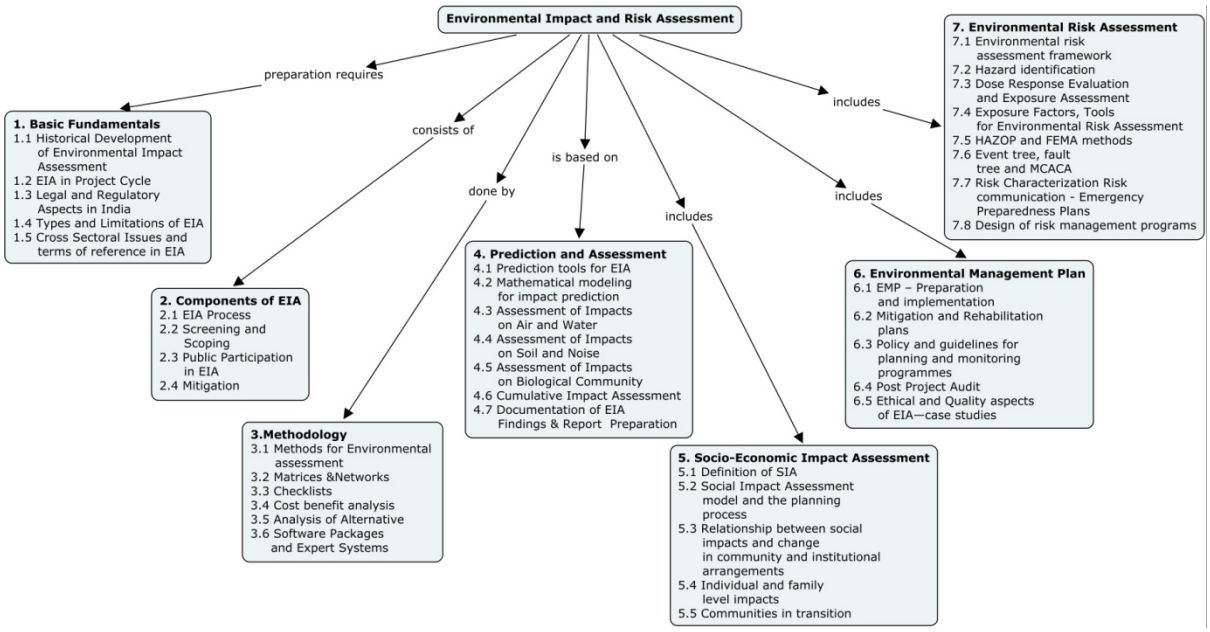
Course Outcome 3 (CO3):

1. Prepare terms of reference for coal based Thermal Power Plant having a capacity of 2x330 MW which is located at Nagapattinam district.
2. In Madurai it is propose to develop a CETP for 20 Electroplating units. Identify the potential impacts of the project and prescribe suitable terms of reference for the project.
3. It is proposed to construct a large hydro-electric power project at the foot hills of Varusanaadu. Prepare terms of reference for the socio-economic impacts.

Course Outcome 4 (CO4):

1. Pudur is a town located along the OMR road. It is proposed to construct 6000 No. of residential houses in that area. Identify the potential impacts of the project and suggest a management plan to mitigate them.
2. Sabarimalai is a pilgrimage town located in Kerala state. It is proposed to develop a Greenfield airport project for the capacity to handle six new generation large aircraft. Identify the potential impacts of the project and suggest a management plan to mitigate them.
3. Prepare risk assessment report for a stand-alone distillery unit having a capacity of 50 klpd. The raw material is sugarcane based molasses. Identify the potential impacts and prepare mitigation plan for the same.

Concept Map



Syllabus

Basic fundamentals: Historical Development of Environmental Impact Assessment-EIA in Project Cycle-Legal and Regulatory Aspects in India-Types and Limitations of EIA-Cross Sectoral Issues and terms of references in EIA**. Components of EIA environmental risk assessment**: EIA Process-Screening and Scoping-Public Participation in EIA-Mitigation. **Methodology** : Methods for Environmental assessment-Matrices &Networks-Checklists-Cost benefit analysis-Analysis of Alternative-Software Packages for EIA and Expert Systems in EIA. **Prediction and assessment:** Prediction tools for EIA-Mathematical modeling for impact prediction-Assessment of Impacts on Air and Water-Assessment of Impacts on Soil and Noise -Assessment of Impacts on Biological Community-Cumulative Impact Assessment-Documentation of EIA Findings & Report Preparation. **Socio-economic impact assessment:** Definition of Social Impact Assessment-Social Impact Assessment model and the --planning process-Relationship between social impacts and change in community and institutional arrangements-Individual and family level impacts -Communities in transition. **Environmental management plan:** Environmental Management Plan – Preparation and implementationand Rehabilitation plans-Policy and guidelines for planning and monitoring programmes-Post Project Audit-Ethical and Quality aspects of Environmental Impact Assessment—case studies. **Environmental risk assessment**: Environmental risk assessment framework-Hazard identification -Dose Response Evaluation – Exposure Assessment – Exposure Factors, Tools for Environmental Risk Assessment– HAZOP and FEMA methods – Event tree and fault tree analysis - Risk Characterization Risk communication - Emergency Preparedness Plans –Design of risk management programs.'

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1. Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York, 1996.
2. Lawrence, D.P., "Environmental Impact Assessment – Practical Solutions to recurrent problems", Wiley-Interscience, New Jersey, 2003.
3. Petts, J., "Handbook of Environmental Impact Assessment', Vol., I and II, Blackwell science, London, 1999
4. World Bank – Source Book on Environmental Impact Assessment, 2010

Course Contents and Lecture Schedule

S.No	Topics	Periods
1.0 BASIC FUNDAMENTALS		
1.1	Historical Development of Environmental Impact Assessment	1
1.2	EIA in Project Cycle	1
1.3	Legal and Regulatory Aspects in India	1
1.4	Types and Limitations of EIA	1
1.5	Cross Sectoral Issues and terms of references in EIA	1
2.0 COMPONENTS OF EIA		
2.1	EIA Process	1
2.2	Screening and Scoping	1
2.3	Public Participation in EIA	2
2.4	Mitigation	1
3.0METHODOLOGY		
3.1	Methods for Environmental assessment	2

3.2	Matrices &Networks	2
3.3	Checklists	1
3.4	Cost benefit analysis	1
3.5	Analysis of Alternative	1
3.6	Software Packages for EIA and Expert Systems in EIA	2
4.0 PREDICTION AND ASSESSMENT		
4.1	Prediction tools for EIA	1
4.2	Mathematical modeling for impact prediction	2
4.3	Assessment of Impacts on Air and Water	1
4.4	Assessment of Impacts on Soil and Noise	1
4.5	Assessment of Impacts on Biological Community	1
4.6	Cumulative Impact Assessment	1
4.7	Documentation of EIA Findings &Report Preparation	2
5.0 SOCIO-ECONOMIC IMPACT ASSESSMENT		
5.1	Definition of Social Impact Assessment	1
5.2	Social Impact Assessment model and the --planning process	1
5.3	Relationship between social impacts and change in community and institutional arrangements	1
5.4	Individual and family level impacts	1
5.5	Communities in transition	1
6.0 ENVIRONMENTAL MANAGEMENT PLAN		
6.1	Environmental Management Plan – Preparation and implementation	1
6.2	Mitigation and Rehabilitation plans	1
6.3	Policy and guidelines for planning and monitoring programmes	1
6.4	Post Project Audit	1
6.5	Ethical and Quality aspects of Environmental Impact Assessment—case studies	2
7.0 ENVIRONMENTAL RISK ASSESSMENT		
7.1	Environmental risk assessment framework	1
7.2	Hazard identification	1
7.3	Dose Response Evaluation and Exposure Assessment	1
7.4	Exposure Factors, Tools for Environmental Risk Assessment	2
7.5	HAZOP and FEMA methods	1
7.6	Event tree and fault tree analysis	1
7.7	Risk Characterization Risk communication - Emergency Preparedness Plans	1
7.8	Design of risk management programs	1
	TOTAL	**48**

Course Designer:

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14IMPD0	LARGE SCALE SYSTEMS PLANNING	Category	L	T	P	Credit
		PE	4	0	0	4

Preamble

The aim of this course is to sensitize the students about the basic concepts of systems engineering methodologies to approach the Socio-Techno problems in a holistic manner. This course will address the concepts of cause-effect impacts due to the interrelationships of components and elements of systems in a complex environment.

"Need is mother of Invention". In the modern society there are great possibilities of creating numerous identical solutions for every need. In this situation assessing the technological solutions using systems science and methodologies would be more appropriate rather than accepting the solutions developed based on 'reductionist' theorems. Usually, unintended impacts in view of energy conservation, economy, safety and environment indulge major crisis for the civil society and government in due course of time during and after implementations. These societal and socio-technological problems are typically large and complex, and hence this course has been called "Large-Scale Planning Systems".

We use the word 'Systems' to refer to the application of systems science and tools associated with this science for problem solving. These tools are also called as 'Systems Engineering Methodologies'. Thus systems engineering refers not only to physical systems and devices but to human and social systems too. Thus we must consider the total impact of any technological system on society as an inherent part of 'Systems Engineering'.

The systems approach to problem solving emphasizes interactions and interrelations among devise part of problems. Therefore it may be used to approach large and complex societal problems in a unified fashion. This would be contrasted with fragmented approach to eliminating symptoms of social ills that usually appear in our social systems and planning.

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1) Identify tools for process of forecasting and assessment on the indented and unintended impacts on policies and technological solutions	Understand
(CO2) Participate and coordinate in group discussions in organizations	Apply
(CO3) Understand and apply the components and elements involved in DPR, FR, EIA, EMS and Resettlement & Rehabilitations programs.	Apply
(CO4) Understand and apply the problem situation for higher level policy discussion on any societal and technological issues seamlessly in all domains	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	---	---	---	---	---	---	---	---	---
CO2.	S	M	---	---	---	M	---	S	---	M	---
CO3	S	M	---	---	---	M	---	S	L	M	L
CO4	S	M	L	---	---	M	---	S	L	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	40	40	40	40
Apply	40	40	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1(CO1):

1. Define Systems with an example
2. List the steps involved in value system design
3. Explain the System Behaviors with examples

Course Outcome 2 (CO2):

1. Identify the various needs to combat the educational challenges in India
2. Discuss the various Objectives, constraints, alterable measures for personal transportation in India in 2050 Interrelations
3. Narrate any technology that interacts with society environment

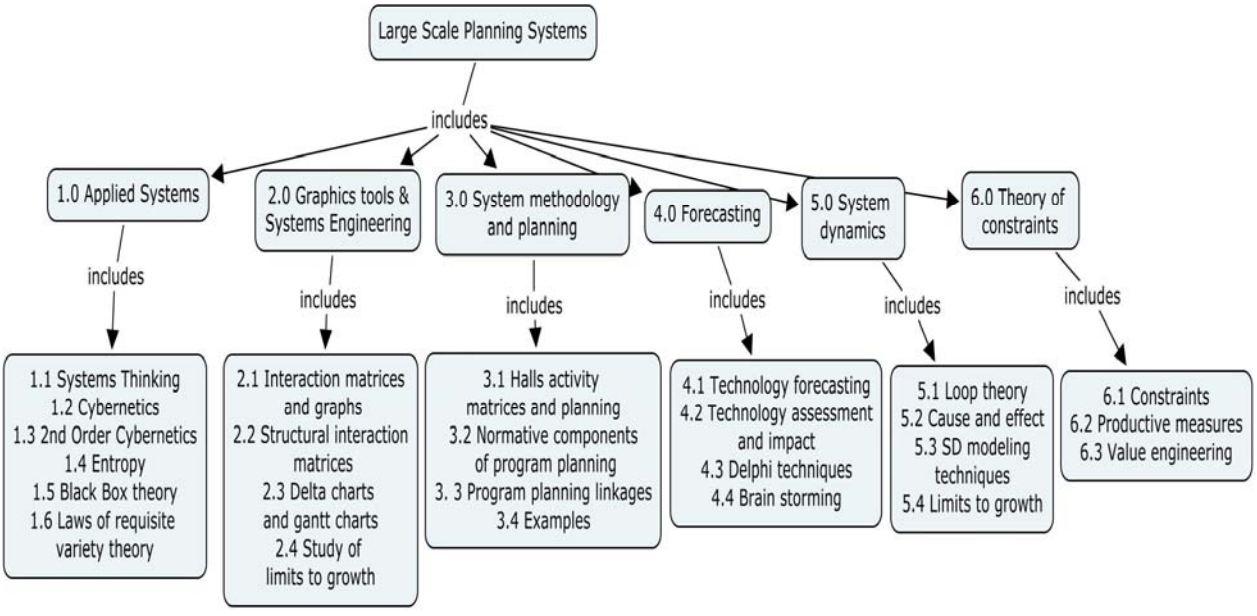
Course Outcome 3 (CO3):

1. Draw the intent structures for education and energy supply
2. State the "Law of requisite theory"
3. Compare System and organism
4. Create a system dynamics model population growth, health, industry and environment.

Course Outcome 4 (CO4):

1. Distinguish Boolean algebra and Conventional Martix
2. Mention two applications of black box theory
3. Discuss Constraints Theory with an example
4. Discuss the components of System Behaviour

Concept Map



Syllabus

Applied Systems: Systems thinking, Cybernetics, 2nd order cybernetics, Entropy, Black Box theory, Laws of requisite variety theory. **Graphics tools and systems engineering:** Interaction matrices and graphs, Structural interaction matrices, Delta charts and Gantt charts, Study of limits to growth. **System methodology and planning:** Halls activity matrices and planning, Normative components of program planning, Program planning linkages, Examples. **Forecasting:** Technology forecasting, Technology assessment and impact, Delphi techniques, Brain storming. **System dynamics:** Loop theory, Cause and effect, SD modeling techniques, Limits to growth. **Theory of constraints:** Constraints, Productive measures, Value engineering.

References

1. Andrew P. Sage, "Methodology for Large-Scale Systems", McGraw Hill Publication, 1977.
2. Anthony N. Michel, Richard K. Miller "Qualitative Analysis of Large Scale Dynamical Systems", Academic Press Inc. 1977
3. Heylighen. F "Cybernetics and Systems theory", Journal of Social and Evolutionary systems, 1996
4. Jerome D. Wiest and Ferdinand K. Levy, "A Management Guide to PERT /CPM", Prentice Hall of India Publishers Ltd., New Delhi, 1982
5. Punmiya B.C. and Khandelwal K.K., "Project Planning and Control with PERT/CPM", Laxmi publications, New Delhi, 2000
6. Warfield, J. N. "An Introduction to Systems Science", World Scientific, Singapore, 2006.

Course Contents and Lecture Schedule

Module No.	Topic	Periods
1.0	**Applied Systems**	
1.1	Systems thinking	1
1.2	Cybernetics	2
1.3	2nd order cybernetics	2
1.4	Entropy	2
1.5	Black Box theory	2
1.6	Laws of requisite variety theory	2
2.0	**Graphics tools and systems engineering**	
2.1	Interaction matrices and graphs	2
2.2	Structural interaction matrices	2
2.3	Delta charts and Gantt charts	2
2.4	Study of limits to growth	1
3.0	**System methodology and planning**	
3.1	Halls activity matrices and planning	2
3.2	Normative components of program planning	2
3.3	Program planning linkages	2
3.4	Examples	2
4.0	**Forecasting**	
4.1	Technology forecasting	2
4.2	Technology assessment and impact	2
4.3	Delphi techniques	2

4.4	Brain storming	2
5.0	**System dynamics**	
5.1	Loop theory	2
5.2	Cause and effect	2
5.3	SD modeling techniques	2
5.4	Limits to growth	2
6.0	**Theory of constraints**	
6.1	Constraints	2
6.2	Productive measures	2
6.3	Value engineering	2
	Total Periods	**48**

Course Designers:

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14IMPE0	ORGANIZATIONAL BEHAVIOUR	Category	L	T	P	Credit
		PE	4	0	0	4

Preamble

To impart knowledge on the importance of Organization Behaviour (OB), individual and group dynamics and organizational processes.

