GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

GITAM School of Technology

REGULATIONS AND SYLLABUS

2 Year Postgraduate Programme

PCIVL03: M.Tech. Construction Technology and Management

w.e.f. 2024-25 admitted batch

(Updated on July 2024)

GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT

Vision

To become a global leader in higher education.

Mission

To impart futuristic and comprehensive education of global standards with a high sense of discipline and social relevance in a serene and invigorating environment.

Quality Policy

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

GITAM School of Technology

Vision

To become a global leader in holistic engineering education and research

Mission

1. To impart a strong academic foundation and practical education through a flexible curriculum, state of the art infrastructure, and best learning resources

2. To actively pursue academic and collaborative research with industries and research institutions, both in India and abroad

3. To build a congenial and innovative eco system by enabling the latest technologies, thus helping the students, to solve the challenges of societal importance

4. To provide our students with the appropriate leadership, management, communication skills and professional ethics for career success and to continuously impact the global lives

M.Tech. in Construction Technology and Management
REGULATIONS
(w.e.f. 2024-25 admitted batch)

1. ADMISSION

1.1 Admission into M.Tech. in **Construction Technology and Management** program of GITAM deemed to be University is governed by GITAM admission regulations.

2. ELIGIBILITY CRITERIA

2.1 A pass in B.E./B.Tech./AMIE in Civil Engineering or its equivalent.

2.2 Admissions into M.Tech. will be based on the following:

(i) Score obtained in GAT (PG), if conducted.
(ii) Performance in Qualifying Examination / Interview.
(iii) Candidates with valid GATE score shall be exempted from appearing for GAT (PG).

2.3 The actual weightage to be given to the above items will be decided by the authorities at the time of admissions.

3. CHOICE BASED CREDIT SYSTEM

3.1 Choice Based Credit System (CBCS) was introduced with effect from 2015-16 admitted batch and revised with effect from academic year 2019-20 in order to promote:

- Student centered Learning
- Activity based learning
- Students to learn courses of their choice
- Cafeteria approach

3.2 Learning objectives and outcomes are outlined for each course to enable a student to know what he/she will be able to do at the end of the program.

4. STRUCTURE OF THE PROGRAM

4.1 The Program Consists of

i) Core Courses (compulsory) which give exposure to a student in core subjects related area.

ii) Program Electives.

iii) Open Electives

iv) Mandatory and Audit Courses

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week per semester.

- One credit for each Lecture / Tutorial hour per week.
- One credit for two hours of Practicals per week.

4.4 The curriculum of the four semesters M.Tech. program is designed to have a total of 68 credits for the award of M.Tech. degree

5. MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English.

6. REGISTRATION

Every student has to register for the courses in each semester at the time specified in the academic calendar.

7. ATTENDANCE REQUIREMENTS

7.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the semester-end examination and he/she will not be allowed to register for subsequent semester of study. He/she has to repeat the semester along with his / her juniors.

7.2 However, the Vice-Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance to the students whose attendance is between 65% and 74% on genuine grounds and on payment of prescribed fee.

8. EVALUATION

8.1 The assessment of the student's performance in a theory course shall be based on two components: Continuous Evaluation (40 marks) and semester-end examination (60 marks).

8.2 A student has to secure a minimum of 40% in any theory course in the two components (ref. 8.1) put together to be declared to have passed the course, subject to the condition that the student must have secured a minimum of 24 marks out of 60 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical/ Project Work/ Viva voce/ Seminar etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.

8.4 Audit courses are assessed through continuous evaluation for satisfactory or not satisfactory only. No credits will be assigned.

Table 1: Assessment Procedure

S.No.	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Evaluation
1	Theory Courses	40	Continuous Evaluation Semester-end Examination	i) Thirty (30) marks for mid Semester examinations. Three mid examinations shall be conducted for 15 marks each; performance in best two shall be taken into consideration. ii) Ten (10) marks for Quizzes, Assignments and Presentations. Sixty (60) marks for Semester-end examinations
	Total	100		
2	Practical Courses	100	Continuous Evaluation	i) Fifty (50) marks for regularity and performance, records and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the semester. ii) Ten (10) marks for case studies. iii) Forty (40) marks for two tests of 20 marks each (one at the mid-term and the other towards the end of the semester) conducted by the concerned lab teacher.
3	Technical Seminar (II Semester)	100	Continuous Evaluation	Through five periodic seminars of 20 marks each

4	Project Work (III Semester)	100	Continuous Evaluation	i) Forty (40) marks for periodic assessment on originality, innovation, sincerity and progress of the work, assessed by the project supervisor. ii) Thirty (30) marks for mid-term evaluation for defending the project, before a panel of examiners. iii) Thirty (30) marks for final report presentation and viva-voce, by a panel of examiners*.
5	Project Work (IV Semester) Total	50	Continuous Evaluation	i) Twenty (20) marks for periodic assessment on originality innovation, sincerity and progress of the work, assessed by the project supervisor. ii) Fifteen (15) marks for mid-term evaluation for defending the project, before a panel of examiners*. iii) Fifteen (15) marks for interim report presentation and viva-voce.
		50	Semester-end Examination	Fifty (50) marks for final project report and viva-voce examination assessed by external examiners.
		100		
6	Audit Courses	100	Continuous Evaluation	Audit courses are assessed for PASS or FAIL only. No credits will be assigned to these courses. If a student secures a minimum of 40 out of 100 marks during continuous evaluation, he / she will be declared PASS, else FAIL. PASS grade is necessary to be eligible to get the degree

**Panel of Examiners shall be appointed by the concerned Head of the Department*

9. PROVISION FOR ANSWER BOOK VERIFICATION AND CHALLENGE EVALUATION

9.1 If a student is not satisfied with his/her grade, the student can apply for answer book verification on payment of prescribed fee for each course within one week after announcement of results.

9.2 After verification, if a student is not satisfied with revaluation marks/grade, he/she can apply for challenge valuation within one week after announcement of answer book verification result or two weeks after the announcement of results, which will be valued by two examiners i.e., one Internal and one External examiner in the presence of the student on payment of prescribed fee. The challenge valuation fee will be returned, if the student is successful in the appeal by securing a better grade.

10. SUPPLEMENTARY AND SPECIAL EXAMINATIONS

10.1 The odd semester supplementary examinations will be conducted after conducting regular even semester examinations during April/May.

10.2 The even semester supplementary examinations will be conducted after conducting regular odd semester examinations during October/November.

10.3 A student who has secured 'F' Grade in Project work shall have to improve his/her work and reappear for viva-voce after satisfactory completion of work approved by panel of examiners.

10.4 A student who has completed period of study and has "F" grade in final semester courses is eligible to appear for special examination.

11. MASSIVE OPEN ONLINE COURSES (MOOCs)

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (**MOOCs**) during the period of study. Students without any backlog courses up to first semester are permitted to register for MOOCs in second semester up to a maximum of 6 credits from program elective / open elective/audit courses. However the Departmental Committee (DC) of the respective campuses has to approve the courses under MOOCs. The grade equivalency will be decided by the respective Board of Studies (BoS).

12. GRADING SYSTEM

12.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

Table 2: Grades and Grade Points

Sl.No.	Grade	Grade Points	Absolute Marks
1	O (outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab (Absent)	0	-

12.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, and is deemed to have earned the credits assigned to that course, subject to securing a GPA of 5.0 for a Pass in the semester.

12. GRADE POINT AVERAGE

13.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$GPA = \frac{\Sigma [C \times G]}{\Sigma C}$$

where, C = number of credits for the course,
G = grade points obtained by the student in the course.

13.2 The Cumulative Grade Point Average (CGPA), is calculated using the above formula considering the grades obtained in all the courses, in all the semesters up to that particular semester.

13.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.

Table 3: CGPA required for Award of Class

Class	CGPA Required
First Class with Distinction	≥ 8.0*
First Class	≥ 6.5
Second Class	≥ 5.5
Pass Class	≥ 5.0

* In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the courses of every semester in the first attempt.

14. ELIGIBILITY FOR AWARD OF THE M.Tech. DEGREE

14.1 Duration of the program: A student is ordinarily expected to complete the M.Tech. Program in four semesters of two years. However a student may complete the program in not more than four years including study period.