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1)	Understand the meaning, importance, scope and different approaches of OB	Understand
(CO2)	Explain the categories, dimensions and physiology of emotional intelligence and applications of emotions to OB	Apply
(CO3)	Explain the determinants, theories and attributes of personality, apply process and theories for motivation and leadership	Apply
(CO4)	Explain the need, importance of Group dynamics in OB and strategies of organizational culture.	Apply
(CO5)	Understand the need, influencing factors for organizational change and strategies for reducing change	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	---	---	---	M	L	M	---	---	---
CO2.	S	L	---	L	---	M	M	M	---	S	M
CO3	S		M	L	---	M	M	M	---	S	M
CO4	S	M	M	M	---	M	S	M	---	S	M
CO5.	S	M	M	L	---	M	L	M	L	---	---

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	50	50	40	40
Apply	30	30	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1(CO1):

1. "Organizational theories should follow the contingency approach". Discuss and Comment on the accuracy of this statement.

2. Define Organizational Behaviour. Mention its need for study in an industry
3. Discuss how globalization influences organizational behavior

Course Outcome 2 (CO2):

1. After few months on a job, Mr.X has experienced several emotional episodes ranging from frustration to joy about work he has been assigned. Use the attitude model to explain how these emotions affects Mr.X's level of job satisfaction with the work itself
2. "Happy employees create happy customers", Discuss.
3. Describe the dimensions of emotional intelligence

Course Outcome 3 (CO3):

1. Find two newspaper ads for management or executive positions. What leadership competencies are mentioned in these ads? If you were on the selection panel, what methods would you use to indentify these competencies in job applicants?
2. Explain why values have gained importance in organizations
3. List the elements of Lewin's force field analysis model
4. Explain how personality relates to Holland's model of vocational choice

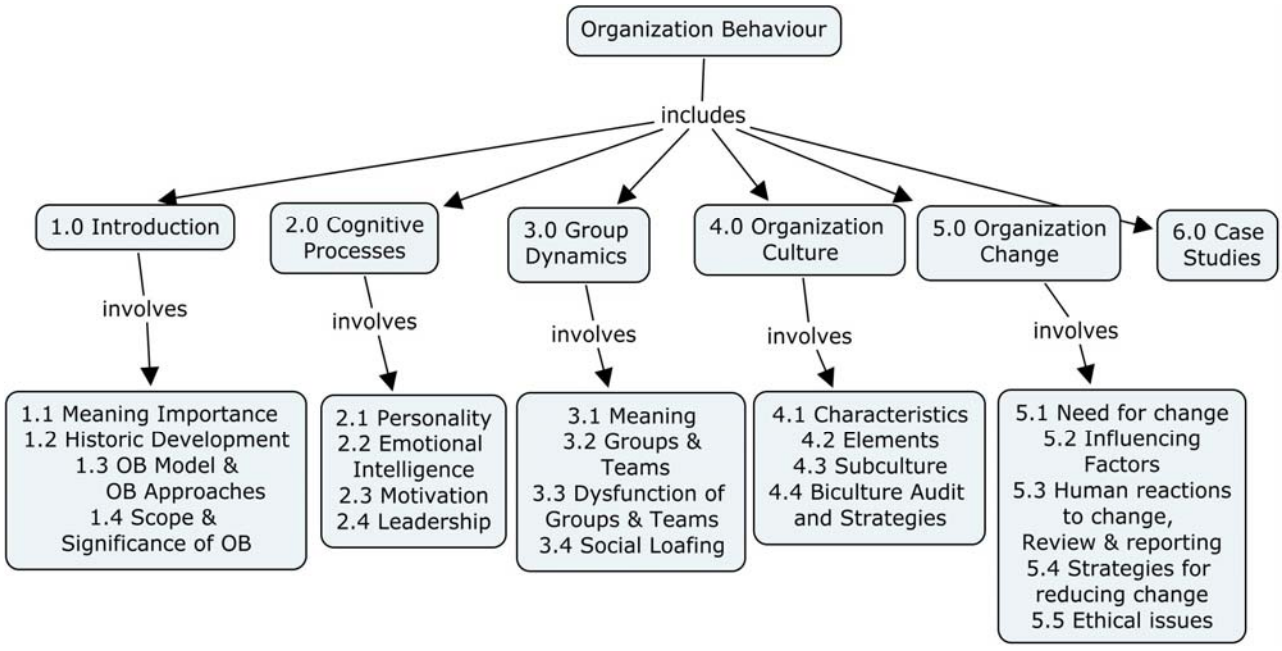
Course Outcome 4 (CO4):

1. "Organizations are more likely to succeed when they have an adaptive culture". Give your comments on the statement with reasons
2. Identify the five types of individual behavior in organizations
3. A steel industry redesigned its production facilities around a team-based system. However the president of the industry believes that employees will not be motivated unless they receive incentives based on their individual performance. Give explanations why the industry should introduce team-based rather than individual rewards in this setting.
4. Differentiate between team and group with examples

Course Outcome 5(CO5):

1. Identify changes in work place in recent years
2. List the five anchors on which organizational behavior is based
3. Compare and contrast Maslow's needs hierarchy theory with Alderfer's ERG theory

Concept Map



Syllabus

Introduction to OB- Definition, Meaning and Importance of OB, Historic developments of OB, Hawthorne experiment, Basic OB Model, Different approaches to OB, Contributing disciplines to OB, Scope of OB, Significance of OB. **Personality-** Definition, Origin of the word Personality, Determinants of Personality, Theories of Personality (Psychoanalytic theory, Self theory, Holland's personality theory, Myers Briggs Type Indicators and Big 5 personality theory), Attributes of personality. **Emotional Intelligence-** Definition and Meaning, Categories of intelligence, EI Dimensions, Physiology of EI, OB applications of emotions. **Motivation-** Definition, Meaning, Characteristics of Motivation, Process of Motivation, Theories of Motivation (Maslow's need theory, ERG theory, Hertzberg theory, Expectancy theory, Theory X & Y, McClelland's theory of needs, Goal setting theory, Equity theory), Incentives for Motivation. **Leadership -** Definition and Meaning, Styles of leadership, Theories of leadership (Trait theory, Ohio state theory, Managerial grid, Contingency theory, Path goal theory, Leader Member Exchange(LMX), Transactional & transformational leadership theory, Charismatic and Visionary leadership theory), Conflict and resolution. **Group Dynamics -** Definition and Meaning, Difference between Group and Team, Groups in Organization, Team Effectiveness model, Troubles with team, Social loafing- law of requisite variety- Ashby theory. **Organizational Culture-** Meaning and Definition, Characteristics of Organizational culture, Elements of Organizational culture, Organizational sub culture, Artifacts for Organizational culture, Bicultural audit, Strategies to merger different organizational culture. **Organizational Change -** Meaning, need for change, Factors of Organizational change, Lewin's forced field model, Human reactions to change, Organization - Control, review and updating. Resistance to change, Strategies for reducing change, Ethical issues in Organizational change. **Case Studies**.

References

1. Fred Luthans, "Organisational Behaviour", McGraw-Hill International Edition., Tenth Edition, 2005.
2. Kreitner Robert., Kinicki Angelo.,"Organisational Behaviour", Illinois, Irwin Inc., 1997.
3. Robbins P.Stephen., "Organizational Behavior", New Delhi, Prentice-Hall of India., Eigth Edition, 1999.
4. Steven L. McShane, Mary Ann Von Glinow, "Organisational Behaviour", New Delhi, Tata McGraw-Hill Edition. third reprint, 2005.
5. Vlad Dimitrov, "Law of Requisite Vorticity in Human Dynamics", http://www.zulenet.com/vladimirdimitrov/pages/vorticity.html

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**Introduction to Organization Behaviour**	
1.1	Definition, Meaning and Importance of OB	1
1.2	Historic developments of OB, Hawthorne experiment	1
1.3	Basic OB Model, Different approaches to OB	2
1.4	Contributing disciplines to OB, Scope of OB, Significance of OB	1
2.0	**Cognitive Processes of Organization Behaviour**	
2.1	**Personality**	
2.1.1	Definition, Origin of the word Personality, Determinants of	1

	Personality	
2.1.2	Theories of Personality - Psychoanalytic theory, Self theory	1
2.1.3	Theories of Personality - Holland's personality theory & Myers Briggs Type Indicators)	1
2.1.4	Theories of Personality - Big 5 personality theory	1
2.1.5	Attributes of personality	1
2.2	**Emotional Intelligence**	
2.2.1	Definition and Meaning, Categories of intelligence	1
2.2.2	EI Dimensions, Physiology of EI	1
2.2.3	OB applications of emotions	1
2.3	**Motivation**	
2.3.1	Definition, Meaning, Characteristics of Motivation	1
2.3.2	Process of Motivation	1
2.3.3	Theories of Motivation - Maslow's need theory, ERG theory	1
2.3.4	Theories of Motivation - Hertzberg theory, Expectancy theory	2
2.3.5	Theories of Motivation - Theory X & Y, McClelland's theory of needs	2
2.3.6	Theories of Motivation - Goal setting theory, Equity theory	2
2.3.7	Incentives for Motivation	2
2.4	**Leadership**	
2.4.1	Definition and Meaning, Styles of leadership	1
2.4.2	Theories of leadership -Trait theory, Ohio state theory	1
2.4.3	Theories of leadership - Managerial grid, Contingency theory	1
2.4.4	Theories of leadership - Path goal theory, Leader Member Exchange(LMX)	2
2.4.5	Theories of leadership - Transactional & transformational leadership theory	1
2.4.6	Theories of leadership - Charismatic and Visionary leadership theory. Conflicts and resolution	1
3.0	**Group Dynamics**	
3.1	Definition and Meaning	1
3.2	Difference between Group and Team Groups in Organization, Team Effectiveness model	1
3.3	Dysfunction of groups and teams -Troubles with team	1
3.4	Social loafing – law of requisite variety- Ashby theory	2
4.0	**Organizational Culture**	
4.1	Meaning and Definition, Characteristics of Organizational culture	1
4.2	Elements of Organizational culture	1
4.3	Organizational sub culture, Artifacts for Organizational culture, Bicultural audit	1
4.4	Strategies to merger different organizational culture	2
5.0	**Organizational Change**	
5.1	Meaning, Need for change	1
5.2	Factors of Organizational change, Lewin's forced field model	1
5.3	Human reactions to change, Organization - Control, review and updating	1
5.4	Strategies for reducing change, Resistance to change	1
5.5	Ethical issues in Organizational change	1
6.0	**Case Studies**	2
	Total Periods	**48**

Course Designers:

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15IMPF0	GEOTECHNIQUES FOR INFRASTRUCTURE	Category	L	T	P	Credit
		PC	4	0	0	4

Preamble

Major Infrastructures like bridges, tunnels, Transmission line Towers etc require the use of special Foundations. Often foundations for these works are constructed in poor soils which require remediation work like the use of geo textiles. This course deals with the methods of construction of raft foundation, piles, caissons, diaphragm walls, Foundation for Transmission Towers, Chimneys etc. Also techniques for the construction of Foundations in Expansive soils, Compressible soils and Drainage and Dewatering methods for the construction of Foundations are addressed.

Prerequisite

Fundamentals of Mathematics, knowledge of Geology, Geotechnical Engineering and Foundation Engineering

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Suggest appropriate construction methods for Rafts and Diaphragm walls. Analyse

CO2: Suggest suitable construction methods for Foundation for Transmission line Towers and Pile Foundations. Analyse

CO3: Suggest suitable Foundation Techniques for Expansive soils and Compressible soils. Analyse

CO4: Suggest suitable Drainage and Dewatering Techniques for the construction of Foundations. Analyse

CO5: Adopt safety measures during piling and sinking of Caissons. Analyse

CO6: Suggest ground remediation work with the use of Geotextiles and Reinforced Earth Walls Analyse

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	M	---	S	---	---	---	---	M	---	S	L
CO2.	M	---	M	L	---	M	---	M	---	S	L
CO3.	M		S	---	---	---	---	---	---	S	L
CO4.		L	M	---	---	---	---	M	---	S	L
CO5.	M	---	---	---	---	M	---	M	---	S	L
CO6.	S	---	S	L	---	M	---	M	L	S	L

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	20	20	20	20
Analyse	30	30	30	30
Evaluate	-	-	-	-
Create	-	-	-	-

Course Level Assessment Questions

CO1: Suggest appropriate construction methods for Rafts and Diaphragm walls.

1. Explain the suitability of different types of Raft foundations.
2. Explain the method of deep excavation in a weak soil for the construction of raft foundation.
3. Discuss the method of construction of diaphragm walls.

CO2: Suggest suitable construction methods for Foundation for Transmission line Towers and Pile Foundations

1. Mention the different types of foundations for transmission line towers.
2. Discuss the various forces and the conditions to be considered in the analysis of chimney and pad footing.
3. Discuss the method of installation of a driven precast pile.
4. Bored cast in-situ piles are recommended for a particular construction project at a site comprising of soft clayey soil. Suggest the appropriate method for advancing bore hole for the installation the pile foundation.

CO3: Suggest suitable Foundation Techniques for Expansive soils and Compressible soils.

1. Explain the method of constructing a shallow isolated footing in expansive clay deposit for a lightly loaded structure.
2. Write a note on zone of soil volume change in expansive soils.
3. Design a drilled pier with a belled shaft for an expansive soil deposit using the following data:

Depth of the unstable zone	= 6 m
Swelling pressure	= 500 kN/m^2
Cohesion	= 100 kN/m^2
Unit weight of soil	= 18 kN/m^3
Diameter of straight shaft of the pier	= 0.45 m
Dead load on the top of the pier	= 225 kN

CO4: Suggest suitable Drainage and Dewatering Techniques for the construction of Foundations.

1. Write a note Electro osmotic method of dewatering.
2. It is proposed to lower the ground water table to a very large depth below the ground surface for deep excavation. Suggest the apt method for lowering the water table and explain the process.
3. Subsoil investigation at a site for an infrastructure project reveals that water table is close to the surface. Recommend and explain the correct procedure for concreting bored piles under this circumstance with sketches.

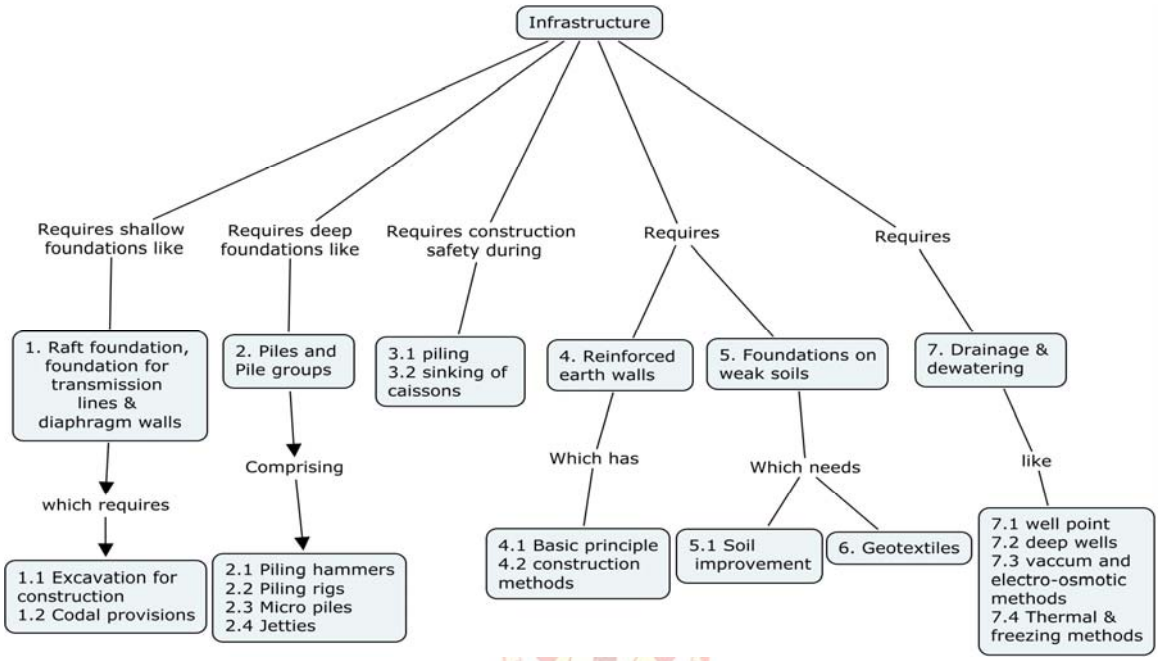
CO5: Adopt safety measures during piling and sinking of Caissons.