14.2 However the above regulation may be relaxed by the Vice-Chancellor in individual cases for cogent and sufficient reasons.

14.3 A student shall be eligible for award of the M.Tech. Degree if he / she fulfills all the following conditions.

a) Registered and successfully completed all the courses and project works.

b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated period.

c) Has no dues to the Institute, Hostels, Libraries, NCC / NSS etc, and

d) No disciplinary action is pending against him / her.

15. DISCRETIONARY POWER

Notwithstanding anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

Department of Civil Engineering

M.Tech. in Construction Technology and Management
Effective from academic year 2024-25 admitted batch

Semester I

S.No	Course Code	Course Name	Category	L	T	P	C
I-PC 1.	24CIVL3071	Construction Methods and Equipment Management	CE	3	0	0	3
I-PC 2.	24CIVL6001	Project Planning and Control	CE	3	0	0	3
I-PC 3.	24CIVL6011	Valuation Techniques in Engineering	CE	3	0	0	3
4.	XXXXXXX	Program Elective I	PE	3	0	0	3
5.	XXXXXXX	Program Elective II	PE	3	0	0	3
	20EMC741	Research Methodology and IPR	MC	2	0	0	2
I-PC 7	24CIVL6031	Project Management Lab -1 (Primavera)	CE	0	0	4	2
8	XXXXXX	Audit Course - I	AC	2	0	0	0
			Total				**19**

Semester II

S.No	Course Code	Course Name	Category	L	T	P	C
II-PC 1.	24CIVL6041	Construction Quality and Safety Management	CE	3	0	0	3
II-PC 2.	24CIVL6051	Financing Infrastructure Projects	CE	3	0	0	3
II-PC 3.	24CIVL6061	Contract Management and Arbitration	CE	3	0	0	3
4.	XXXXXXX	Program Elective III	PE	3	0	0	3
5.	XXXXXXX	Program Elective IV	PE	3	0	0	3
6.	XXXXXX	Open Elective	OE	3	0	0	3
7.	24CIVL6071	Technical Seminar	PC	0	0	4	2
II-PC 8.	24CIVL6271	Project Management Laboratory – 2 (BIM)	PC	0	0	4	2
9.	HSMCH102	Universal Human Values -2 : Understanding Harmony	MC	3	0	0	3
10.	XXXXXX	Audit Course - II	AC	2	0	0	0
			Total				**25**

Semester III

S.No	Course Code	Course Name	Category	L	T	P	C
1.	24PROJ7888	Project Work I	PW	0	0	26	13
			Total				**13**

Semester IV

S.No	Course Code	Course Name	Category	L	T	P	C
1	24PROJ7999	Project Work II	PW	0	0	26	13
			Total				**13**

Total Number of Credits

Semester	I	II	III	IV	**Total**
Credits	19	25	13	13	**70**

M.Tech. in Construction Technology and Management

List of PROGRAM ELECTIVE COURSES
Program Elective I, II, III and IV

S. No	Course Code	Course Title	Category	L	T	P	C
PE-1	24CIVL6081	Construction Materials	PE	3	0	0	3
PE-2	24CIVL3421	Waste Management	PE	3	0	0	3
3	24CIVL6091	Applications of Building Information Modelling (BIM) in Civil Engineering	PE	3	0	0	3
4	24CIVL6101	Emerging Technologies in Construction	PE	3	0	0	3
5	24CIVL6111	Construction Techniques of High-Rise Buildings and Towers	PE	3	0	0	3
6	24CIVL6121	Construction of Underground Structures	PE	3	0	0	3
7	24CIVL3351	Transportation Infrastructure Engineering	PE	3	0	0	3
8	24CIVL6131	Tunnel Engineering and Construction Methods	PE	3	0	0	3
9	24CIVL6151	Sustainable Development and Management	PE	3	0	0	3
10	24CIVL3371	Urban Transportation Planning	PE	3	0	0	3
11	24CIVL6161	Precast and Prestress Construction	PE	3	0	0	3
12	24CIVL6171	Quantitative Techniques for Management	PE	3	0	0	3
13	24CIVL6181	Construction Safety and Risk Management	PE	3	0	0	3
14	24CIVL6211	Lean Construction	PE	3	0	0	3
15	24CIVL6221	Maintenance and Rehabilitation of Structures	PE	3	0	0	3
16	24CIVL3151	Remote Sensing and Geographic Information System	PE	3	0	0	3
17	24CIVL6241	Infrastructure Planning	PE	3	0	0	3
18	24CIVL2131	Environmental Impact Assessment	PE	3	0	0	3
19	24CIVL6251	Human Resource Management in Projects	PE	3	0	0	3
20	24CIVL6261	Organization Management	PE	3	0	0	3

PROGRAM CORE COURSES

I Semester							
S.No	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**C**
I-PC 1.	24CIVL3071	Construction Methods and Equipment Management	CE	3	0	0	3
I-PC 2.	24CIVL6001	Project Planning and Control	CE	3	0	0	3
I-PC 3.	24CIVL6011	Valuation Techniques in Engineering	CE	3	0	0	3

II Semester							
S.No	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**C**
II-PC 1.	24CIVL6041	Construction Quality and Safety Management	CE	3	0	0	3
II-PC 2.	24CIVL6051	Financing Infrastructure Projects	CE	3	0	0	3
II-PC 3.	24CIVL6061	Contract Management and Arbitration	CE	3	0	0	3

AUDIT COURSES I and II

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EAC741	English For Research Paper Writing	AC	2	0	0	0
2	19EAC742	Disaster Management	AC	2	0	0	0
3	19EAC743	Sanskrit for Technical Knowledge	AC	2	0	0	0
4	19EAC744	Value Education	AC	2	0	0	0
5	19EAC745	Constitution of India	AC	2	0	0	0
6	19EAC746	Pedagogy Studies	AC	2	0	0	0
7	19EAC747	Stress Management by Yoga	AC	2	0	0	0
8	19EAC748	Personality Development through Life Enlightenment Skills	AC	2	0	0	0
9	19EAC750	Developing Soft Skills And Personality	AC	3	0	0	0

OPEN ELECTIVES

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EOE742	Business Analytics	OE	3	0	0	3
2	19EOE744	Industrial Safety	OE	3	0	0	3
3	19EOE746	Operations Research	OE	3	0	0	3
4	19EOE748	Cost Management of Engineering Projects	OE	3	0	0	3
5	19EOE752	Waste to Energy	OE	3	0	0	3
6	19EOE754	Green Buildings	OE	3	0	0	3

Detailed Syllabus of PROGRAM CORE COURSES

I-PC 1.	**24CIVL3071 : CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT**	**L**	**T**	**P**	**S**	**J**	**C**
		3	0	**0**	**0**	**0**	**3**

Preamble/ Course Description:

Planning of methods and equipment play vital role for successful execution of any project. Selection of right equipment and method of construction for the right job is very much important. This course provides comprehensive information and guidelines for selection of equipment and methods of construction.

Course Educational Objectives (CEO):

1. Develop a comprehensive understanding of construction methods, equipment, and management principles.
2. Gain practical skills in equipment selection, operation, maintenance, and safety.
3. Learn project management techniques for efficient resource allocation, scheduling, and cost control in construction projects.
4. Promote awareness of safety practices and environmental considerations in construction operations.
5. Prepare students for careers in construction management by providing industry-relevant knowledge and skills.

Unit I

Planning Process for Equipment and Methods; Cost of Owning and Operating Construction Equipment - Ownership cost, Depreciation, Operating cost, and Ownership and operating costs calculation methods;

Unit II

Equipment Life and Replacement Procedures - Physical, profit and economic life, Replacement analysis; Engineering Fundamentals of Moving Earth - Rolling resistance, Effect of grade on tractive effort, Effect of altitude on performance of IC engines;

Unit III

Earthmoving, Excavating, and Lifting 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;

Unit IV

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;

Unit V

Estimation of Equipment Productivity - Mathematical models, Simulations; 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 - Financing methods, Rental and lease contract considerations.

Text Books:

1. Construction Planning, Equipment, and Methods, Robert L. Peurifoy, Clifford J. Schexnayder, Robert Schmitt and AviadShapira, McGraw-Hill Education, 2018, Ninth Edition.
2. Construction Equipment and Management, S. C. Sharma, Khanna Publishing, 2019, First Edition.