1. Explain the various safety measures to be adopted during the installation of pile foundations.
2. Explain the procedure of sinking of caissons.
3. Discuss the various methods of overcoming tilt during sinking of caissons.

CO6: Suggest ground remediation work with the use of Geotextiles and reinforced earth walls

1. Suggest an apt material to be used as reinforcement for weak soil and discuss the method of constructing embankments using it.
2. Explain vibroflotation method of deep compaction.
3. A 10m vertical embankment is to be built using tension strips in backfilling. The reinforcing strips are 100mm wide. The facing units are of interlocking concrete blocks. Assume γ = 18 kN/m^3; $\varnothing = 30^0$ and $\delta = 24^0$ for the fill. Find required length of soil reinforcement.

Concept Map



Syllabus

CONSTRUCTION OF SHALLOW FOUNDATIONS: Excavations for Foundations in soft soils – Recommendations – Types of Raft - Construction of Raft Foundations – Foundations for Transmission line towers and poles – Construction of Diaphragm walls – Codal provisions. **CONSTRUCTION OF DEEP FOUNDATIONS:** Selection of appropriate type of Pile – Piling rig – Pile driving hammers - Construction aspects of bored and driven Piles – Micro Piles – Pile groups – Berthing structures and Jetties – Codal provisions. **CONSTRUCTION SAFETY:** Safety measures during piling – sinking of Caissons - **EARTH REINFORCEMENT:** Earth reinforcement – Principles and basic mechanism of reinforced earth – Construction of reinforced earth retaining walls. **FOUNDATIONS ON WEAK SOILS:** Soil improvement and Foundation Techniques for compressible and expansive soils. **GEOTEXTILES:** Synthetic and natural fiber based Geotextiles and their applications - Filtration, drainage, separation, erosion control. **DRAINAGE AND DEWATERING METHODS**: Drainage - Ground Water lowering by Well points, Deep wells, Vacuum and Electro-osmotic methods- Design steps for Dewatering system – capacity of pumps required – Types of Drains and their components – Stabilization by thermal and freezing techniques – Case studies.

References

1. Das, B.M., Principles of Foundation Engineering, Sixth Edition, India Edition, Thomson, 2007.
2. Hans – George Kempfert & Berhane Gebreselassie., Excavation And Foundations in soft soils, Springer.
3. Murthy, V.N.S., “Advanced Foundation Engineering”, CBS Publishers & Distributors, New Delhi, 2007.
4. Purushothama Raj, P., Ground Improvement Techniques, Laxmi Publications (P) Ltd., New Delhi, 2007
5. Tomlinson M.J., Pile Design and Construction Practice, Fourth Edition, E & FN SPON an imprint of Chapman & Hall.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**CONSTRUCTION OF SHALLOW FOUNDATIONS**	
1.1	Excavations for Foundations in soft soils - recommendations	3
1.2	Types of Raft - Construction of Raft Foundations	3
1.3	Foundations for Transmission line towers and poles – Construction of Diaphragm walls	3
1.4	Codal provisions	2
2.0	**CONSTRUCTION OF DEEP FOUNDATIONS**	
2.1	Selection of appropriate type of Pile – Piling rig – Pile driving hammers	2
2.2	Construction aspects of bored and driven Piles – Micro Piles – Pile groups	2
2.3	Berthing structures and Jetties – Codal provisions	3
3.0	**CONSTRUCTION SAFETY**	
3.1	Safety measures during piling – sinking of Caissons	3
4.0	**EARTH REINFORCEMENT**	
4.1	Earth reinforcement – Principles and basic mechanism of reinforced earth	2
4.2	Construction of reinforced earth retaining walls	1
5.0	**FOUNDATIONS ON WEAK SOILS**	
5.1	Soil improvement for compressible and expansive soils	3
5.2	Foundation Techniques for compressible and expansive soils.	3
6.0	**GEOTEXTILES**	
6.1	Synthetic and natural fiber based Geotextiles	2
6.2	Application of Geotextiles - Filtration, drainage	2
6.3	Separation - erosion control	2
7.0	**DRAINAGE AND DEWATERING METHODS**	
7.1	Drainage - Ground Water lowering by Well points, Deep wells	3
7.2	Vacuum and Electro-osmotic methods	3
7.3	Design steps for Dewatering system – capacity of pumps required	2
7.4	Types of Drains and their components.	2
7.5	Stabilization by thermal and freezing techniques	2
	Total hours	**48**

Course Designer:

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14IMPG0	REMOTE SENSING AND GIS	Category	L	T	P	Credit
		PE	4	0	0	4

Preamble

Remote sensing is small- or large-scale acquisition of information of an object or phenomenon, by the use of either recording or real-time sensing device(s) that are wireless, or not in physical or intimate contact with the object (such as by way of aircraft, spacecraft, satellite, buoy, or ship). The quality of remote sensing data consists of its spatial, spectral, radiometric and temporal resolutions. A Geographic Information System (GIS) is a system that captures, stores, analyzes, manages and presents data with reference to geographic location data. GIS is the merging of cartography, statistical analysis, and database technology. GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data, maps, and present the results of all these operations.

Course Outcomes

On the successful completion of the course, students will be able to

(CO1):	Understand the fundamentals of physics of Remote Sensing and geographical concepts for mapping, analysis and interpretation for problem solving	Understand
(CO2):	Understand the various data acquisition systems and collection methods for remote object data information and storage	Understand
(CO3):	Explain various techniques of remote data information analysis and interpretation in relation with spatial objects	Apply
(CO4):	Explain applications of remote sensing and geographical information system tool in various domains of civil engineering	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	---	---	---	---	---	---	---	---	---
CO2.	S	M	S	---	---	---	---	---	---	---	---
CO3	S	M	M	---	---	---	---	---	---	---	---
CO4	S	L	---	L	M	L	---	M	---	S	L

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	40	40	40	40
Apply	40	40	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Discuss how remote sensing data quality is affected by energy interaction with atmosphere and earth surface materials?
2. List types of scattering.
3. Distinguish raster and vector data.

Course Outcome 2 (CO2):

1. Mention the use of filtering technique.
2. Write various types of data for storage and analysis in GIS.
3. Explain in detail the spectral reflectance and signature with its significance

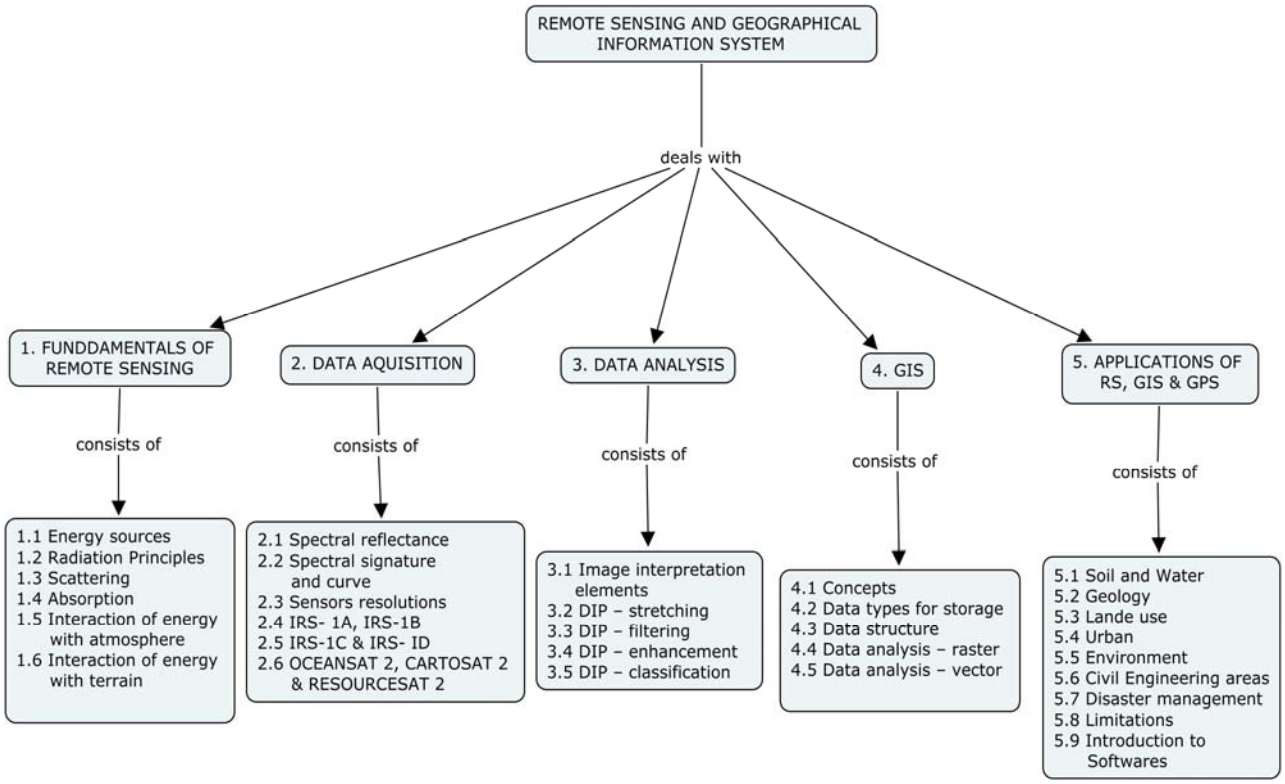
Course Outcome 3 (CO3):

1. Describe the role of importance of sensors resolutions in data interpretation
2. Explain the significance of filtering technique in digital image interpretation.
3. Explain the classification technique in image interpretation

Course Outcome 4 (CO4):

1. Write the applications of GPS in disaster mitigation and management.
2. How Remote Sensing and GIS technique is applied in land use and land cover mapping?
3. Discuss the radiation principles and its application in remote sensing data capturing.

Concept Map



Syllabus

Fundamentals of Remote Sensing – Radiation principles, Scattering, Absorption, Interaction of energy with atmosphere and earth; **Data Acquisition –** spectral reflectance and signature, sensors resolutions, IRS series satellites study; **Data Analysis –** Interpretation elements, Digital image processing techniques-stretching, Filtering, Enhancement and classification; **GIS**-concepts, data structure, types of data and analysis; **Applications of RS & GIS –** soil &water resources mapping, geological mapping, land use & land cover mapping, urban sprawl mapping, environmental management and planning studies, and disaster mitigation and management; Applications of GPS in civil engineering. Application of RS & GIS in infrastructural Development – Airport & Harbor, Transport & Settlements

References

1. Campbell. J. B, “Introduction to remote sensing”, (3rd ed.), The Guilford Press, (2002)
2. Chang. K, “Introduction to Geographic Information System”, 4th Edition. McGraw Hill. (2007)
3. Fu, P and J. Sun, “Web GIS: Principles and Applications”, ESRI Press. Redlands, CA, (2010)
4. Jensen. J. R, “Remote sensing of the environment: an Earth resource perspective” (2nd ed.). Prentice Hall.(2007).
5. Jensen., J. R. (2005). Digital Image Processing: a Remote Sensing Perspective (3rd ed.), Prentice Hall.
6. Lillesand. T. M.; R. W. Kiefer, and J. W. Chipman, “Remote sensing and image interpretation”, (5th ed.), Wiley Publications, (2003)
7. Maguire. D.J., Goodchild M.F., Rhind D.W, "Geographic Information Systems: principles, and applications", Longman Scientific and Technical, Harlow, (1997)
8. Richards. J. A.; and X. Jia, “Remote sensing digital image analysis: an introduction” (4th ed.), Springer, (2006)

Course Contents and Lecture Schedule

S.No	Topic	No.of Lecture
1.0	**Fundamentals of Remote Sensing**	
1.1	Energy sources	1
1.2	Radiation Principles – Black body radiation, Plank’s, Stefen and Boltzman law	2
1.3	Scattering – Raleigh, Mie and Non-selective scattering	2
1.4	Absorption – Atmospheric windows and its significance	2
1.5	Interaction of energy with atmosphere	2
1.6	Interaction of energy with terrain	1
2.0	**Data Acquisition**	
2.1	Spectral reflectance – different wave length of EMR	1
2.2	Spectral signature and curve – significance	2
2.3	Sensors resolutions – spectral, spatial, temporal and radiometry	1
2.4	IRS series – IRS- 1A, IRS-1B sensors details, its characteristics and importance	2
2.5	IRS series – IRS-1C & IRS- ID sensors details, its characteristics and importance	2
2.6	IRS – OCEANSAT 2, CARTOSAT 2 & RESOURCESAT 2	1
3.0	**Data Analysis**	
3.1	Image interpretation elements – visual and digital	2
3.2	DIP – stretching technique and its importance	2
3.3	DIP – filtering technique and its importance	2

3.4	DIP – enhancement technique and its importance	2
3.5	DIP – classification technique and its importance	2
4.0	**GIS**	
4.1	Concepts of GIS	1
4.2	Data types for storage – spatial & non spatial	1
4.3	Data structure – raster and vector	2
4.4	Data analysis – raster	1
4.5	Data analysis – vector	1
5.0	**Applications of RS & GIS**	
5.1	Application of RS & GIS in soil & water resources mapping	2
5.2	Application of RS & GIS in geological mapping	1
5.3	Application of RS & GIS in land use & land cover mapping	1
5.4	Application of RS & GIS in urban sprawl mapping	1
5.5	Application of RS & GIS in environmental management and planning	1
5.6	Application of GPS in Civil Engineering	1
5.7	Application of RS & GIS in Disaster mitigation and management	1
5.8	Limitations of RS & GIS techniques in civil engineering	1
5.9	Introduction to RS & GIS Software	1
5.10	Application of RS & GIS in infrastructural Development – Airport & Harbor	1
5.11	Application of RS & GIS in infrastructural Development - Transport	1
5.12	Application of RS & GIS in infrastructural Development – Settlements	1
	Total	**48**

Course Designers:

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		Category	L	T	P	Credit
14IMPH1	**SUSTAINABLE DEVELOPMENT**	PE	4	0	0	4

Preamble

This course work aims at imparting the knowledge on Sustainable development for a sustainable future. Starting from minimizing the causes for various Environmental issues (like resource degradation, greenhouse gases, industrialization) implementing eco development programmes, promoting Environmental awareness among public/individuals for resource protection and technological innovations for sustainable development are well addressed. The student is expected to understand the Environmental issues and demonstrate knowledge of and need for sustainable development, apply knowledge of technological innovations, range of technology and an engineering specialization for achieving sustainable development, and understand the effects of various technologies on global health as they interact with society and culture.

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1)	Describe the concept and socio-economic policies of Sustainable Development	Understand
(CO2)	Identify the strategies for implementing eco development programmes	Apply
(CO3)	Identify different approaches for resource conservation and management	Apply
(CO4)	Suggest action plans for implementation of sustainable development	Apply
(CO5)	Review technological innovations for their impact on environment and integration in different settings	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	---	---	---	---	---	---	---	---	---
CO2.	S	M	---	---	---	M	---	---	---	S	M
CO3	S	M	---	---	---	M	---	---	---	S	M
CO4	S	M	M	---	---	M	---	M	M	S	M
CO5.	S	M	M	---	---	S	---	M	M	S	L

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	10	10	10
Understand	40	40	40	40
Apply	40	30	30	30
Analyse	0	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1(CO1):

1. Define sustainable development
2. Discuss the principles of Sustainable Development
3. Explain the concept of sustainable development
4. Explain the current Environmental issues

Course Outcome 2 (CO2):

1. Discuss the Indicators for Sustainable Development
2. Define Desertification.
3. Identify the strategies you would consider for implementation of eco-development programmes

Course Outcome 3 (CO3):

1. Discuss the role of fossil fuels in climate change
2. Explain the strategies for implementing resource conservation initiatives
3. Enumerate the framework for the resource protection and management for a given environmental setting

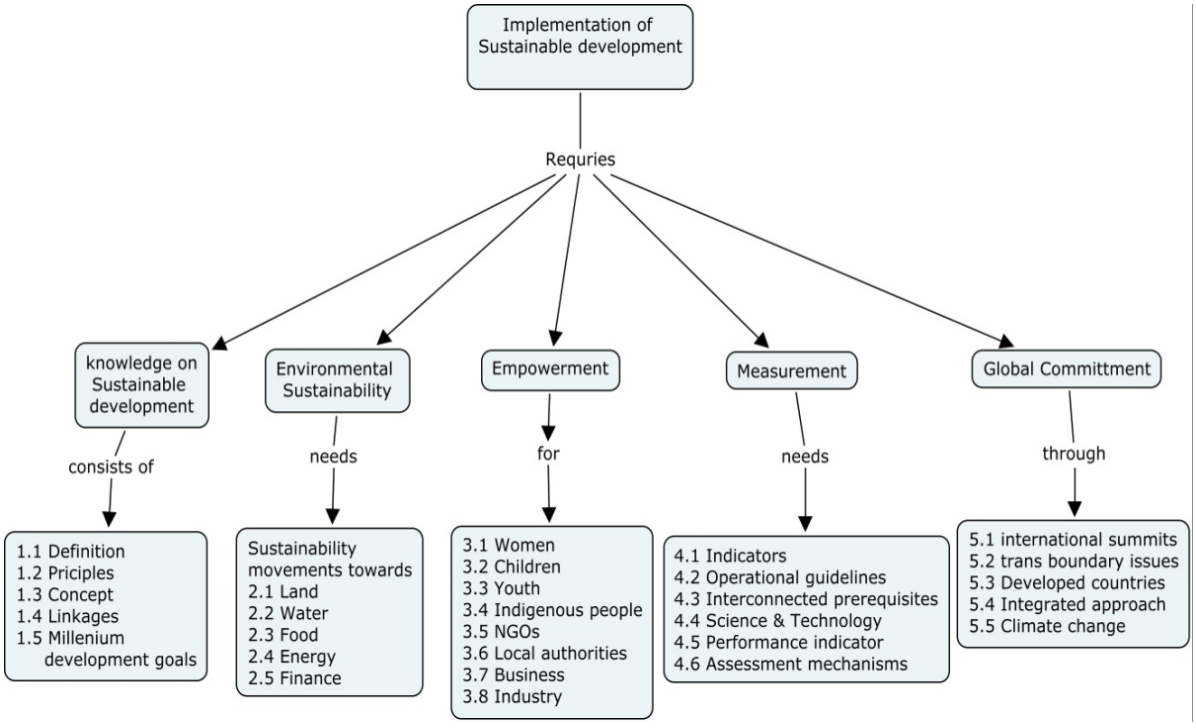
Course Outcome 4 (CO4):

1. Identify and discuss the strategies you would follow to promote Environmental awareness
2. Identify the means of achieving sustainable development in global trading
3. Discuss the actions you would exercise to implement sustainable development

Course Outcome 5 (CO5):

1. Identify how we can minimize the environmental impact to achieve sustainable development with suitable reasons
2. Discuss the criteria of selecting the approach for resource protection
3. Suggest means of minimize the non-renewable energy source in future with reasons

Concept Map



Syllabus

Introduction to Sustainable Development: Definitions and principles of Sustainable Development – History and emergence of the concept of Sustainable Development – Environment and Development linkages – Globalization and environment – Millennium Development Goals: Status (global and Indian) – Impacts on approach to development policy and practice in India, future directions. **Environmental Sustainability:** Land, Water and Food production – Moving towards sustainability: Energy powering Sustainable Development – Financing the environment and Sustainable Development. **Empowerment:** Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities, Business and Industry – Sustainability indicators – Hurdles to sustainability – Operational guidelines – Interconnected prerequisites for sustainable development – Science and Technology for sustainable development – Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development. **Measurements:** Role of developed countries in the development of developing countries – International summits, Transboundry issues – Integrated approach for resource protection and management. **Global Commitment:** Climate change – Chemistry of atmosphere, Chemistry of greenhouse gases, effects on plants and animals. Global warming, Sea level rise, Ozone problem. The greenhouse effect-ecosystems and species interactions, changes in agricultural production, droughts, spread of epidemics, wildfires and other extreme weather events. Role of fossil fuels in climate change, future use of renewable energy, role of governments, industries and individuals, International agreements and protocols. Green building concepts – LEED.

References

1. Gilg A W and Yarwood R, “Rural Change and Sustainability – Agriculture, the Environment and Communities”, CABI Edited by S J Essex, September 2005.
2. Ganesha Somayaji and Sakarama Somayaji, “Environmental Concerns and Sustainable development: Some perspectives from India”, Editors:, publisher TERI Press, ISBN 8179932249.
3. James H. Weaver, Michael T. Rock, Kenneth Kustere, “Achieving Broad-Based Sustainable Development: Governance, Environment, and Growth with Equity”, Kumarian Press, West Hartford, CT. Publication Year,1997.
4. Kirkby. J, O’Keefe P. and Timberlake, “Sustainable development” Earth Scan Publication, London, 1996.
5. Kerry Turner. R, “Sustainable Environmental Management”, Principles and Practice Publisher: Belhaven Press, ISBN:1852930039.
6. Munier N, “Introduction to Sustainability”, Springer 2005

Course Contents and Lecture Schedule

Module No.	Topics	No. of Periods
Introduction to Sustainable Development		
1.1	Definitions	1
1.2	Principles of Sustainable Development	1
1.3	concept of Sustainable Development	2
1.4	Environment and Development linkages	1
1.5	Millennium Development Goals	1

Environmental Sustainability		
2.1	Sustainability movement towards Land	1
2.2	Sustainability movement towards Water	2
2.3	Sustainability movement towards food	2
2.4	Sustainability movement towards Energy	1
2.5	Finance for sustainable development	1
Empowerment		
3.1	Women	1
3.2	Children	1
3.3	Youth	1
3.4	Indigenous people	1
3.5	NGOs	1
3.6	Local authorities	1
3.7	Business	1
3.8	Industry	1
Measurements		
4.1	Sustainability Indicators	2
4.2	Operational guidelines	1
4.3	Interconnected prerequisites for sustainable development	2
4.4	Science and Technology for sustainable development	2
4.5	Performance indicators of sustainability	1
4.6	Assessment mechanism & Constraints and barriers for sustainable development	2
Global Commitment		
5.1	Developed countries	1
5.2	International summits	1
5.3	Trans-boundary issues	1
5.4	Integrated approach for resource protection and management	1
5.5	Climate change	1
5.5.1	Chemistry of atmosphere	1
5.5.2	Chemistry of green house gases	1
5.5.3	Effects on plants and animals	1
5.5.4	Global warming, Sea level rise, Ozone problem	2
5.5.5	ecosystems and species interactions	1
5.5.6	changes in agricultural production, droughts, spread of epidemics	1
5.5.7	wildfires and other extreme weather events	1
5.5.8	Role of fossil fuels in climate change, future use of renewable energy	2
5.5.9	Role of governments, industries and individuals	1
5.5.10	International agreements and protocols	1
	Total Periods	**48**

Course Designers:

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3. Mr. V.Ravi Sankar environmentengr@gmail.com

		Category	L	T	P	Credit
14IMPJ1	**URBAN PLANNING AND DESIGN**	PE	4	0	0	4

Preamble

Urban planning and design must seek to improve the quality of the life of people living in complex urban conditions, with full respect for indigenous, cultural and social needs. This course is intended to raise the awareness of the components of physical city and the forces that shape it and the planning of urban infrastructure in the urban context.

Course Outcomes

On the successful completion of the course, students will be able to

(CO1) : Understand the characteristics and types of urban settlements	Understand
(CO2) : Identify the role of urban planning in development	Understand
(CO3) : Explain the theories and models of urban planning	Understand
(CO4) : Apply sustainable practices in urban development and planning	Apply
(CO5) : Design infrastructure with an understanding of the urban context and development	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	L	---	---	---	---	---	---	---	---
CO2.	S	---	---	---	---	---	---	---	---	---	---
CO3.	S	---	---	---	---	---	L	L	---	---	---
CO4.	S	---	L	---	---	M	L	M	---	---	L
CO5.	S	M	L	---	---	M	M	M	---	---	L

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	60	60	60	50
Apply	20	20	20	30
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1)

1. Explain the various types and characteristics of urban settlements
2. Describe the components that of urban settlements
3. What are the factors that influence urban development

Course Outcome 2 (CO2)

1. List the various types of urban development plans

2. Explain the Regulations and legislation in India with respect to urban planning

Course Outcome 3 (CO3)

1. Discuss the various land use models in planning
2. Describe the national and international guidelines and standards for urban planning

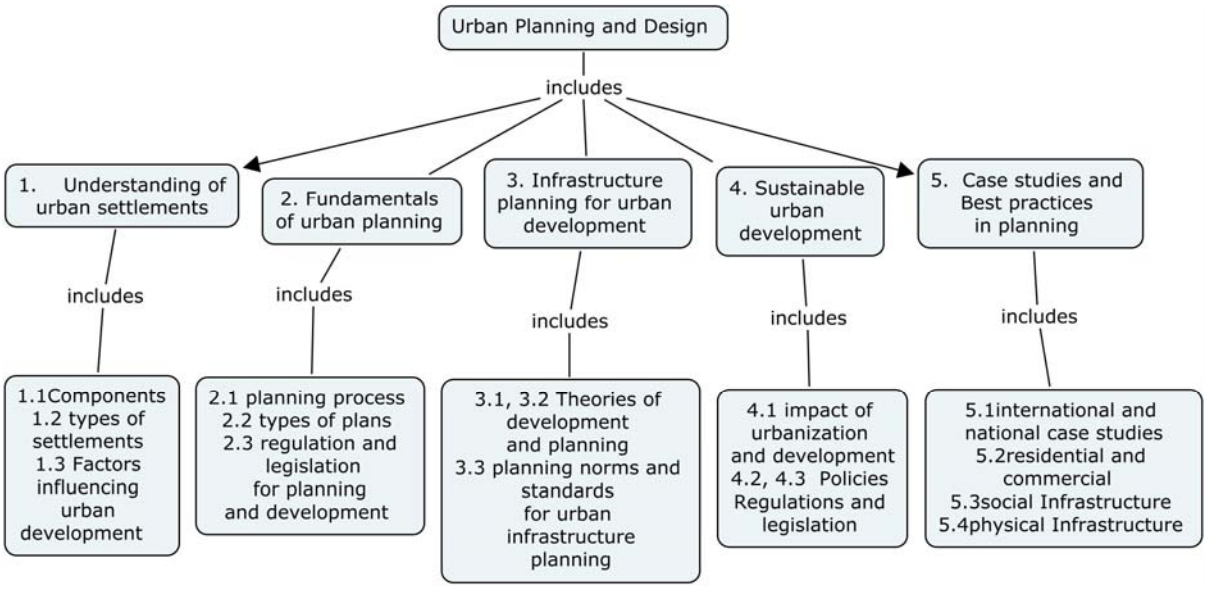
Course Outcome 4 (CO4)

1. Discuss the impact of urban development on the environment
2. List a few sustainable practices in urban development planning

Course Outcome 5 (CO5)

1. Explain a case study of transportation system planning for a city
2. Describe 2 case studies of best practices in physical infrastructure planning

Concept Map



Syllabus

Introduction to Urban settlements: Definition of settlements, rural and urban settlements – their characteristics ; Basic components, factors influencing urban settlements and their interrelationships; Anatomy & classification of Human settlements based on configuration of shape, function, location, Resource, Population & Occupational structure; Structure and form of Human settlements – Linear, non-linear and circular –Combinations; Structure and form of Human settlements – Linear, non-linear and circular –Combinations; Reasons for development – Major Growth factors – advantages and disadvantages – case studies – factors influencing development / decay; **Urban Planning:** Need, General issues and potentials of urban planning; Planning process and monitoring; Planning machinery in India – levels of planning – Town and country planning act; Types of development plans - Regional plan, Master plan, Structure plan, Zonal Development plan – their scope and content; Urban Development programmes like JNNURM, TNUDP, IDSMT etc; Regulations and legislation in India; Indicators of development and quality of life; role of infra structure in urban development; **Infrastructure planning for urban development:** Theories of urban development ; Land Use models ; Introduction to modes of planning; Various urban development strategies and initiatives in India; smart city – smart grid; National and international guidelines; planning norms and standards for zoning and sub division, physical (transport, water supply, drainage, solid waste management, power etc), social (educational, health, recreational, cultural etc) infrastructure, residential and commercial infrastructure; **Sustainable urban development:** Ecological, environmental and social impact of

urbanization and development; Policies and urban design guidelines for new developments; Regulations and legislation w.r.t environment; Environmental Impact assessment – need, process and issues; social and environmental cost benefit; Indicators of ecological analysis; **Case Studies:** Best practices in urban planning and design – inter-national and national case studies; Case studies of Planning of large scale residential, commercial, physical and social Infrastructure at urban level.

References

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2. Frederic J. OSBORN -New towns - Arnold whittick – Leonard Hill, 1988
3. Gideon golany "Urban Planning for Arid Zones" , A wiley interscience publication MTP construction, 1995
4. Kevin Lynch," Image of the city" - MIT Press, 1992
5. Jain A.K. "Indian mega city and economic reforms", Management publishing Company, 2009
6. Jayashri Ray Chaudhuri "An Introduction to Development & Regional Planning" Orient Longman Ltd (2001).
7. Koperdekar H.D & Diwan G.R. " Urban and Regional Planning: Principles", practice and law, 1994
8. Mercedes Gonzalez de la Rocha "Fundamentals of Town Planning", Black well publishers, 2001
9. Pratap Rao M. "Urban Planning theory and practice", cbs, http: www.bagchee.com/books
10. Popposwamy – Town country planning and Housing – Sri Aurobindo ashram press, 1969.
11. Rangwala -Town Planning 17th & 18th edition-Charotar Publishing House (2003).