References:

1. Fundamentals of Building Construction: Materials and Methods, Edward Allen and Joseph Iano, Wiley, 2019, Seventh Edition.
2. D. G. Gransberg, C. M. Popescu and R. C. Ryan, *Construction equipment management for engineers, estimators, and owners*, Taylor & Francis, New York, 2006.
3. D. A. Day and N. B. H. Benjamin, *Construction equipment guide*, 2nd ed., Wiley, New Jersey, 1991.

I-PC 2.	**24CIVL6001 : PROJECT PLANNING AND CONTROL**	**L**	**T**	**P**	**S**	**J**	**C**
		3	0	**0**	**0**	**0**	**3**

Preamble/ Course Description:

Understanding and applying the concepts of Project Planning and Control is fundamental to the area of construction/project management. Planning and control systems form the backbone of all formal project management systems. A first course in Planning and Control can be covered from two distinct angles - a practical angle or a theoretical angle. The theoretical angle is not subjective and is easier to cover in a class-room context. However, as most students in the course are likely to apply the concepts in a practical context, the course will focus on covering adequate theory required from an implementation perspective. In this regard, there are three objectives for this course:

1. Understand the basic and allied concepts of Critical Path Method (CPM).
2. Apply the concepts to practical problems through analytical tools and software packages with an appreciation of the limitations.
3. Explore advanced project management concepts and case studies.

Course Educational Objectives (CEO):

1. To Understand and apply the concepts of Project Planning and Control is fundamental to the area of construction/project management.
2. To cover adequate theory required from an implementation perspective.
3. To Understand the basic and allied concepts of Critical Path Method (CPM).
4. To Apply the concepts to practical problems through analytical tools and software packages with an appreciation of the limitations.
5. To Explore advanced project management concepts and case studies.

UNIT 1 Introduction to Project Management

What is Project Management? Is Project Management an Art/ Science?, Objectives of a Project, Scientific Way of Managing of Objectives, Course Scope & Plan, Questions and Discussions, Construction Industry and National Growth, Project Stakeholders, Project Phases, Project Organization, Project Scheduling Levels (& Scheduling Engineer Responsibilities)

UNIT 2 Work Breakdown Structures Activity on Arrow (AOA) Diagrams

Time Management - Overview, Basics of Work Breakdown Structure (WBS), Tools for Time Management, Gantt / Bar Chart - History, Representation, Progress Monitoring, Uses, Steps to draw a Bar Chart, Develop a Bar Chart (Exercise), Bar Charts for Resource Usage, Pros and Cons, Duration Estimation - Types, Inputs, Methods, Parametric Estimation, Factors influencing Productivity, Example for Ideal Productivity, Factored Productivity and Working Time Factor, Introduction to Floats, Types of Floats and Examples. Usage of Floats for Project Decisions

UNIT 3

Activity on Node (AON) Diagrams, Critical Path Method, Time-Cost Trade-off (Crashing),

Fast-Tracking vs Crashing, Relationship between Activity Direct Cost & Activity Duration - Assumptions, Time-Cost trade-off: ABCD Example Project, Steps for Crashing, Time-Cost trade-off: Class Exercises, Time-Cost trade-off: Problems, Tabulation Approach, Incorporating Factors such as Bonus and Penalty; Problems

UNIT 4

Precedence Diagram Method, Program Evaluation and Review Technique (PERT) Network Crashing

Introduction to Precedence Diagramming Method (PDM), PDM network representation and its issues, Network Calculation, PDM – Problem #1, Issues in PDM, Negative Lags, PDM – Analysis with non-continuous duration, Floats, Defining Relationship (Based on Construction Method) - Simple Shed,

UNIT 5

Resource Allocation and Levelling Project Control - Earned Value Analysis

Project Monitoring & Control – Typical Project Time Monitoring Process, Levels and Frequency of updates, Project Control Process, Daily Progress Report, Macro Level Update-Data Need, Standard Progress Reports, Application: Two Span Bridge – ES Schedule, Review of Key Issues in Project Monitoring, Earned Value Concept Through Examples, Basic Earned Value Definitions & Terminology, Summary, Uncertainty in Project Schedules, PERT Background & Assumptions, Stepwise Procedure, PERT Example Problem, Summary

Course Outcomes:

1. At the end of unit 1, the student will be able to understand the importance of project management
2. At the end of unit 2, the student can draw activity on arrow diagram
3. At the end of unit 3, the student can identify critical path in a given project
4. At the end of unit 4, the student applies PERT and do network crashing
5. At the end of unit 5, the student will be able to understand, assimilate, and deploy various resources and control a project

Text books:

1. Jha, K. N. 2015. *Construction Project Management: Theory and Practice*. Delhi: Pearson Publication.
2. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley & Sons. (2021)
3. Project Management for Engineering and Construction, GD. Oberlender, McGraw-Hill. (2014)

References:

1. Construction Project Scheduling, Callaghan, MT., Quackenbush, DG. and Rowings, JE., McGraw-Hill. (1992)
2. Precedence and Arrow Network Techniques for Construction, RB. Harris, John Wiley & Sons. (1978)

I-Program Core-3	24CIVL6011: VALUATION TECHNIQUES IN ENGINEERING	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

Valuation is the process of determining the present marketable cost or fair value of a building, property, or other engineering structures.

Course Educational Objectives:

This course provides an overview of advanced foundation engineering

- To familiarize with the purpose of valuation and its different forms
- To acquaint the different methods of valuation
- To acquaint the methods to valuate the building
- To study the concept of easements and its types
- To understand the market real price and its applications.

Unit I

Introduction - Purpose of valuation - Different forms of values. Outgoings- Municipal & Govt .Taxes, insurance, Loss of rent, collection charges, sinking fund, Annual repairs & maintenance. Depreciation – Methods of calculation. Land value, Year's Purchase, Capitalised value, Obsolescence, Amortization

Unit II

Methods of valuation - Open land valuation-factors affecting intrinsic values of land, Comparative method, Abstractive method, Belting method. Rent-definition, forms. Cost of structure- BIS rules for measuring plinth area and cubical contents. **Case studies of latest technologies.**

Unit III

Valuation of land with buildings - Rental method, Land and building method, Valuation on profit basis, Direct comparison of capital value, Residual or Development method. Rights and Liabilities of Lessor & Lessee, Leasehold properties, freehold Properties. **Exposure to real-world applications.**

Unit IV

Easements - self-imposed, legally created, Dominant and servient heritage - effect of easements on valuation.

Unit V

Market Real Estate market and market value - fair market value, open market value-parameters affecting. Investments Bonds, debentures, capital gains, Wealth Tax and Income Tax.

Course Outcomes:

At the end of course the students will be able to

1. understand the concept of valuation and its forms
2. understand the concepts of different methods of valuation
3. apply the concept to do the valuation of buildings
4. know the concept of easements
5. Understand the concept of market real value and the factors affecting it

Text Books

1. Banerjee, Principles and Practices of Valuation, 2018

Reference Books

1. Rao Gopinath CH, Valuation Practices of Immovable Properties.
2. MitraAK,Theory and Practice of Valuation, 2019
3.ShahN.A, Quality Surveying and Valuation, 2020

I-PC 8	24CIVL6031: PROJECT MANAGEMENT LAB -1 (PRIMAVERA)	L	T	P	S	J	C
		0	0	4	0	0	2

Preamble/ Course Description:

This hands-on and comprehensive program is designed to equip students with the essential skills and knowledge needed to effectively utilize Primavera for project management. Students can become seasoned project manager through this course which will empower students to master the art of project planning, scheduling, and control using one of the industry's leading project management tools.

In this lab, students will delve into the fundamentals of Primavera, exploring its features and functionalities that are crucial for successful project management. From project initiation to closure, student will gain practical experience in navigating the Primavera environment, creating project schedules, managing resources, and monitoring progress.

Course Educational Objectives (CEO):

1. This Primavera Project Management Course guides the student through the process of planning and controlling projects using the Project Management module.
2. The student would become familiar with the process of PPM, then follow the steps in each successive learning objective to build projects and project components, set up codes and documents
3. The student would become familiar with the process of managing the resources required to complete the project plan,
4. The student would become familiar with the process of updating projects as work gets underway, and report results throughout the project life cycle.

Unit 1

Understanding Primavera: Develop a solid understanding of Primavera's interface, tools, and capabilities.

Unit 2

Project Planning: Learn how to create comprehensive project plans, including task definition, resource allocation, and critical path analysis.

Unit 3

Scheduling Techniques: Master scheduling techniques to optimize project timelines and ensure successful project delivery.

Unit 4

Resource Management: Explore Primavera's resource management features to effectively allocate and manage resources for maximum project efficiency.

Unit 5

Progress Monitoring: Gain insights into real-time project progress monitoring and reporting to make informed decisions.
The list of exercises that students will perform as listed below:

1. **Getting Started**
    1. Understanding Data Types
    2. Overview and Navigating
    3. Pages and Views
2. **Planning the Project**
    1. Creating a Project
    2. Creating a WBS
    3. Adding Activities
    4. Creating Relationships
    5. Managing Calendars
3. **Scheduling**
    1. Scheduling
    2. Using Constraints
    3. Setting Baselines
4. **Managing Resources**
    1. Understanding Roles and Resources
    2. Assigning Roles and Resources
    3. Resource Bucket Planning
    4. Resource Leveling
5. **Executing the Project**
    1. Executing the Project Plan
    2. Updating Activities in P6 Mobile
    3. Submitting Timesheets in P6 Mobile
6. **Team Member**
    1. Submitting Timesheets
    2. Updating Activities
7. **Analyzing the Project**
    1. Managing Dashboards
    2. Analyzing Portfolios
    3. Earned Value Overview

Course Outcomes:

1. At the end of unit 1, the student will be able to do Planning the Project
2. At the end of unit 2, the student can Schedule project
3. At the end of unit 3, the student can manage Resources
4. At the end of unit 4, the student develops Executing the Project
5. At the end of unit 5, the student will be able to understand, assimilate, and analyze the Project

Textbooks:

1. Oracle Primavera P6 Version 8: Project and Portfolio Management by Daniel L. Williams · 2012
2. Project Planning and Control Using Primavera P6 by Paul E. Harris · 2010

References:

1. Planning and Managing Projects with PRIMAVERA (P6) Project by P. Vinayagam, A. Vimala · 2017

20EMC741: RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

This course introduces the student, to the fundamentals of research, research process, technical writing and intellectual property rights. Students will be able to use this knowledge to gain interest in their subject area and pursue their career in research.

Course Objectives

- To familiarize the meaning, objectives and sources of research
- To acquaint the student with the importance and methods of literature review/research ethics
- To impart the knowledge of technical writing for preparing reports, presentations, research proposals, conference/journal publications
- To introduce the terminology and process of obtaining intellectual property rights
- To expose the intricacies in the process of obtaining patent rights

Unit I **5L**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning of a research problem (L1)
- list the different sources of research problem (L2)
- enumerate the different criteria of good research and list the different errors in selecting research problem (L2)
- contrast the different approaches of research (L3)
- compare the different methods for data collection and analysis (L5)

Unit II **5L**

Effective literature studies approaches, analysis Plagiarism, Research ethics

Learning Outcomes

After the completion of this unit, the student will be able to

- list and elaborate the different steps of the research process (L1)
- explain the importance of carrying out an effective literature review (L2)
- identify the research gaps from literature review (L5)
- describe the ethical principles to be following during research process and authorship (L2)
- define the terminology and list the methods to avoid being accused of plagiarism (L1)
- list the different types of research misconduct (L2)

Unit III **5L**

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Learning Outcomes

After the completion of this unit, the student will be able to

- list the attributes, reasons and guidelines for effective technical writing (L1)
- contrast between conference paper, technical presentation and journal paper (L3)
- choose a particular research contribution for patenting or journal publication (L4)
- describe the terminology related to citation, citation index, h-index etc (L2)

Unit IV **5L**

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. **International Scenario**: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the codes and standards in building intellectual property rights(L2)
- list the subject, importance and requirements for of patentability(L1)
- explain the process of patenting and commercialization in academia(L2)
- enumerate the procedure for application preparation, filing and grant of Patents(L2)

Unit V **8L**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. **New Developments in IPR**: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the scope of patent rights(L2)
- describe the process for licensing and transfer of technology(L2)
- identify the sources of patent information and databases(L1)
- elaborate the administration of patent system(L2)
- describe the new developments in IPR in computer software, biological systems etc(L3)

Text Book(s):

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for Science and engineering students”, Tata Mcgraw Hill India, 2013.
2. Ranjit Kumar, “Research Methodology: A Step by Step Guide for beginners”, 2/e, Prentice Hall of India, 2013.

References:

1. Halbert, “Resisting Intellectual Property”, Taylor and Francis Limited, 2007.
2. Mayall, “Industrial Design”, McGraw Hill, 1992.
3. Niebel, “Product Design”, McGraw Hill, 1974.
4. Asimov, “Introduction to Design”, Prentice Hall, 1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016
6. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand Publishers, 2008

Course Outcomes

After successful completion of the course, the student will be able to

- define the meaning, sources, approaches for research problems (L1)
- explain the guidelines for carrying out effective literature review and identify research gaps(L2)
- describe effective guidelines for preparing technical reports, research publications, presentations and research proposals(L2)
- describe the codes, standards and process of obtaining intellectual property rights(L3)
- enumerate the new developments of IPR in engineering systems(L3)

II-PC 1.	24CIVL6041: CONSTRUCTION QUALITY AND SAFETY MANAGEMENT	L	T	P	S	J	C
		3	0	**0**	**0**	**0**	**3**

Preamble

The purpose of this Construction Quality and Safety Management System is to provide a comprehensive framework for planning, executing, monitoring, and continuously improving the quality and safety aspects of our construction projects. By implementing robust management practices, we aim to enhance project outcomes, minimize risks, and foster a culture of responsibility and diligence in all project activities.

Course Educational Objectives (CEO):

This course provides an overview of construction quality and safety management:

- Develop a comprehensive understanding of the regulatory framework governing construction quality at both local and international levels.
- Acquire in-depth knowledge of Quality Management Systems (QMS), with a focus on ISO 9001, and understand their application in the construction industry.
- Gain proficiency in safety planning, risk assessment, and the integration of safety considerations into construction project planning and execution.
- Familiarize participants with the legal obligations, responsibilities, and compliance requirements related to safety in construction projects.
- Understand the principles and methodologies of conducting effective site inspections and quality audits to ensure compliance with quality and safety standards.

Unit I

Quality Management: Quality Gurus, Quality policy in the construction industry-Consumer satisfaction Ergonomics, Quality tools, Quality Function Deployment, Cost of Quality, Statistical Tolerance Taguchi's concept of quality- -inspection procedures.

Unit II

Quality Management Systems (QMS) in Construction: Introduction to QMS standards (ISO 9001), Development and implementation of QMS, Quality planning and control processes, Hazard identification and risk assessment, Safety planning and strategy development, Incorporating safety into project planning

Unit III

Quality Assurance and Control: Total QA/QC Program and cost implication. Statistical Quality Control, Different aspects of quality-Appraisals, failure mode analysis, Stability methods and tools, Influence of drawings, detailing, and specification.

Unit IV

Safety Programmes and organization: Introduction to safety, challenges in the construction sector, accident statistics, accident causation theories, Cost of Safety, Safety acts and Regulations, Safety audit, accident investigation and prevention Techniques, Environmental safety, Social and environmental factors, Application of digital technology in construction safety.

Unit V

Safety Regulations and Compliance:

In-depth study of OSHA regulations and standards, Compliance requirements for construction projects, Legal responsibilities of contractors and employers, Conducting safety inspections and quality audits, Developing checklists and inspection protocols, Corrective actions and continuous improvement.

Course Outcomes:

At the end of course the students will be able to

1. Distinguish different aspects of quality and apply related tools.
2. Apply techniques of total quality assurance and quality control programme.
3. Plan various aspects of safety during construction activity.
4. Apply principles of environmental safety to construction projects.