Course Contents and Lecture Schedule

Module No.	Topic	No. of lectures
1.0	**Introduction to Urban settlements**	**9**
1.1	Definition of settlements, rural and urban settlements – their characteristics ; Basic components, factors influencing urban settlements and their interrelationships	2
1.2	Anatomy and classification of Human settlements based on configuration of shape, function, location, Resource, Population & Occupational structure	2
1.3	Structure and form of Human settlements – Linear, non-linear and circular –Combinations	2
1.4	Reasons for development – Major Growth factors – advantages and disadvantages – case studies – factors influencing development / decay	3
2.0	**Urban Planning**	**9**
2.1	Need, General issues and potentials of urban planning; Planning process and monitoring; Planning machinery in India – levels of planning – Town and country planning act	3
2.2	Types of development plans - Regional plan, Master plan, Structure plan, Zonal Development plan – their scope and content; Urban Development programmes like JNNURM, TNUDP, IDSMT etc	3
2.3	Regulations and legislation in India; Indicators of development and quality of life; role of infra structure in urban development	3
3.0	**Infrastructure planning for urban development**	**9**
3.1	Theories of urban development ; Land Use models ; Introduction to	4

	modes of planning	
3.2	Various urban development strategies and initiatives in India, smart city - overview	2
3.3	National and international guidelines; planning norms and standards for zoning and sub division, physical (transport, water supply, drainage, solid waste management, power etc), social (educational, health, recreational, cultural etc) infrastructure, residential and commercial infrastructure	3
4.0	**Sustainable urban development**	**9**
4.1	Ecological, environmental and social impact of urbanization and development	3
4.2	Policies and urban design guidelines for new developments; Regulations and legislation w.r.t environment	3
4.3	Environmental Impact assessment – need , process and issues ; social and environmental cost benefit; Indicators of ecological analysis	3
5.0	**Case Studies**	**12**
5.1	Best practices in urban planning and design – inter-national and national case studies	3
5.2	Case studies of Planning of large scale residential and commercial Infrastructure at urban level	3
5.3	Case studies of Planning of social Infrastructure at urban level	3
5.4	Case studies of Planning of physical Infrastructure at urban level	3
	Total Hours	**48**

Course Designers:

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14IMPK1	INFRASTRUCTURE FINANCE	Category	L	T	P	Credit
		PE	3	1	0	4

Preamble

This main objective of the course is to provide an understanding and appreciation of a financing technique that is widely used to finance infrastructure projects today. Project Finance, as it is called, differs quantitatively and qualitatively in many ways as compared to the traditional corporate finance. This course will provide an exposure to this innovative financing method - Project Finance, and its applicability and utility across industries.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the concept of Profit and Wealth Maximization Function.	Apply
CO2	Analysis of Statement of Changes in Financial Statement	Apply
CO3	Analyse Cash Flow with Capital Budgeting Problem	Analyse
CO4	Analysis of Risk and Financial Leverage	Analyse
CO5	Determinants of Working Capital , Policy and Financing Policy	Analyse

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	M	S	---	---	---	---	S	---	---	M	---
CO2.	---	S	M	---	---	---	M	---	S	---	---
CO3.	M	S	---	L	M	---	---	---	M	---	---
CO4.	---	S	M	---	---	---	M	---	---	S	---
CO5.	---	S	---	L	---	---	---	---	---	---	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	10	10
Understand	10	10	10	10
Apply	40	40	40	40
Analyse	40	40	40	40
Evaluate	-	-	-	-
Create	-	-	-	-

Course Level Assessment Questions

CO1: Understand the concept of Profit and Wealth Maximization Function.

1. Define the scope of financial management. What role should the financial manager play in a modern enterprise?
2. Explain the various accounting concepts relevant for the preparation of final accounts.
3. Define 'subsidiary books'. Explain the purpose of each of them.

CO2: **Analysis of Statement of Changes in Financial Statement**

1. Explain in brief:
   a. Risk and uncertainty
   b. Certainty equivalents
   c. Sensitivity analysis

2. Calculate profitability index for each project and rank them. Which project would you choose if the total available funds are Rs. 80,00,000?

2. A company is considering the following six projects:

Project	Cost (Rs.'000)	NPV (Rs.'000)
1	1,000	210
2	6,000	1,560
3	5,000	850
4	2,000	260
5	2,500	500
6	500	95

3.

3. Explain in detail certainty equivalents and Beta coefficients, Productivity tree approach and sensitivity analysis?
4. State the merits and demerits of different types of financial analysis.

CO3: **Analyse Cash Flow with Capital Budgeting Problem**

1. There are two projects available in the market namely Sony and Ericson.
   The details of those two projects are under:

Particulars	Sony	Ericson
C0	Rs. 5,00,000	Rs. 6,00,000
C1	Rs. 1,20,000	Rs. 1,30,000
C2	Rs. 1,20,000	Rs. 1,30,000
C3	Rs. 1,20,000	Rs. 1,30,000
C4	Rs. 1,20,000	Rs. 1,30,000
C5	Rs. 1,20,000	Rs. 1,30,000

   Based on the above information suggest which project is more feasible by using IRR.
2. Contrast the IRR and the NPV methods. Under what circumstance may they lead to a) comparable recommendations and b) give conflicting recommendations?
3. How is risk assessed for a particular investment by using a probability of distribution? Take a simple example to illustrate the method.

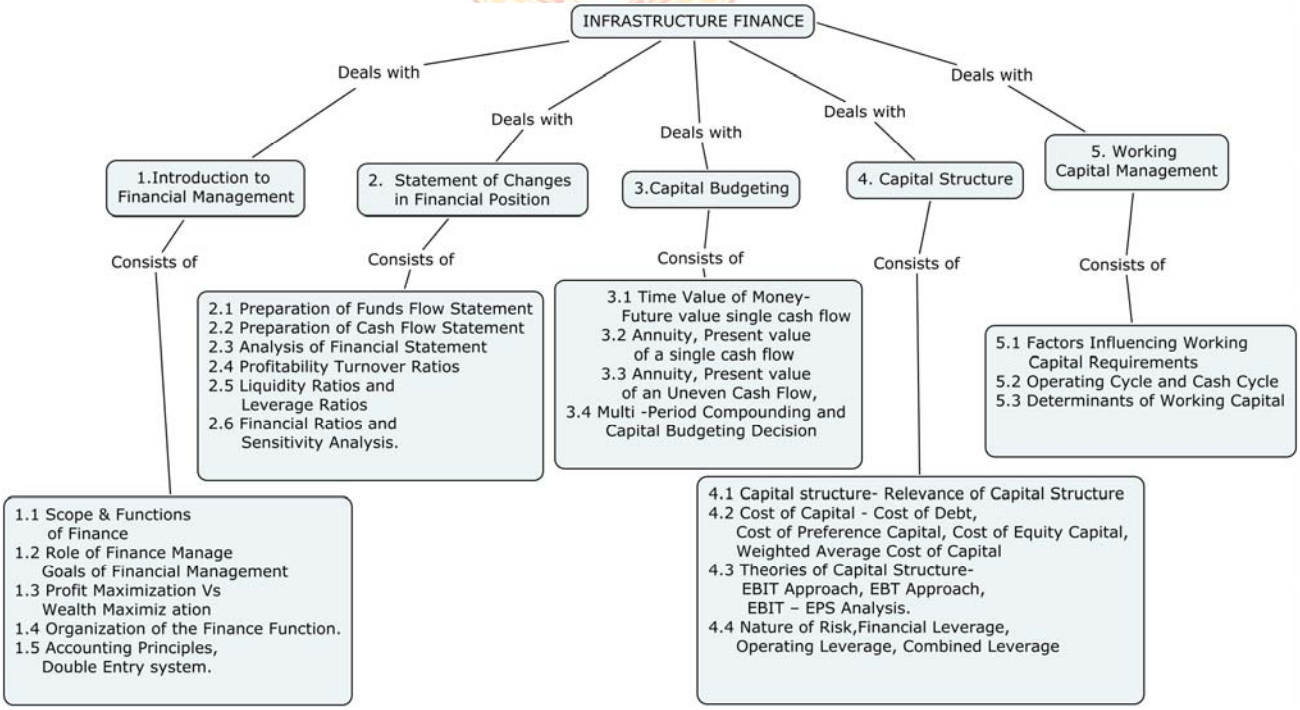
CO4: **Understand Various Theories of Capital Structure and then Analysis of Risk and Financial Leverage**

1. Explain optimum capital structure? State the different factors which influence optimum capital structure.
2. Enumerate with an appropriate examples The nominal cost of capital is not equivalent to the sum of the real cost of capital and the expected inflation rate.
3. Explain CAPM approach for computing the cost of equity. Discuss merits and demerits of the approach.

CO5: **Determinants of Working Capital , Policy and Financing Policy**

1. Write the importance of working capital for a manufacturing firm? What shall be the repercussions if a firm has:
   (i) Paucity of working capital.
   (ii) Excess working capital.
2. Define working capital. Discuss the factors to be considered while determining working capital requirements
3. Explain the Length of operating cycle is a major determinant of working capital needs of a business firm.

Concept Map



Syllabus

Introduction to Financial Management: Scope & Functions of Finance, Goals of Financial Management .Organization of the Finance Function. **Accounting Principles** – preparation of journal, ledger, trial balance, Double Entry system, preparation of final account. **Statement of Changes in Financial Position:** Preparation of Fund- Flow Statement, Preparation of Cash- Flow Statement, Analysis of Financial Statement– Profitability Turnover

Ratios, Liquidity Ratios, Leverage Ratios, and Financial Ratios, Sensitivity Analysis. **Capital Budgeting:** Concept and importance**,** factors influencing working capital requirements, Time Value of Money- Future value of a single cash flow, Annuity, Present value of a single cash flow, Annuity, Present value of an Uneven Cash Flow, Multi - Period Compounding. Capital Budgeting Decision. **Analysis of project viability:** Capital structure, Relevance of Capital Structure, Theories of Capital Structure- EBIT Approach, EBT Approach, EBIT – EPS Analysis, Nature of Risk, Financial Leverage, Operating Leverage, Combined Leverage.

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3 Jim McMenamin, “Financial Management – An Introduction”, Taylor and Francis, 2002
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7 Narayanaswamy, “Financial Accounting – A Managerial Perspective”, PHI, 2011
8 Prasanna Chandra, “Financial Management”, Tata Mcgraw Hill Publication, 2008
9 Pande I.M, “Financial Management”, Vikash Publication, 2007
10 Robert N Anthony, David F Hawkins and Kenneth A , “Accounting”, Merchant, 2007

Course Contents and Lecture Schedule

Module No.	TOPICS	NO. OF HOURS
1. Introduction to Financial Management		
1.1	Scope & Functions of Finance	1
1.2	Role of Finance Manager- Goals of Financial Management	1
1.3	Profit Maximization Vs Wealth Maximiz ation	2
1.4	Organization of the Finance Function.	1
1.5	Accounting Principles, Double Entry system.	1
2.0 Statement of Changes in Financial Position		
2.1	Preparation of Funds Flow Statement	2
2.2	Preparation of Cash Flow Statement	1
2.3	Analysis of Financial Statement	2
	Tutorial - Financial Statement	2
2.4	Profitability Turnover Ratios	1

2.5	Liquidity Ratios and Leverage Ratios	2
2.6	Financial Ratios and Sensitivity Analysis.	2
	Tutorial- Sensitivity Analysis	2
3.0 Capital Budgeting		
3.1	Time Value of Money-Future value of a single cash flow	1
3.2	Annuity, Present value of a single cash flow	2
3.3	Annuity, Present value of an Uneven Cash Flow,	2
	Tutorial- cash flow	2
3.4	Multi -Period Compounding and Capital Budgeting Decision	1
4.0 Capital Structure		
4.1	Capital structure- Relevance of Capital Structure	
4.2	Cost of Capital - Cost of Debt, Cost of Preference Capital, Cost of Equity Capital, Weighted Average Cost of Capital	2
	Tutorial- Cost of Capital	2
4.3	Theories of Capital Structure- EBIT Approach, EBT Approach, EBIT – EPS Analysis.	2
	Tutorial- Theories of Capital Structure	2
4.4	Nature of Risk,. Financial Leverage, Operating Leverage, Combined Leverage	2
5.0 Working Capital Management		
5.1	Factors Influencing Working Capital Requirements	1
5.2	Operating Cycle and Cash Cycle	2
	Tutorial- Operating Cycle and Cash Cycle	2
5.3	Determinants of Working Capital	1
	Total No. of periods	**48**

Course Designers:

1. Mr. R. Sankaranarayanan rsciv@tce.edu
2. Ms. D. Srividya dsciv@tce.edu

14IMPL0 TRANSPORTATION PLANNING

Category	L	T	P	Credit
PC	3	1	0	4

Preamble

This course focuses on four stages of urban transportation planning i.e,trip generation, trip distribution, mode choice modelling and route assignment. The course will give exposure to land use transport models. The course provides adequate exposure to identity the right type of transportation system needed to cater to the future demand and quantify the same.

Prerequisite

Fundamentals of traffic and transportation engineering, probability and statistics

Course Outcomes

On the successful completion of the course, students will be able to:

CO1: Explain the interrelation between landuse pattern and transportation system	Understand
CO2: Explain transportation system planning process	Understand
CO3: Estimate trip production and attraction	Apply
CO4: Undertake efficient mode choice analysis and trip distribution modelling	Apply
CO5: Perform route assignment in a network	Apply
CO6: Analyse traffic flow pattern using transport land use models	Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	M	S	S	---	M	---	L	M	S	---
CO2.	S	L	---	---	---	M	M	---	---	---	---
CO3.	S	M	S	S	---	M	M	L	M	S	---
CO4.	S	M	S	S	---	M	---	---	M	S	---
CO5.	S	L	---	---	---	M	M	---	M	---	M
CO6.	S	L	---	---	M	---	---	---	---	---	---

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	10	10	10
Understand	30	30	30	30
Apply	60	40	40	40
Analyse	-	20	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1)

1. Explain the impact of socio economic activities on transport planning.
2. Describe the freight transport planning aspects.
3. List various types of urban transport systems .

Course Outcome 2 (CO2)

1. Explain system approach in transportation planning process.
2. Mention the interdependence of land use and traffic.
3. Discuss the analysis of existing conditions for new transportation system planning.

Course Outcome 3 (CO3)

1. Explain the factors governing trip generation and attraction.
2. Discuss critical appraisal of category analysis technique.
3. The trip rate (y) and the corresponding household sizes (x) from a sample are shown in table below. Compute the trip rate if the average household size is 3.25 (use regression method).

Trips per day (y)	House hold size (x)			
	1	2	3	4
	1	3	4	5
	3	4	5	8
	3	5	7	8

Course Outcome 4 (CO4)

1. List various factors affecting modal split.
2. Discuss briefly the various trip distribution models.
3. The total trips produced in and attracted to the three zones A, B and C of a survey area in the design year are tabulated as:

Zone	Trips produced	Trips attracted
A	2000	3000
B	3000	4000
C	4000	2000

It is known that the trips between zones are inversely proportional to the second power of travel time between zones, which is uniformly 20 minutes. If the trip interchange between zones B and C is 600, calculate the trip interchange between zones A and B, B and A, C and B.