Text Books:

1. Introduction to Health and Safety in construction, Phil Hughes and Ed Ferrett, Routledge publications, Fifth Edition, 2016.

2. Construction Inspection Handbook: Quality Assurance/Quality Control, James, J.O Brian, Third Edition, 2012.

Reference Books:

1. Construction Safety Management, Prof Jha, Patel and Singh, 2021 (In Press)

2. Quality planning and Analysis, Juran Frank, J.M. and Gryna, F.M ,Tata McGraw Hill, 2000

3. Quality Management in Construction Projects, Abdul RazzakRumane, CRC Press, 2018, Second Edition,

4. ISO 9000:2015, Quality management systems — Fundamentals and vocabulary

5. ISO 9001:2015, Quality management systems — Requirements

6. ISO 9004:2018, Quality management — Quality of an organization — Guidance to achieve sustained success

7. OHSAS 18001:2007 Occupation Health and Safety Management Systems

8. National Building Code of India 2016, Bureau of Indian standards, IS SP 7 : 2016

Online Resources:

1. https://nptel.ac.in/courses/105/102/105102206/ Website reference links.

II-PC 2	24CIVL6051: FINANCING INFRASTRUCTURE PROJECTS	L	T	P	S	J	C
		3	0	0	0	0	3

Course Educational Objectives (CEO):

1. To introduce the unique characteristics of financing infrastructure projects to students of civil engineering who are going to play a major role in development and management of infrastructure projects.
2. To provide understanding on critical issues in infrastructure financing such as government role in infrastructure creation, regulation
3. To provide understanding on frameworks for private sector participation, public private partnerships
4. To provide understanding on risk management.
5. To provide understanding on through a few case studies to demonstrate the application of the theoretical concepts on infrastructure financing such as procurement process, risk management and project finance.

UNIT 1

Introduction to infrastructure financing; Role of governments in financing infrastructure projects; Economic multiplier effects of infrastructure; Means of financing-public finance and private finance; Procurement of infrastructure projects through Public Private Partnership route-Types of PPP models,

UNIT 2

Contractual structure of PPP projects, Value for money evaluation, Lifecycle of PPP projects, PPP procurement process; Concessions for infrastructure-Design and award, Allocation of responsibilities, Price setting, Penalties and bonuses, Dispute resolution;

UNIT 3

Financing infrastructure projects with private capital- Introduction to project finance concept, Analyzing project viability, Designing security arrangements, Structuring the project, Preparing project financing plan;

UNIT 4

Risk management of infrastructure projects-Risk associated with various infrastructure projects, Risk identification techniques, Risk allocation frameworks, Risk mitigation strategies;

UNIT 5

Ratings of infrastructure projects-Role of credit ratings in financial infrastructure projects, Rating frameworks used by national and international credit agencies; Case studies.

Textbooks:

1. Danny Myers, Construction Economics: A New Approach, Taylor and Francis Publisher, 2016.
2. Va**zi**rani and chandola, Construction Accounting and Finance, Dhanpat Rai Publications,2011
3. Goodman, A., & Hastak, M. 2015. ***Infrastructure Planning, Engineering, and Economics*** (2nd ed.). New York: McGraw Hill Professional and ASCE Press.
4. E.R. Yescombe, Principles of Project Finance, Academic Press, 2002.

References:

1. J. Parkin and D. Sharma, *Infrastructure planning*, Thomas Telford, London, 1999.
2. A. Akintoye, M. Beck and C. Hardcastle, Public-Private Partnerships - Managing risks and opportunities, Oxford: Blackwell Science Limited, 2003.
3. J. D. Finnerty, Project Financing - Asset-Based Financial Engineering. New York: John Wiley & Sons, Inc, 1996.

Course Further Reading:

1. Haldea, G. 2011. ***Infrastructure at crossroads: The challenges of governance***. Oxford University Press.

Course Outcomes:

1. At the end of unit 1, the student will be able to understand and identify the various kinds of infrastructure projects, the key requirements, and the planning steps.
2. At the end of unit 2, the student realises the infrastructure demand-supply gap in India concerning all major sectors of infrastructure and applies scientific tools to identify the best alternative among available options
3. At the end of unit 3, the student performs economic analysis and develops economic models for any infrastructure project
4. At the end of unit 4, the student can design financial evaluations and develop financial models for a given infrastructure project.
5. At the end of unit 5, the student will be able to understand, assimilate, and deploy infrastructure planning concepts and methodologies to real projects/contexts.

II-PC 3	24CIVL6061: CONTRACT MANAGEMENT AND ARBITRATION	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble

Contract Management and Arbitration course intends to provide the participants a comprehensive understanding on the legal issues in commercial transactions with specific focus on contractual issues and commercial dispute resolution. The course shall address different types and facets of contracts and the rights, obligations, and implications on business operations. The course shall legal issues in contracts, contract with governments, breach of contract, special contracts, tender and procurement, project finance contracts, legal issues involving infrastructure companies and cyber contracts. In addition, the dispute management techniques such as Adjudication, Arbitration and Alternative Dispute Resolution the understanding of which are imperative for today's managers, are discussed. Having a reasonable understanding of the contract law and dispute resolution methods, which are foundation to all legal transactions, will help the managers/executives in designing the strategies for competitive advantage.

Course Educational Objectives (CEO):

1. This course provides a comprehensive understanding of contract management,
2. To provide understanding on dispute resolution, and arbitration in the context of construction and business contracts.
3. To enable learning on how to effectively manage contracts,
4. To enable learning on preventing disputes,
5. To enable learning on use arbitration as a means of resolving conflicts.

UNIT 1

General Principles Contracts: Ingredients of a valid contract; Privity of Contract, exceptions; Breach of Contracts; Remedies for Breach of Contracts; Measure of damages; Liquidated damages and penalty, Quasi Contracts; Government contracts; Special Contracts Case-laws.

UNIT 2

Contracts: Tender and Procurement; Legal issues in inviting tenders; Bidding and evaluation procedures; Relevance of evaluation criteria, public Procurement; Bidding process involving pre-qualification, Request for Proposals, Bid evaluation system, Bid negotiation, case-laws on tendering.

UNIT 3

Project Finance Contracts: various forms of project contracts; Ring fencing, high leverage, non–recourse finance; BOLT, BOT Projects; Receivable financing, Securitization; Benefits to investors, Loan Syndication; Off-take Contracts, Take or Pay Contracts; Long-term Sales Contract, Throughput Contracts; Compensation for Additional Costs; Step-in Rights, Force Majeure, Termination; Ancillary Contracts, Construction Contracts; EPC/DPC Contracts; Infrastructure contracts.

UNIT 4

Arbitration and Alternative Dispute Resolution: Adjudication; Arbitration; Conciliation; Mediation; Lok Adalats; Arbitral Tribunals and Arbitral awards; Recourse against arbitral award; Enforcement of foreign awards; Investment Arbitration under BITS, ICSID, etc.

UNIT 5

Case Studies on Contracts

Course Learning outcomes

1. At the end of unit 1, the student will be able to understand Contract Management and Arbitration
2. At the end of unit 2, the student knows Contract Formation and Administration, Contract Types and Provisions
3. At the end of unit 3, the student can understand the Contract Performance objectives and Disputes
4. At the end of unit 4, the student develops critical thinking on Arbitration Procedures and Practices, Arbitration Process and Evidence
5. At the end of unit 5, the student will be able to understand, assimilate, and deploy knowledge through Case Studies, International Arbitration and Industry Trends

Textbooks:

1. Hughes, W., Champion, R., & Murdoch, J. 2015. ***Construction Contracts: Law and Management*** (5th ed.). Oxon: Routledge.

References:

1. Anurag K. Agarwal, *Contracts and Arbitration for Managers*, 2016, New Delhi, India: SAGE Publications, 231 pp., ₹450. ISBN: 9789351506379.

Core	**24CIVL6271: PROJECT MANAGEMENT LABORATORY-2 (BIM)**	**L**	**T**	**P**	**S**	**J**	**C**
		0	**0**	4	**0**	**0**	2

Preamble

The purpose of the Building Information Modeling course is to provide a thorough understanding of the principles, processes, and applications of BIM in the architecture, engineering, and construction (AEC) industry. Participants will delve into the theoretical foundations of BIM while gaining hands-on experience with industry-standard BIM tools. The course aims to bridge the gap between traditional design and construction practices and the innovative, collaborative world of digital modeling.