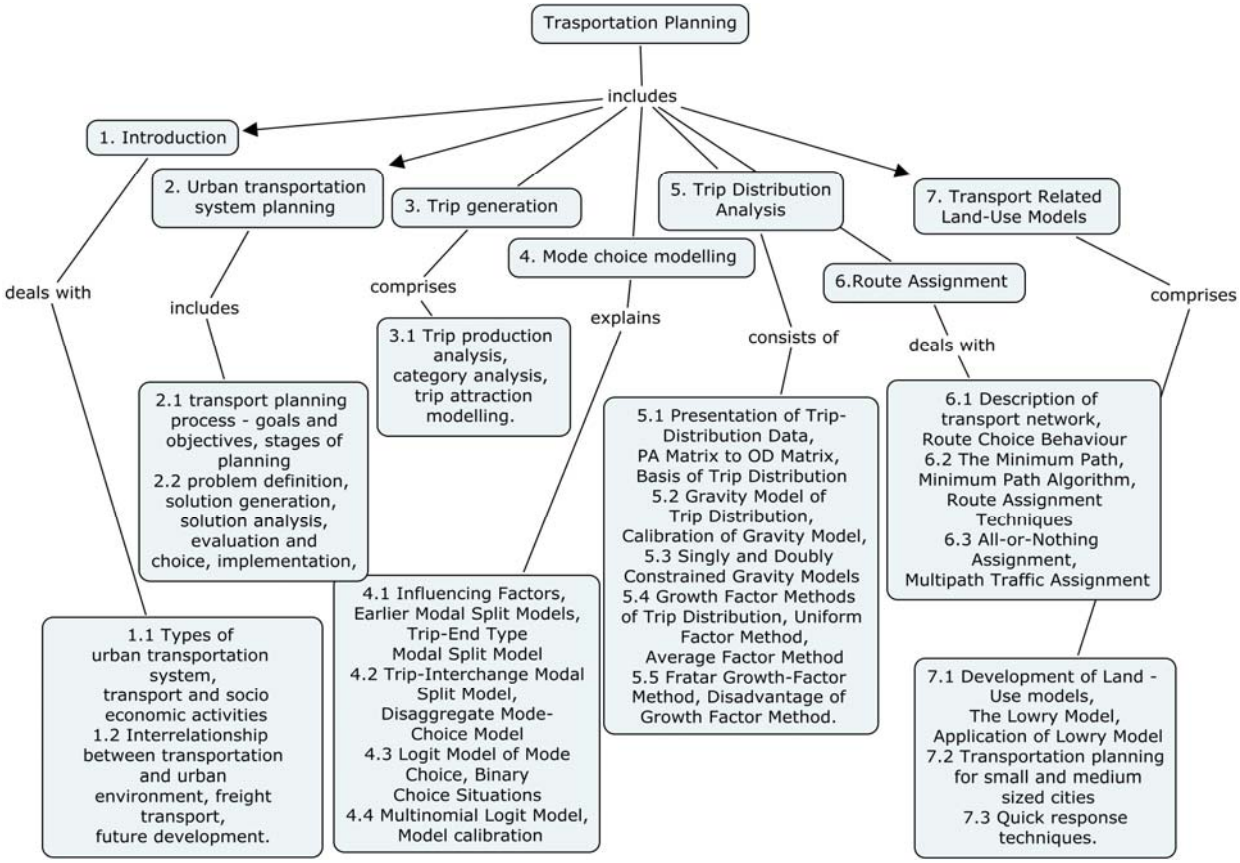
Course Outcome 5 (CO5)

1. Illusitrate purpose of traffic assignment.
2. Describe various techniques of route assignment.
3. Discuss the general principle involved in minimum path tree.

Course Outcome 6 (CO6)

1. Recall the considerations in selecting a land use model.
2. Explain features of Lowry model.
3. Discuss the lans use models application in Indian traffic scenario.

Concept Map



Syllabus

Introduction - Types of urban transportation systems, transport and socio economic activities, interrelationship between transportation and urban environment, freight transport, future development. T**ransportation system planning -** Transport planning process, problem definition, solution generation, solution analysis, evaluation and choice, implementation, sequence of activities involved in transportation analysis. Difficulties in transport planning process. **Trip generation -** Trip production analysis, category analysis, trip attraction modelling. **Mode choice modelling** - Influencing Factors, Earlier Modal Split Models, Trip-End Type Modal Split Model, Trip-Interchange Modal Split Model, Disaggregate Mode-Choice Model, Logit Model of Mode Choice, Binary Choice Situations, Multinomial Logit Model, Model calibration. **Trip Distribution Analysis -** Presentation of Trip-Distribution Data, PA Matrix to OD Matrix, Basis of Trip Distribution, Gravity Model of Trip Distribution, Calibration of Gravity Model, Singly and Doubly Constrained Gravity Models, Methods of Trip Distribution - Uniform Factor Method, Average Factor Method, Growth-Factor Method, Disadvantage of Growth Factor Method. **Route Assignment -** Description of transport network, Route Choice Behaviour, The Minimum Path, Minimum Path Algorithm, Route Assignment Techniques, All-or-Nothing Assignment, Multipath Traffic Assignment, Capacity-Restrained Traffic Assignment. **Transport Related Land-Use Models -** Development of Land - Use models, The Lowry Model, Application of Lowry Model. Transportation planning

for small and medium sized cities, Quick response techniques. Remote sensing and GIS in urban planning (Brief Concepts).

References

1. Brase/Brase "Understandable Statistics 3rd edition",D C Health and Company, Lexington, Massachusetts,Toronko,1987.
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3. Jason C.yu, Transportation Engineering: Introduction to planning, Design and Operations, Elsevier,1992.
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6. Mike Slinn, Peter Guest and Paul Matthews "Traffic Engineering Design Principles and Practice", Elsevier, 2006
7. Nicholas J. Garben and Lester A Hoel,"Traffic and Highway Engineering", PWS Publication, 1999.
8. Partha Chakroborty and Animesh Das," Principle of Traffic Engineering", Prentice Hall of India,New Delhi,2003.
9. Taylor M.A.P and Young W,Traffic Analysis-New Technology and New solutions, Hargreen Publishing Company,1998.
10. http://www.nptel.ac.in/downloads/105101008/
11. http://www.nptel.ac.in/courses/105106058/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**Introduction**	
1.1	Types of urban transportation systems, transport and socio economic activities,	2
1.2	Interrelationship between transportation and urban environment, freight transport, future development.	2
2.0	**Urban transportation system planning**	
2.1	transport planning process - goals and objectives, stages of planning	2
2.2	problem definition, solution generation, solution analysis, evaluation and choice, implementation,	2
2.3	Sequence of activities involved in transportation analysis .Difficulties in transport planning process.	2
3.0	**Trip generation**	
3.1	Trip production analysis, category analysis, trip attraction modelling.	2
	Tutorials	2
4.0	**Mode choice modelling**	1
4.1	Influencing Factors, Earlier Modal Split Models, Trip-End Type Modal Split Model	2
4.2	Trip-Interchange Modal Split Model, Disaggregate Mode-Choice Model	1

4.3	Logit Model of Mode Choice, Binary Choice Situations,	1
4.4	Multinomial Logit Model, Model calibration	1
	Tutorials	2
5.0	**Trip Distribution Analysis**	
5.1	Presentation of Trip-Distribution Data, PA Matrix to OD Matrix, Basis of Trip Distribution,	2
5.2	Gravity Model of Trip Distribution, Calibration of Gravity Model,	1
5.3	Singly and Doubly Constrained Gravity Models,	1
5.4	Growth Factor Methods of Trip Distribution, Uniform Factor Method, Average Factor Method,	2
5.5	Fratar Growth-Factor Method, Disadvantage of Growth Factor Method.	2
	Tutorials	2
6.0	**Route Assignment**	
6.1	Description of transport network, Route Choice Behaviour, t	2
6.2	The Minimum Path, Minimum Path Algorithm, Route Assignment Techniques,	2
6.3	All-or-Nothing Assignment, Multipath Traffic Assignment,	1
6.4	Capacity-Restrained Traffic Assignment.	2
	Tutorials	2
7.0	**Transport Related Land-Use Models**	
7.1	Development of Land - Use models, The Lowry Model, Application of Lowry Model.	2
7.2	Transportation planning for small and medium seized cities,	2
7.3	Quick response techniques.	1
7.4	Remote Sensing and GIS for planning	2
	TOTAL HOURS	**48**

Course Designers:

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2. Dr. R. Velkennedy rvkciv@tce.edu

15IMPM0	URBAN ENVIRONMENTAL MANAGEMENT	Category	L	T	P	Credit
		PC	4	0	0	4

Preamble

This course work deals with the various environmental issues in an urban scenario. It provides exposure to the urban water resources and its management. It deals with the stages of works involved in a water supply project of a city, safe wastewater collection system for generated wastewater and its management, solid waste and their safe disposal beyond urban limit to be free from pollution is also addressed in the course work.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1) Understand planning of a city and identify various urban environmental issues	Understand
(CO2) Apply and Prepare project Plans to integrate urban water resource	Apply
(CO3) Develop water resource management using available water resources	Apply
(CO4)Develop sustainable wastewater management concepts comparing with successful models followed in developed nation	Analyze
(CO5) Understand and apply the principles of solid waste management	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	---	---	---	---	---	---	M	---	---	---
CO2.	S	L	---	---	---	M	M	---	---	S	L
CO3	S	L	---	---	---	M	M	---	---	S	L
CO4	S	M	---	---	---	M	L	---	---	S	L
CO5	S	L	L	---	---	M	---	L	---	S	L

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	50	50	30	30
Apply	30	30	30	30
Analyse	0	0	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1(CO1)

1. Define: Master Plan
2. Differentiate Point and Non Point source of pollution with examples
3. Write the principles of Ecopsychology
4. Define: Recycling and Reuse
5. List the softwares available for environmental engineering

Course Outcome 2 (CO2)

1. Discuss how temple tanks can be used for Rain water Harvesting
2. Describe how fish ponds are better than duckweed ponds. justify your answer
3. Assume the 20 years of rainfall for a city with population of 1 Million and chart out an "Integrated Water Plan" after considering all the available resources
4. Write the process of converting the urban tank into a percolation pond and discuss why the urban tank is to be converted into a pond

Course Outcome 3 (CO3)

1. Discuss why social awareness is necessary for water management
2. Suggest and prioritize Rain water harvesting methods for a city with rainfall of 900 mm and open area of 22%.
3. Estimate the population of the city in the year 2031, the details are as follows: 2001- 9.5 lakhs , 1991- 8.2 lakhs, 1981- 6.5 lakhs by any two methods.
4. List the advantages of SCS curve method for the runoff calculation
5. Define: Sustainable Management

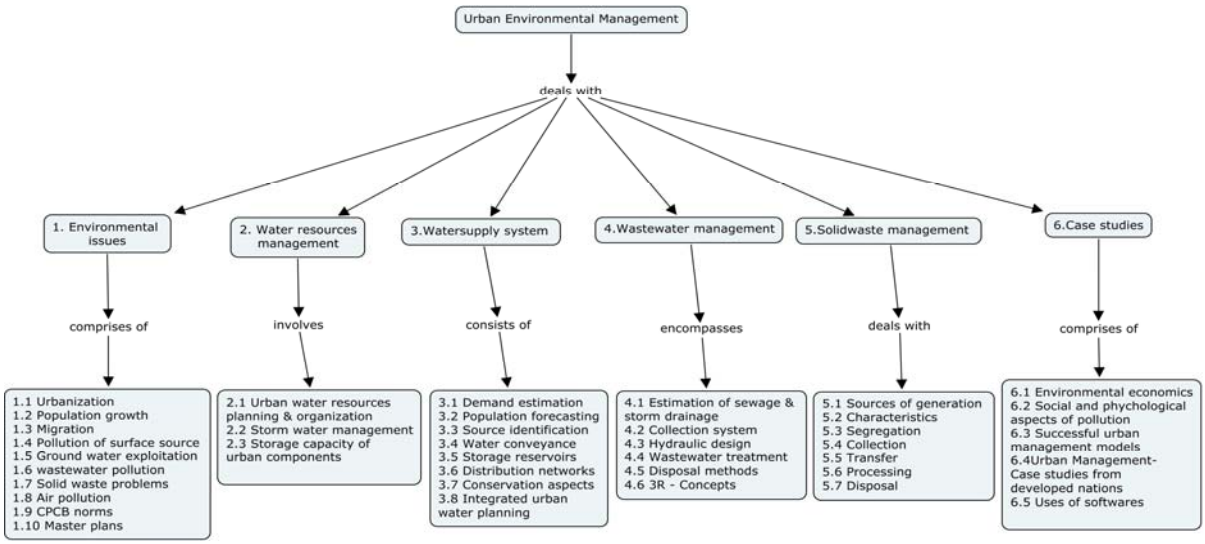
Course Outcome 4 (CO4)

1. Justify the statement "Domestic wastewater as a resource"
2. Discuss the importance of Storm water drain
3. Write the importance of Urban Agriculture in the context of pollution prevention
4. Write significance of management of urban environment in today's context.

Course Outcome 5 (CO5)

1. Explain the process of volume reduction by various methods.
2. Explain the sanitary landfill process in solid waste management
3. Explain the energy recovery process in solid waste management

Concept Map



Syllabus

Urban Environmental issues - Urbanization- Population growth scenario – migration – Pollution of surface water resources – rivers, tanks, channels – ground water exploitation – wastewater – characteristics – pollution problems – Solid waste – air pollution – CPCB norms. **Urban master plans** – Planning and organizational aspects. **Urban waste resources management** – Water in urban ecosystem – urban water resources planning and organization aspects – storm water management practices – types of storage – magnitude of storage – storage capacity of urban components – percolation ponds – temple tanks – rainwater harvesting. **Urban water supply** – Demand estimation – population forecasting – source identification – water conveyance – storage reservoirs – fixing storage capacity – Distribution network – types – analysis – computer applications – Conservation techniques – Integrated urban water planning. **Urban wastewater management** – Sewage generation – storm drainage estimation – industry contribution – wastewater collection system – separate and combined system – hydraulic design of sewer and storm drain – wastewater treatment – disposal methods – concept of decentralization – 3R concepts. **Municipal solid waste management** – Sources of solid waste – characteristics – rate of generation – segregation at source – collection of solid waste – methods of collection – route analysis – transfer and transfer stations – processing and disposal of solid waste. **Case Studies-** Environmental economics- Social and Physiological aspects of pollution- Successful Urban Management – models- Urban Management-Case studies from Developed Nations – Softwares.

References

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2. McGhee J., “Water supply and sewerage”, McGraw Hill Publishers, 1991
3. Martin P. Wanelista and Yousef. “Storm Water Management and Operations”, JohnWiley and Sons, 1993.
4. Neil S. Grigg., “Urban Water Infrastructure Planning – Management and Operations”, John Wiley and Sons, 1986.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	**Environmental issues**	
1.1	Urbanization	1
1.2	Population growth scenario	1
1.3	Migration	1
1.4	Pollution of surface water resources	1
1.5	Ground water exploitation– rivers, tanks, channels	1
1.6	Wastewater – characteristics	1
1.7	Solid waste problem	1
1.8	Air pollution	1
1.9	CPCB norms	1
1.10	Urban master plans – Planning and organizational aspects	2
2.0	**Urban waste resources management**	
2.1	Water in urban ecosystem – urban water resources planning and organization aspects	2
2.2	Storm water management practices	1

2.3	Types of storage – magnitude of storage – storage capacity of urban components – percolation ponds – temple tanks – rainwater harvesting	2
3.0	**Urban water supply**	
3.1	Demand estimation	1
3.2	Population forecasting	1
3.3	Source identification	1
3.4	water conveyance	1
3.5	Storage reservoirs–fixing storage capacity	2
3.6	Distribution network – types – analysis – computer applications	2
3.7	Conservation techniques	1
3.8	Integrated urban water planning	1
4.0	**Urban wastewater management**	
4.1	Sewage generation – storm drainage estimation – industry contribution	2
4.2	Wastewater collection system – separate and combined system	2
4.3	Hydraulic design of sewer and storm drain	1
4.4	Wastewater treatment	1
4.5	Disposal methods– concept of decentralization	1
4.6	3R concepts	1
5.0	**Municipal solid waste management**	
5.1	Sources of solid waste	1
5.2	Characteristics of solid waste	1
5.3	Rate of generation	1
5.4	Segregation at source	1
5.5	Collection of solid waste	1
5.6	Methods of collection – route analysis – transfer and transfer stations	1
5.7	Processing	1
5.8	Disposal of solid waste	1
6.0	**Case Studies**	
6.1	Environmental economics	1
6.2	Social and Physiological aspects of pollution	1
6.3	Successful Urban Management –models	1
6.4	Urban Management-Case studies from Developed Nations	2
6.5	Softwares	1
	Total	**48**

Course Designers:

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14IMPN0	CONSTRUCTION EQUIPMENT MANAGEMENT	Category	L	T	P	Credit
		PC	3	1	0	4

Preamble

Selection of appropriate equipment based on the requirements of project is crucial for completion of project at optimal cost and time. The mistakes during selection of equipment for any construction can be avoided by scheduling and optimising the construction equipment system productivity and making proper equipment financing decisions. This can be accomplished by understanding cost and life of equipment and its maintenance.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to:

(CO1) Explain the significance equipment management in construction	Understand
(CO2) Estimate various cost components of equipment in relation to its life cycle.	Apply
(CO3) Choose an appropriate equipment for a specific purpose	Apply
(CO4) Estimate and Optimize equipment system productivity	Apply
(CO5) Analyse the projects and identify the suitable equipment	Analyze
(CO6) Compare and contrast various financing decisions for equipment purchase, operation and maintenance	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	M	-	L	L	-	L	M	S	M	L	M
CO2.	M	S	M	M	-	L	M	M	M	L	S
CO3.	M	M	S	M	-	L	M	M	M	S	S
CO4.	M	S	M	M	-	M	M	M	M	L	S
CO5.	S	S	M	M	-	M	M	M	S	L	M
CO6.	S	S	M	M	-	S	M	S	S	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	60	30	20	20
Apply	40	50	40	40
Analyse	0	0	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Identify the role of heavy equipment in construction.
2. Discuss the development of earth moving and excavating equipment.
3. List the various and equipment and tool used in construction.