Course Educational Objectives (CEO):

This course provides an overview of BIM process and tools:

- Understand the fundamental concepts and principles of Building Information Modeling.
- Navigate and utilize industry-standard BIM software applications proficiently.
- Apply BIM methodologies to improve project collaboration and communication.
- Evaluate the impact of BIM on project efficiency, cost, and sustainability.
- Incorporate BIM into various phases of the project life cycle, from planning to facility management.
- Analyze legal and ethical considerations associated with BIM implementation.

Syllabus

- Level of Detail (LOD) BIM Concepts
- Detailed Architectural BIM Modeling
- Basic Introduction to Structural / MEP BIM Concepts
- 3D Spatial Interference Analysis
- Generating Good for Construction (GFC) Documentation
- Material Take-Off(MTO)
- Bill of Quantity (BOQ) Generation
- Project Scheduling with BIM
- 4D Simulation
- Project work

Course Outcomes:

At the end of the course the students will be able to

1. Apply the fundamental concepts of Building Information Modeling (BIM).
2. Integrate construction processes through Building Information Modelling (BIM).
3. Analyze project delivery methods using BIM and related digital technologies.
4. Model a structure with building information modeling (BIM) software.

Text Books:

1. BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, Chuck Eastman, Paul Teicholz, Rafael Sacks and Kathleen Liston, John Wiley & Sons, 2008.
2. BIM and Construction Management: Proven Tools, Methods, and Workflows, Brad Hardin, Sybex, 2009.
3. Building Information Modeling: BIM in Current and Future Practice, Karen Kensek and Douglas Noble, Wiley, 2014, First Edition.

Reference Books:

1. BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Department of Civil Engineering M Tech (CTM) Scheme and Syllabi w.e.f. 2021-22 Engineers, Contractors, and Facility Managers, Rafael Sacks, Chuck Eastman, Ghang Lee and Paul Teicholz, Wiley, 2018, Third Edition.
2. Building Information Modeling (Pocket Architecture), Karen M. Kensek, Routledge, 2014, First Edition.

Online Resources:

1. https://youtube.com/playlist?list=PLbJykfQm9O8cArlgixHjUnHI4QLbTZpV3
2. https://youtu.be/fiUr9B2yKiI

Detailed Syllabus of PROGRAM EECTIVE (PE) COURSES

PE-1	24CIVL6081: CONSTRUCTION MATERIALS	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

This course familiarizes with various materials in construction industry. Properties and applications of various materials such as stone, brick, wood, cement and supplementary cementitious materials are discussed. Use of mortar in different types of masonry is explained. Utilization of sustainable construction materials and thermal insulation materials is further discussed.

Course Educational Objectives (CEO):

- To familiarize with the basic construction materials stone, brick and wood.
- To select suitable polymers, glass and alloys
- To understand the properties of mortar and cement.
- To explain the use of supplementary cementitious materials and thermal insulation materials for construction
- To utilize sustainable construction materials.

Unit I

Stones and Bricks -Properties of building stones, classification of stones, stone quarrying, various types of bricks and blocks used for construction, tests on bricks and blocks

Wood: Classification of various types of woods used in buildings, Timber – Market forms – Industrial timber, Strength and Failure in Timber

Exercise to be done: Survey availability and cost of various construction materials available commercially

Unit II

Polymer types-Properties and Applications, Reinforcing Fibre Materials,-Manufacture of Fibre Composites, Application of Fibre Composites in Construction,

Glass: Properties and Performance, Applications,

Metals and Alloys: Iron and Steel, Aluminium

Unit III

Masonry: Materials and Components for Masonry, Masonry construction and forms, Brick Masonry construction, Stone Masonry Construction, Masonry in cement mortar, Masonry in lime mortar, Masonry in mud mortar

Cement: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrated cement – Test on physical properties – Types and different grades of cement.

Unit IV

Supplementary cementitious materials

Fly ash, GGBS, agro-wastes such as rice husk ash and baggase ash.

Thermal insulation materials

General characteristics of insulation materials, properties and application of modern insulation materials in residential buildings, Aerogel, Vacuum insulation panels, Transparent isolation material, phase-change isolation material.

Unit V

Sustainable Building Materials

Fine Recycled Aggregated from Construction and Demolition Waste (CDM), Mortar with fine recycled concrete aggregates, Concrete with fine recycled concrete aggregates, Mortar with recycled ceramic masonry aggregates, Green walls on buildings,

Text Books

1. Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., Spon Press, 2001
2. Building Materials, P.C. Varghese, Prentice-Hall India, 2005
3. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill, 2006.
4. https://pb.edu.pl/oficyna-wydawnicza/wp-content/uploads/sites/4/2018/12/Buildings-2020-part1-20.12-rozdz-3.pdf

Course Outcomes:

- Classify stones, bricks and wood.
- Identify suitable glass and polymers for construction.
- Explain properties of mortar and cement.
- Demonstrate thermal insulation materials
- List different sustainable building materials

Program Elective-2: 24CIVL3421: WASTE MANAGEMENT L T P C :: 3 0 0 3

Course Description:

The proper disposal of urban waste is not only absolutely necessary for the preservation and improvement of public health but it has an immense potential for resource recovery. From this need, the course work is structured to provide an understanding of solid and hazardous waste characteristics. This course imparts students to acquire proficiency in processing technologies and disposal methods for municipal solid waste and hazardous waste generated from a community.

Course Educational Objectives:

- to study various types of solid wastes and their characteristics
- to familiarize with different solid waste disposal techniques
- to introduce various methods of composting and influence of plastic waste on environment
- to expose to various hazardous wastes and to evaluate the possible health risks on humans and environment
- to impart various characteristics of soil pollution and to assess the controlling measures of soil pollution

UNIT 1

Municipal solid waste Definition - Sources and types of solid waste- composition and its determinants of Solid waste-factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization. Collection and transfer of Municipal Solid Waste.

UNIT 2

Disposal of Solid Wastes: Refuse disposal – various methods – incineration – principle features of an incinerator – site selection and plant layout of an incinerator - sanitary landfill- methods of operation – advantages and disadvantages of sanitary land fill - site selection – reactions accruing in completed landfills – gas and leachate movement and control – equipments necessary

UNIT 3

Composting: Principle – types- factors affecting compost process- mechanical composting methods. Reuse and recycling of paper, glass, rubber. Plastic waste status in India. Effect of plastic wastes on environment, management of plastic waste.

UNIT 4

Hazardous waste Management: Sources and classification of hazardous wastes – Storage and collection of hazardous wastes – Treatment and disposal techniques: Physical, chemical and biological - Protection of public health and the environment. Biomedical wastes – Types – Management and handling and control. Radioactive wastes- sources and types - control and management.

UNIT 5

Soil Pollution – Physical, Chemical, Mineralogical and Biological properties of soil, sources of soil pollution, Pollution and residual toxicity from the application of insecticides, pesticides and fertilizers; Soil erosion and land degradation. Control of Soil pollution**.**

References

1. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management,Mc Graw – Hill,1997.
2. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. of. India, New Delhi, 2000.
3. Ramanatha Ayyar, T.S. " Soil Engineering in Relation to Environment " Published by LBS Centre for Science and Technology, Thiruvananthapuram, 2000

https://nptel.ac.in/courses/120108005/

Course Outcomes:

After completion of this course, the student will be able to

1. categories various types of solid wastes-L2
2. select an appropriate solid waste disposal technique-L2
3. differentiate different methods of composting and explain the impact of plastic waste-L3
4. evaluate hazardous waste management techniques –L4
5. summarize the impact of soil pollution on environment –L2

Program Elective-3	24CIVL6091: Application of BIM in Civil Engineering	L	T	P	S	J	C
		2	1	0	0	0	3

Preamble

In the dynamic landscape of civil engineering, the integration of cutting-edge technologies is reshaping traditional paradigms and unlocking unprecedented possibilities. This preamble introduces the "Application of Building Information Modeling (BIM) in Civil Engineering" course, a transformative educational journey designed to empower professionals with the skills and insights needed to harness the full potential of BIM in the civil engineering domain. As the demands on infrastructure continue to evolve, the utilization of BIM emerges as a pivotal factor in enhancing project efficiency, collaboration, and overall success. This course serves as a gateway for individuals seeking to explore the transformative impact of BIM methodologies, from conceptualization through construction to facility management.

Course Educational Objectives (CEO):

This course provides an overview of application of BIM in Civil Engineering:

- Describe evolution and development of BIM from it origination to today.
- Be able to compare, including advantages and disadvantages of BIM vs. 2D and 3D CAD
- Explain the challenges and roadblocks still facing the use of BIM.
- Demonstrate proficiency of commonly used BIM software (Autodesk Revit), including project
- document development and professional presentation of a BIM model.
- Understand applications of BIM, such as cost estimation, architectural renderings, interference checking, and modeling of energy consumption

Unit I

Introduction to/Review of Buildings & Systems: Building components and systems (architectural, MEP, structural), Building vocabulary, Building drawings, specifications, Building design process and roles of owners, managers, designers, engineers and contractors/subcontractors.

Unit II

Introduction to BIM and BIM Concepts: What is BIM, How can BIM be a part of the building design process, BIM vs. 3D CAD, Evolution and development of BIM & object-based parametric modelling, BIM platforms.

Unit III

BIM in Sustainable Building Design: Low/Zero-Impact Buildings - Assesses the role of BIM in designing and operating Sustainable (Comfortable) buildings that significantly reduce or eliminate energy use. Evaluation of low or zero-carbon and renewable technologies, application of BIM to evaluate buildings' environmental performance and explore the impact of IGBC, BREEAM, LEED and EPC ratings.

Unit IV

BIM in Construction Operation - BIM approaches and applications for construction planning and operations, including simulating construction schedules and logistics, buildability forecasting and clash detection.

Unit V

BIM in Construction Organization and Practice - BIM approaches and protocols using case studies. BIM organizational strategic and implementation plan to ensure it's aligned with the business strategy.

Course Outcomes:

At the end of course the students will be able to

- Study the role of BIM in sustainable building design and construction
- Apply BIM approach in construction Planning, Control and Operation
- Demonstrate the use of BIM as a communication tool for decision-making among Stakeholders.
- Apply BIM in sustainable building design and construction practices through case studies

Text Books:

1. 1.Building Information Modelling (BIM) in Design, Construction and Operations De Wilde, P.,Mahdjoubi, L., &Garrigós, A. G., WIT Press, 2019, Volume 192.
2. BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors. Eastman, C. M., Eastman, C., Teicholz, P., Sacks, R., & Liston, K.John Wiley & Sons, 2018, 3nd Edition.
3. Building information modeling: BIM in current and future practice, Kensek, K., & Noble, D., John Wiley & Sons, 2014, 1st Edition.

Reference Books:

1. Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, And Building Information Modelling, Elvin, G., John Wiley & Sons, 2007, First Edition.
2. Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling:
Concepts and principles, BS EN ISO 19650-1, The British Standards Institution, 2018.
3. Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling: Delivery phase of the assets, BS EN ISO 19650-2, The British Standards Institution, 2018.
4. Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling. Operational phase of the assets, BS EN ISO 19650-3:2020, The British Standards Institution, 2020.
5. Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling. Security-minded approach to information management, BS EN ISO 19650-5:2020, The British Standards Institution, 2020.

Program Elective-4	24CIVL6101: EMERGING TECHNOLOGIES IN CONSTRUCTION	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

The emerging trends in Civil Engineering help to complete the undertaken projects within prescribed schedule, saves the natural resources and to make the projects eco-friendly. This subject helps to make awareness about soft computing techniques, new materials, advanced machineries, sustainable resource management and advancement in Civil Engineering.

Course Educational Objectives:

This course provides an overview of advanced foundation engineering

- To familiarize with the different types of softwares available for construction
- To acquaint the new materials for construction of buildings
- To acquaint the students with the latest and advanced tools and equipment available for the construction process.
- To study the importance and implementation of sustainable resource management
- To familiarize the students with the advancement in the construction.

Unit I

Soft Computing Techniques: Introduction of soft computing techniques and its types, Merits and demerits of soft computing technique, Graphical User Interface Software (GUI) Introduction, salient features and applications of software's - REVIT, ETAB, 3D Architect Home, Build-Master, HEC-RAS, STRAP, WaterGEMS, Tekla, ArcGIS, QuikGrid, STAAD.Pro, SAFE, RISA- Connection, Civil 3D, Site 3D, SkyCiv Structural 3D, SAP 2000, MIDAS, LUSAS, BricsCAD, Estimate Master, ProEst, WinEst, Clear Estimate, Procore, Buildertrend, Building Management System (BMS), Primavera Pro, Microsoft Pro (MSP). **Case studies of latest technologies.**

Unit II

Building Materials - Artificial sand, Sensi tile, carbon fibre, Bricks made up of cigarette butts, 3D printed bricks, Translucent wood, laminated timber, 3D Tiles

Road Materials - Gyo-synthetics, Noise-reducing asphalt, Porous Pavement, Plastic Roads, solar roads

Concrete Materials - Portland Pozzolana Cement, Portland Slag Cement, New admixtures - Masterglanium, Polycarboxylic Ether, Self Healing Concrete, Fibre- Reinforced Concrete, High Strength concrete, High Performance Concrete, Nano concrete , Light transmitting concrete.

Sustainable Materials - Ground Granulated Glass Blast-furnace Slag (GGBS) concrete, Aero-gel insulatiun, Cooling bricks, Green concrete, Timbercrete, Ferrock

Unit III

Latest Tools and Equipments:

Survey equipment - LiDAR, Scan Station, Global Positioning System (GPS), Geographical Information System (GIS), Photogrammetry, Drones, Direct Reading Grade Rods, 3D Laser scanning, laser level

Construction Equipment - Earth moving equipment-Skid and crawler loaders, trenchers, scrappers, wheeled loading shovels, advanced plastering machine, Bridge launcher.

Material handling equipment - Cranes, conveyors, hoists, forklifts, mobile concrete mixer, paver, road header, tunnel boring machine.

Acquaintance of related applications of Computer / Software.

Unit IV

Sustainable Resource Management

Water resource management- Principles and technique, 4R's in waste management-Reduce, Reuse, Recycle and Recover, Concept of Zero Waste Reuse of waste in construction-Fly Ash, Slag and Plastic Renewable energy sources-solar energy, biomass, wind energy, ocean wave energy, Geo thermal energy and hybrid power system. Energy Audit-Necessity and methods. Natural disaster management- Flood , Earthquake, Tsunami, Volcanic Eruption, Hurricanes, Landslides. Site Safety-necessity, principles, tools, techniques, laws, rules and regulations.

Unit V

Advancement in Construction:

Building construction Techniques: Zero energy building, Green building, Mass housing-precast housing, prefab homes, pre-engineering, Solar Paints, Building Photovoltaic (BIPV), Earthquake ResistingControls-Isolation and Dissipation.

Road construction techniques- 3D Printing, Road Printer, smart roads

Coastal construction techniques - Soundproofing walls, water resistant roofs, high performance doors and windows, air and moisture barriers.

Acquaintance of related applications of Computer / Software.

Ground improvement techniques - Advanced piling techniques - Stone Column, Vibro Floatation, Micro Piles, Soil Nailing, Vertical drains- Sand Drains, Pre-Fabricated Vertical Drains, Thermal Methods- soil heating and soil freezing.

Course Outcomes:

At the end of course the students will be able to

1. understand different applications of software's for planning, designing and execution of projects.
2. Suggest the advanced materials as per site condition.
3. Recommend the suitable tools and equipments for the given situation.
4. Suggest the advanced resource management techniques for the given project.
5. Use the feasible advance techniques for various civil engineering projects.