Course Outcome 2 (CO2):

1. List the constituents of ownership cost.
2. Compare the depreciation in each year of the equipment's useful life for each of the above depreciation methods for the following wheeled front-end bucket loader:
    - Initial cost: Rs.148,000 includes delivery and other costs
    - Tire cost: Rs.16,000
    - Useful life: 7 years
    - Salvage value: Rs.18,000
3. Estimate the hourly repair cost of the scraper in Example 2.3 for the second year of operation. The initial cost of the scraper is Rs. 1,86,000, tire cost Rs.14,000, and its useful life is 5 years. Assume average operating condition and 2000 h of operation per year.

Course Outcome 3 (CO3):

1. Report the conditions in which choice of front shovel for earthwork is suitable.
2. Discuss the various activities for which a dozer can be used.
3. Explain fork lifts.

Course Outcome 4 (CO4):

1. An 18–cubic yard dump truck has a loading time of 3 min, a travel time of 7 min, and the dumping and delay times of 5 min. Calculate the cycle time, optimum number of hauling units, and productivity.
2. List the assumptions in Peurifoy's method.
3. Compare Peurifoy's method with Phelp's method.

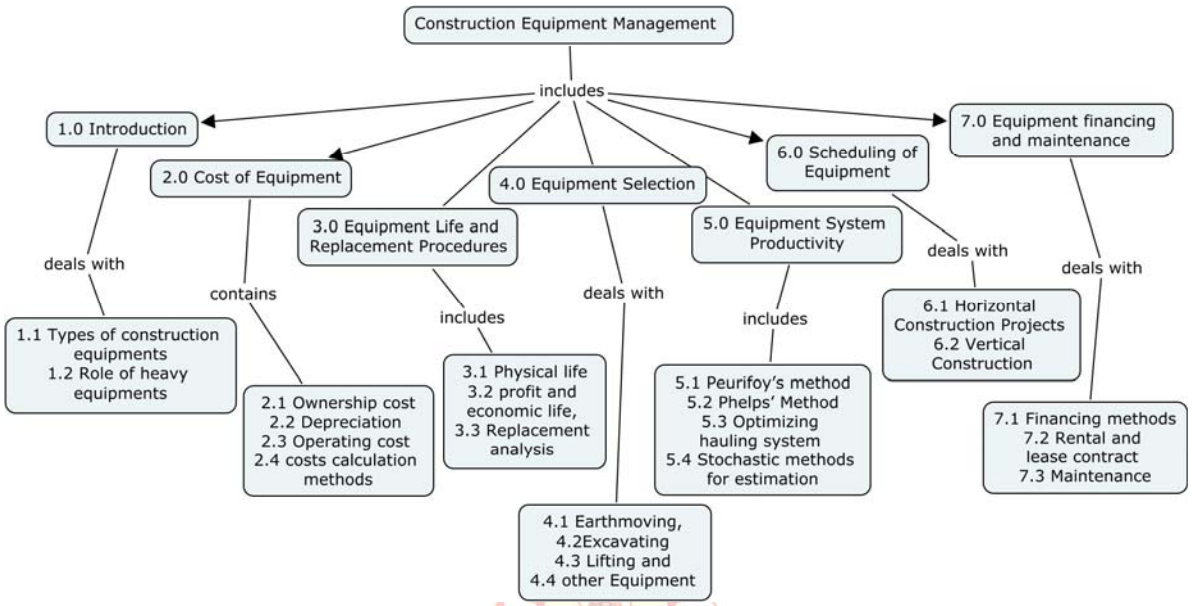
Course Outcome 5 (CO5):

1. Discuss the equipments for Vertical construction.
2. A free standing, top slewing, standard configuration, two-part standard line Liebherr tower crane secured in a concrete foundation base is hoisting a 1.75 cy bucket to pour concrete columns on a high-rise office building. The pour is a 10th floor column. Each floor is about 110600 floor surface to floor surface. The top of this column form is 60 off the 10th floor surface. The crane capacity is verified for the lifting radius of 900 and the setup. Arrive at the hourly production rate for the concrete to make this pour.
3. Describe linear scheduling method.

Course Outcome 6 (CO6):

1. Explain the significance of a maintenance program
2. Describe equipment renting and the conditions for adopting the same.
3. Prepare a list of factors making lease an attractive option for financing.

Concept Map



Syllabus

Role of Heavy Equipment in Construction; **Cost of Owning and Operating Construction Equipment** - Ownership cost, Depreciation, Operating cost, and Ownership and operating costs calculation methods; **Equipment Life and Replacement Procedures** - Physical, profit and economic life, Replacement analysis and selection; **Earthmoving, Excavating Lifting and other Equipment Selection** - Bulldozers, Front-end Loaders, Scrapers, Trucks, Excavators, Backhoes, Front shovels, Cranes, and Forklifts; Piles and Pile-Driving Equipment; Production of Crushed-stone Aggregate; Concreting Equipment; Asphalt Mix Production and Placement - Asphalt Plants, and Paving Equipment; **Estimating and Optimizing Construction Equipment System Productivity** - Peurifoy's method of optimizing productivity, Phelps' Method, Optimizing hauling system based on loading facility, Stochastic methods for estimation of productivity; **Scheduling Equipment Intensive Horizontal Construction Projects** - Linear scheduling method, Precedence diagramming method, Developing equipment resource packages; **Scheduling Lifting Equipment for Vertical Construction**; **Equipment Financing Decision**s – Fundamental Concepts of Equipment economics - Financing methods, Rental and lease contract considerations, **Construction Equipment Maintenance.**

References

1. Gransberg, D.G., Popescu, C. M., and Ryan, R. C., "Construction equipment management for engineers, estimators, and owners", Taylor & Francis, New York, 2006.
2. Peurifoy, R. L., Schexnayder, C. J., Shapira, A., and Schmitt, R., "Construction planning, equipment, and methods", 8th ed., McGraw Hill, New York, 2010.
3. Day, D. A. and. Benjamin, N. B. H., "Construction equipment guide", 2nd edition, Wiley Publications, New Jersey, 1991.

4. Harris, F., “Modern construction and ground engineering equipment and methods”, 2nd edition, Longman, London, 1994.
5. Singh, J., “Heavy construction - planning, equipment and methods”, 3rd edition, CRC Press, 2009.
6. Sharma S.C., “Construction equipment and management, Khanna Publishers, New Delhi, 2011.
7. Ministry of Rural Development, GOI, “Procurement Manual”, National Rural Livelihoods Project, 2010
8. Peter Holm Andreasen, “Dynamics of Procurement Management – A Complexity Approach”, Copenhagen Business School, 2012
9. Peter Baily, David Farmer, Barry Crocker, David Jessop & David Jones, “Procurement Principles and Management”, FT Prentice Hall, 2010

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	**Introduction**	
1.1	Role of Heavy Equipment in Construction	1
2	**Cost of Owning and Operating Construction Equipment**	
2.1	Ownership cost – depreciation cost	1
	Tutorials	1
2.2	Cost of operating construction equipment	1
	Tutorials	1
2.3	Methods of calculating ownership and operation cost – Corps of engineers method, AGC method, Peurifoy method	1
	Tutorials	1
3	**Equipment Life and Replacement Procedures**	
3.1	Equipment life – Physical life, Profit life and Economic life	2
3.2	Replacement Analysis - Theoretical methods, Practical methods, and sensitivity analysis	2
	Tutorials	1
3.3	Replacement equipment selection	2
4	**Earthmoving, Excavating Lifting and other Equipment Selection**	
4.1	Earthmoving Equipment Selection - Bulldozers, Front-end Loaders, Scrapers, Trucks	1
4.2	Excavating Equipment Selection - Excavators, Backhoes, Front shovels	1
4.3	Lifting Equipment Selection - Cranes, and Forklifts	1
4.4	Other Equipment - Piles and Pile Driving Equipment, Production of Crushed-stone Aggregate, Concreting Equipment, Asphalt Mix Production and Placement Equipment	2
5	**Estimating and Optimizing Construction Equipment System Productivity**	
5.1	Peurifoy’s Method	1
	Tutorials	1
5.2	Phelps’ Method	1
	Tutorials	1
5.3	Optimizing the Hauling System Based on Loading Facility	2

Module No.	Topic	No. of Lectures
	Characteristics	
	Tutorials	1
5.4	Stochastic Methods	3
	Tutorials	1
6	**Scheduling Equipment Intensive Horizontal Construction Projects**	
6.1	Linear scheduling method	1
6.2	Precedence diagramming method	1
	Tutorials	1
6.3	Developing equipment resource packages	1
	Tutorials	1
7	**Scheduling Lifting Equipment for Vertical Construction**	
7.1	Scheduling lifting for high rise work	1
7.2	Scheduling concrete placing cranes	1
	Tutorials	1
8	**Equipment Financing Decisions**	
8.1	Fundamental concepts of equipment economics	1
8.2	Financing Methods	2
8.3	Rental and lease contract considerations	1
	Tutorials	1
9	**Construction Equipment Maintenance**	
9.1	Need for a maintenance program	1
9.2	Designing a Maintenance Program	2
9.3	Preventive and predictive maintenance	2
	Total Hours	**48**

Course Designers:

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14IMPP0	VALUE ENGINEERING	Category	L	T	P	Credit
		HSS	4	0	0	4

Common to 14ENPP0, 14SEPT0

Preamble

New Product development is on rise and developing these products without compromising quality and cost is a challenge. In such development, it has become necessary to reduce the cost or eliminating the unnecessary cost, while improving the product performance or otherwise quality. This course deals with improving the quality in terms of the requirements of customer at the same or reduced cost by ensuring adequate system performance. Value engineering is a systematic approach for value improvement and contains seven broader phases. Hence, for product development, both cost and quality related issues need to be tackled concurrently.

Prerequisite

Probability and Statistics

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Establish the Value engineering methodology	Apply
CO2	Recognize the various phases of value engineering	Understand
CO3	Perform function cost worth analysis	Apply
CO4	Create the ideas for solving the problems	Apply
CO5	Analyse the functional importance and functional cost	Apply
CO6	Recommend the present facts and present costs	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	L	L	L	M	-	-	-	M	M	L	L
CO2.	L	L	-	-	-	-	-	M	-	L	L
CO3.	L	M	S	S	-	M	-	-	S	L	L
CO4.	L	S	S	S	-	M	-	-	S	M	M
CO5.	L	S	S	S	-	M	-	M	S	S	S
CO6.	L	M	S	S	-	M	-	M	M	S	S

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	20	20	20	20
Analyse	40	40	40	40
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What are the objectives of value engineering?
2. Name the types of value
3. Define : Function

Course Outcome 2 (CO2):

1. Outline the techniques of value engineering plan
2. Differentiate between ex-factory selling price and life cycle cost of a product
3. Compare real savings and false savings

Course Outcome 3 (CO3):

1. How would you determine the costs required to accomplish various functions of a product? Explain with an example.

2. Explain how the low cost promising ideas for various customer desired functions combined together to develop a number of workable solutions.

3. A product is manufactured at the break-even point. The management is considering a change in the product design in spite of the fact that the fixed costs will increase 50%. The sale of the new product is expected to shoot up by 100%. What should be the profitability of the new design (as compared to the present design) so that the company realizes a profit equal to the initial fixed cost per year?

Course Outcome 4 (CO4):

1. A company proposes to invest Rs.40000 in a new machine. The service life of machine is 10 years.

    a) What should be the annual savings if the minimum acceptable rate of return is 20%?
    b) If the actual savings over this period are Rs.8000/- per year. What is the actual rate of return (internal) on investment?

2. A man needs Rs.300000immediately for the purchase of a house. He will be required to repay the loan in equal six monthly installments over the next 10 years. What are the required payments at

    a) 6% interest compounded semi annually
    b) 10% interest compounded semi annually.

3. A new office copying machine costing $5600 will enable a company to save $0.03 per sheet on some duplicating work. The present usage is approximately 9000 sheets per month. Calculate the after tax IRR

Economic life	8 years
Depreciation term	10 Years
Depreciation method	Straight line
Incremental tax rate	50 percent
Interest rate	10 percent

Course Outcome 5 (CO5):

1. Consider the following decision making situation involving alternatives A & B

	A (RS.)	**B(RS.)**
Investment	20000	30000
Salvage Value	4000	0
Annual receipts	10000	14000
Annual costs	4400	8600
Life (years)	5	10

If minimum acceptable rate of return (MARR) is 15% and period of analysis is 10 years, alternative is to be chosen (use NPW method)

2. Consider the following three alternatives

	ALT A	ALTB	ALTC
Investment cost	28000	16000	23500
Net cash flow per year	5500	3300	4800
Salvage value	1500	0	500
Life (Years)	10	10	10

Assuming MARR = 15% and using IRR method, chosse the best alternative of the above.

3. Assume an initial investment of an asset as Rs.100000 and salvage value of Rs.10000 with the life of the assets as 10 years
Consider the following three methods of depreciation:
i) Straight line (ii) SYD (iii) Declining balance method (with 10% rate)
For these methods, plot the profile of book value as a function of life. Assuming interest rate of 15%, Compute the net present worth of cash flows if above methods are to be used. Incremental tax rate is 50%. Also rank the depreciation methods.

Course Outcome 6 (CO6):

1. An equipment is purchased for Rs.50000 that will reduce materials and labour cost by Rs.14000 each year for N years. After N years, there will be no need for the equipment and since it is specially designed, it will have no salvage value at any time. However, according to the company tax procedure, this equipment must be depreciated on a straight line basis for the tax life of 5 years. If the tax rate is 50%, what is the minimum number of years (that is N) that the company must operate the equipment to earn a minimum 10% after tax return.

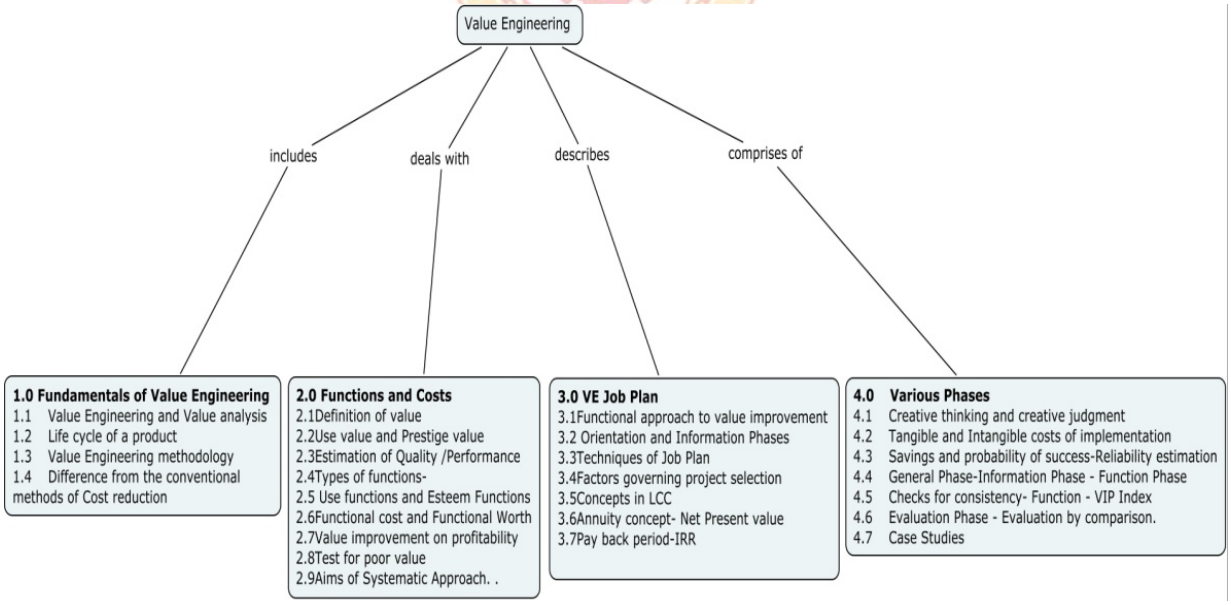
2. Consider the following data for two machines X & Y

Machine	Initial Cost	Annual costs	Salvage value
X	25000	4000	0
Y	15000	8000	0

The machines can be used fir 5 years or they can be retained for use after the 5th year. If so, the total useful life will be 20 years. The company is permitted to write off the machine in 5 years for tax purpose, or it can write off the machine in 20 years. Compare the results of using the long (20 years) or short (5 years) write off periods of the tax rate is 50% and sum of year's digits (SYD) method is used for depreciation. Assume interest rate of 10%.

A plant manager is attempting to determine whether his firm should purchase a component part or make it at its own facilities. If he purchases the item, it will cost the company Rs.10 per unit. The company can make the item on an assembly line at a variable cost of RS.2.50 per unit with a fixed cost of Rs.20000/- per year, or it can make it at individual stations at a variable cost of Rs.5.00 per unit with a fixed cost of Rs.10000 per year. Assuming that the annual demand is expected to be 3500 units, determine which alternative the plant manager should select. Also, frame decision rules for MAKE/BUY for various levels of annual demand.

Concept Map



Syllabus

Value Engineering (VE) and Value Analysis(VA) - Life Cycle of a product-Methodology of value engineering – Difference from the conventional methods of cost reduction-Unnecessary costs reasons- Quantitative definition of value- Use value and Prestige value. Estimation of product Quality/performance-Types of functions- Relationship between Use functions and Esteem Functions in product design – Functional cost and Functional Worth – Effect of Value improvement on profitability-Test for poor value –Aims of Systematic Approach. Functional approach to value improvement-various phases and techniques of Job Plan – Factors governing project selection – Types of Projects-Life Cycle Costing (LCC) for

managing the Total Value- Concepts in LCC – Present value concept-Annuity concept- Net Present value-Pay back period-Internal rate of return on Investment (IRR)-Examples and Illustrations. Creative thinking and creative judgment- positive or constructive discontent-Tangible and Intangible costs of implementation-False material-labour and overhead saving – Relationship between savings and probability of success-Reliability estimation-System reliability- Reliability elements in series and parallel. General Phase-Information Phase – Type of costs- Function Phase – Evaluation of Functional Relationships- Checks for consistency-Function –cost-weight-matrix-VIP Index – High cost and Poor value areas-Creativity/Speculation Phase – Rules of creativity-Brainstorming- Idea activators- Result accelerators – Evaluation Phase – Estimation of costs of ideas- Evaluation by comparison.

Reference Books

1. Arthur E Mudge, “Value Engineering”, McGraw Hill Book Company, 1971
2. A.D.Raven, Profit Improvement through Value Analysis, value Engineering and Purchase Price Analysis, Cassell and Co. London. (1971)
3. Richard J Park, “Value Engineering – A Plan for Inventions”, St.Lucie Press, London, 1999
4. S S Iyer,” Value Engineering – A How to Manual”, 3rd edition, New Age Publishers, Chennai, ISBN: 978-81-224-2405-8,2006
5. Value engineering, Mukhopadhyaya, Anil Kumar, Response Books, New Delhi , , ISBN: 0-7619-9788-1, 2003

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	**Introduction**	
1.1	Value Engineering and Value analysis	2
1.2	Life cycle of a product	2
1.3	Value Engineering methodology	2
1.4	Difference from the conventional methods of Cost reduction	1
2	**Reasons for unnecessary costs**	
2.1	Definition of value	1
2.2	Use value and Prestige value	1
2.3	Estimation of Quality /Performance	1
2.4	Types of functions-	1
2.5	Relationship between Use functions and Esteem Functions in product design	2
2.6	Functional cost and Functional Worth	2
2.7	Effect of Value improvement on profitability	1
2.8	Test for poor value	1
2.9	Aims of Systematic Approach. Functional approach to value improvement	1
3	**VE Job Plan**	
3.1	Functional approach to value improvement	1
3.2	Orientation and Information Phases	2
3.3	Techniques of Job Plan	2
3.4	Factors governing project selection – Types of Projects	2
3.5	Life Cycle Costing (LCC) for managing the Total Value- Concepts in LCC –	2
3.6	Present value concept-Annuity concept- Net Present value	3
3.7	Pay back period-Internal rate of return on Investment (IRR)-Examples and Illustrations	3

4	**Various phases**	
4.1	Creative thinking and creative judgment- positive or constructive discontent	2
4.2	Tangible and Intangible costs of implementation-False material-labour and overhead saving	2
4.3	Relationship between savings and probability of success-Reliability estimation-System reliability- Reliability elements in series and parallel.	2
4.4	General Phase-Information Phase – Type of costs - Function Phase	2
4.5	Evaluation of Functional Relationships - Checks for consistency-Function – cost-weight-matrix - VIP Index – High cost and Poor value areas-	2
4.6	Evaluation Phase – Estimation of costs of ideas- Evaluation by comparison.	2
4.7	Case Studies	3
Total		**48**

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15IMPQ0	CONSTRUCTION MATERIALS AND TECHNOLOGY	Category	L	T	P	Credit
		PC	4	0	0	4

Preamble

This course work gives an exposure on the advanced materials and technologies used in infrastructure industry.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

(CO1) Explain the properties and applications of special concretes, composites, smart and intelligent materials	Understand
(CO2) Identify and explain advanced construction techniques used for sub structure construction	Apply
(CO3) Select appropriate techniques for super structure construction of buildings	Apply
(CO4) Select suitable techniques for construction of special structures	Apply
(CO5) Choose relevant technique for demolition and dismantling works	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1.	S	L	L	---	L	---	M	L	---	M	---
CO2.	S	S	L	---	L	---	M	L	---	M	---
CO3	S	S	S	M	L	M	M	L	---	S	M
CO4	S	S	S	M	L	M	M	L	---	S	M
CO5.	S	S	S	M	L	M	M	M	---	S	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	50	40	30	30
Apply	30	40	50	50
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Differentiate between high strength and high performance concrete
2. Discuss two properties of ductal
3. Discuss the features of smart and intelligent materials mentioning its applications

Course Outcome 2 (CO2):

1. Discuss the conditions where trenchless technology can be used
2. Explain the construction sequence of reservoir construction

3. Differentiate between box jacking and pipe jacking

Course Outcome 3 (CO3):

1. Recommend suitable formwork for cooling towers construction and justify your recommendation
2. For a roof decking work for an industry suggest a suitable type of steel with justification
3. For an old building under distress laid over a poor soil, suggest a treatment material with reasons

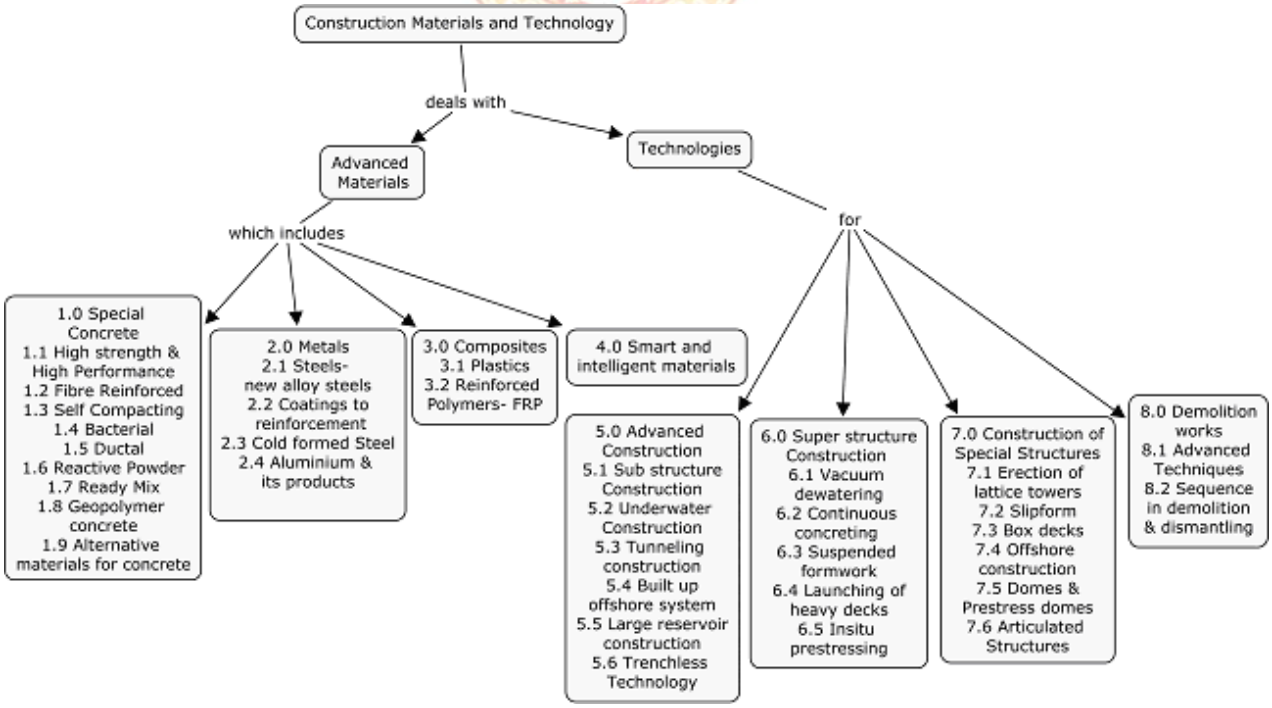
Course Outcome 4 (CO4):

1. Recommend a type of concreting method for under water construction works with reasons
2. As an Infrastructure Engineer recommend a suitable concrete for reservoir construction. Provide suitable reasons for your selection
3. Suggest and explain a suitable method of erection of articulated structures

Course Outcome 5 (CO5):

1. Suggest suitable sequence to be followed for demolition and dismantling of a distressed bridge
2. Identify and recommend a suitable sequence in demolition of a distressed building give suitable reasons
3. An old building severely distressed is to be dismantled is having a Government Hospital (GH) in its neighbourhood. Suggest a suitable method of demolition and dismantling so as to cause limited nuisance to the patients in the GH. Give suitable justification

Concept Map



Syllabus

Special Concretes: Concretes, Behaviour of concretes – High Strength and High Performance Concrete - Fibre Reinforced Concrete, Self Compacting Concrete, Bacterial Concrete, Ductal, Reactive Powder concrete, Ready Mix concrete, geopolymer concrete, alternative materials for concrete. **Metals:** Steels –new alloy steels, coatings to reinforcement, Cold formed steel aluminum and its products – applications. **Composites:** Plastics – Reinforced polymers- FRP – applications. **Smart and intelligent materials:** Smart and intelligent materials for intelligent

buildings – Special features. **Advanced Construction Techniques:** Sub Structure Construction: Box jacking- pipe jacking- under water construction of diaphragm walls and basement- tunneling techniques-cable anchoring and grouting-driving diaphragm walls, sheet piles, laying operations for built up offshore system- shoring for deep cutting- large reservoir construction -trenchless technology. **Superstructure Construction for buildings:** Vacuum dewatering of concrete flooring- concrete paving technology- techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques-suspended form work -erection techniques of tall structures, large span structures- launching techniques for heavy decks – insitu prestressing in high rise structures, aerial transporting, handling, erecting lightweight components on tall structures. **Construction of Special Structures:** Erection of lattice towers and rigging of transmission line structures- construction sequence in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges- launching and pushing of box decks – advanced construction techniques of offshore structures- construction sequence and methods in domes and prestress domes – support structure for heavy equipment and conveyor and machinery in heavy industries – erection of articulated structures, braced domes and space decks. **Demolition Techniques:** Advanced techniques and sequence in demolition and dismantling.

References

1. Jerry Irvine, “Advanced Construction Techniques”, C.A. Rocketr, 1984
2. Patrick Powers, “Construction Dewatering: New Methods and Applications”, John Wiley & Sons, 1992
3. Robertwade Brown, “Practical foundation Engineering handbook”, McGraw Hill Publications, 1995.
4. Sankar S.K. and Saraswathi. S, “Construction Technology”, Oxford University Press, New Delhi, 2008.

Course Contents and Lecture Schedule

Module No.	Topics	No. of Lectures
	Advanced Materials	
1.0	**Special Concretes:** Concretes, Behaviour of concretes	
1.1	High Strength and High performance Concrete – manufacture, properties & applications	2
1.2	Fibre Reinforced Concrete– manufacture, properties & applications	1
1.3	Self Compacting Concrete – manufacture, properties & applications	1
1.4	Bacterial Concrete – manufacture, properties & applications	1
1.5	Ductal – manufacture, properties & applications	1
1.6	Reactive Powder concrete – manufacture, properties & applications	1
1.7	Ready Mix concrete – manufacture, properties & applications	1
1.8	Geopolymer concrete– manufacture, properties & applications	1
1.9	Alternative materials for concrete – manufacture, properties & applications	2
2.0	**Metals:**	
2.1	Steels, new alloy steels – properties & applications	1
2.2	coatings to reinforcement – properties & applications	1
2.3	Cold formed steel – properties & applications	2
2.4	Aluminum and its products – properties & applications	1
3.0	**Composites:**	
3.1	Plastics - properties & applications	1

3.2	Reinforced polymers- Fibre Reinforced Polymers - properties & applications	1
4.0	**Smart and intelligent materials:** Smart and intelligent materials for intelligent buildings	2
	Construction Technologies	
5.0	**Advanced Construction Techniques**	
5.1	Sub Structure Construction: Box jacking- pipe jacking, shoring for deep cutting	2
5.2	Under water construction of diaphragm walls and basement	2
5.3	Tunneling techniques-cable anchoring and grouting-driving diaphragm walls, sheet piles	2
5.4	Laying operations for built up offshore system	2
5.5	Large reservoir construction	2
5.6	Trenchless technology	1
6.0	**Superstructure Construction for buildings:**	
6.1	Vacuum dewatering of concrete flooring- concrete paving technology	1
6.2	Techniques of construction for continuous concreting	1
6.3	Operation in tall buildings of various shapes and varying sections – launching techniques- suspended form work -erection techniques of tall structures	2
6.4	Large span structures- launching techniques for heavy decks	1
6.5	Insitu prestressing in high rise structures, aerial transporting, handling, erecting lightweight components on tall structures	2
7.0	**Construction of Special Structures:**	
7.1	Erection of lattice towers and rigging of transmission line structures	1
7.2	Construction sequence in cooling towers, silos, chimney, sky scrapers	1
7.3	Bow string bridges, cable stayed bridges- launching and pushing of box decks	1
7.4	Advanced construction techniques of offshore structures	1
7.5	Construction sequence and methods in domes and prestress domes- support structure for heavy equipment and conveyor and machinery in heavy industries	2
7.6	Erection of articulated structures, braced domes and space decks.	1
8.0	**Demolition Techniques:**	
8.1	Advanced techniques of demolition	1
8.2	Sequence in demolition and dismantling operation	2
	Total Hours	**48**

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