Text Books

1. Emerging Materials for Civil Infrastructure: State of the Art by Roberto Lopez- Anido, Tarun Naik, American Society of Civil Engineers (31 July 2000), ISBN-13: 978-0784405383

Reference Books

1. Sustainable Construction Materials by Ravindra K. Dhir OBE Jorge de Brito Rui Silva Chao Qun Lye, Woodhead Publishing, 9th January 2019, eBook ISBN: 9780081009918

		L	T	P	S	J	C
Program Elective-5	**24CIVL6111: Construction Techniques of High-Rise Buildings and Towers**	**3**	**0**	**0**	**0**	**0**	**3**

Preamble:
This course helps the learner to acquire the comprehensive knowledge of structural design of tall buildings. The learner will understand various concepts related to building management and site investigation. The learner will familiarize with various equipment involved in material handling. The learner will understand behavior of tall buildings under wind and seismic loads along with various design concepts mentioned in standard codes.

Course Educational Objectives:
The student will be able
- To teach the design criteria for structural design of tall buildings.
- To introduce various concepts related to building management.
- To study the concepts involved in site investigation.
- To know various equipment involved in material handling.
- To study the behavior of tall buildings under wind and seismic loads along with various design concepts mentioned in standard codes.

Unit I

Evolution of Tall Buildings: Introduction, Design Criteria for Structural Design of Tall Building, Concept of Premium for Height, Development of High-Rise Architecture.

Unit II

Assembly of Building: Building Performance –Cost, Quality and Time, Environmental Requirements, Industrialization& Robotics in Construction, Introduction to Safety and Health Management System.

Unit III

Site Investigation: Stages of Site Investigation, Site Reconnaissance & Ground Investigation-Field Tests & Laboratory Tests.

Unit IV

Construction equipment: Foundation Systems, Material Handling and Mechanization: Material Handling Considerations, Earthmoving Equipment's, Horizontal and Vertical Movements, Selection & Utility of Cranes (Tower Cranes & Climbing Cranes).

Unit V

Wind Effects on Behavior of Tall Structures: Outlook of Design Considerations and Characteristics of Wind, codal Wind Loads and Cladding Pressures On Behavior of Tall Buildings.

Seismic Effects on Behavior of Tall Structures: Introduction to Tall Building Behavior During Earthquakes and Seismic Design Philosophy – Building Behavior – Seismic Design Concept – Dynamic Response Concept – Dynamic Analysis Theory – Design Techniques.

Course Outcomes:

At the end of course the students will be able to

1. understand the design criteria for structural design of tall buildings. (L-2)
2. understand various concepts related to building management. (L-2)
3. understand the concepts involved in site investigation. (L-2)
4. understand various equipment involved in material handling. (L-2)
5. understand the behaviour of tall buildings under wind and seismic loads along with various design concepts mentioned in standard codes. (L-2)

Text Books

1. Taranath, B, Concrete and Composite Design of Tall Buildings, CRC Press, 2016.
2. Bryan S,Smith and Alex Coull, Tall Buildings Structures Analysis And Design, Wiley India Pvt Ltd.
3. The Design of Building Structures. By Wolfgang Schueller, Prentice Hall India, 2016

Reference Books

1. White and Salmon, Building Structural Design Handbook, John Wiley & Sons.
2. Mark Sarkisia, Designing Tall Buildings: Structure as Architecture.

Program Elective-6	24CIVL6121: CONSTRUCTION OF UNDERGROUND STRUCTURES	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

The course intends to convey the significance of geo-investigation, geo instrumentation and design methodologies for construction of underground structures. Especial emphasis will be given in discussing the planning, modelling, monitoring and construction methodology of underground structures, safety and comfort aspects associated with underground space, and the effects of tunnelling on superstructures.

Course Educational Objectives:

This course provides an overview of advanced foundation engineering

- To familiarize with the operations of underground space and investigations required for the underground structures.
- To acquaint the construction procedure of underground structures
- To acquaint the design of tunnel for various civil applications
- To study the design of the wall supports and tunnel linings
- To understand the underground openings and determine the bearing capacity of rocks.

Unit I

Introduction – Planning, development and operation of underground space, safety and comfort, human-space interaction, geo-investigation, drainage and dewatering, geomechanical analysis, effects of tunnelling on superstructures.

Unit II

Underground structures – Modelling, design and construction methodology, Monitoring and maintenance aspects of underground structures by employing geo-instrumentation, underground earth-sheltered structures, underground pipelines, ducts, and cables. Micro-tunneling, and other forms of trenchless technologies.

Unit III

Rock tunneling – Basic design principles of tunnels in rock applications. **Case studies of latest technologies.**

Unit IV

Braced excavation, types, earth pressure, effect of wall rigidity and sequence of construction, Design of wall and wall supports; tunnels and shafts, pressure distribution, design of tunnel lining, methods of tunnelling, ground loss. **Exposure to real-world applications.**

Unit V

Underground openings, structural geology in rock tunnelling, Rock slopes, Rock foundations; Bearing Capacity of Rocks; Drilling and blasting of rocks; Grouting; Instrumentation and measurements in tunnelling. **Acquaintance of related applications of Computer / Software for slope failures.**

Course Outcomes:

At the end of course the students will be able to

1. Plan geotechnical investigation for underground construction and account for safety aspects associated with planning of underground infrastructures
2. Design underground structures in soils and rocks
3. Design tunnel in civil applications
4. Design the wall supports and tunnel linings
5. Understand the underground openings and determine the bearing capacity of rocks

Text Books

1. "Tunnelling and Underground Space Technology", International tunneling association, Pergamon Press,

Reference Books

1. Hvorslev, M. J., "Subsurface exploration and sampling of soils for civil engineering purpose", edited by Waterways Experiment Station, Mississippi.

PE-7	24CIVL3351: TRANSPORTATION INFRASTRUCTURE ENGINEERING	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

This course imparts the student's knowledge of planning, design, construction and maintenance of railway tracks. The students acquire proficiency in the application of modern techniques such as GIS, GPS and remote sensing in Railway Engineering. The student develops skills on airport planning and design with the prime focus on runway and taxiway geometrics. Students become conversant with the definition, purpose, location and materials of coastal structures such as piers, breakwaters, wharves, jetties, quays and fenders. The students acquire knowledge on site reconnaissance for location and planning of harbours

Course Educational Objectives:

The purpose of this course is to

- Familiarize about the history of non-highway transportation i.e. Railways, Air Transportation, Harbour and Dock Engineering
- Enable to design railway infrastructure along with design and analysis of railway track system
- Explain about layout and design of airport
- Familiarize on the orientation of the runways and geometrical design of the airport infrastructure,
- Impart knowledge on planning of a seaport and its infrastructure and aids

UNIT 1

Railways - Introduction and Planning: Development of railways in India, components of a permanent way and its functions, rails, sleepers, ballast, formation, rail fittings and fastenings, comparison of roadways and railways, engineering surveys for track alignment and GIS, GPS and RS applications, track alignment considerations, track construction and track maintenance, track drainage, introduction to modern developments in railways.

UNIT 2

Railways – Geometric Design, Points and Crossings, Signalling and Interlocking: Gradient and grade compensation on curves, speed on curves, super elevation and negative super elevation, widening of gauge on curves, types of stations and station yards, station equipment's, types of points switch and crossings, design calculation of turnout, various types of track junctions, signalling and interlocking, different types of signals, their working and location, control systems of signals, track circuiting.

UNIT 3

Airport Engineering: Layout and Design: Introduction, classification of airports, factors influencing site selection, components of airport landing areas, terminal area and terminal buildings, cross sectional components of runway and taxiway, components, drainage, airport

zoning, clear zone, approach zone, buffer zone, turning zone, clearance over highways and railways.

UNIT 4

Airport Planning and Air Traffic Control: Hangers and helipads, turning radius, taxiway as per Indian standards, wind rose diagram, runway orientation, landing aids, air traffic control, airfield marking and lighting- sign, aircraft parking system, flight planning and operations, design standards, planning and design of airport as per Indian condition.

UNIT 5

Harbours Docks and Management: Dock, different types, functional design and various types and their usage, navigational aids, necessity and type of signals and different types of dredges and their applications, classification and requirements of harbours, classification and construction, wharves, piers and bulkheads, dolphins, fender and other mooring devices, typical layout of existing harbours.

TextBooks:

1. Ashford N.J., MumayizS.A., and PWright.H., Airport Engineering: Planning, Design and Development of 21st Century Airports, 4/e, John Wiley and Sons,2011
2. Subhash C. S, and Arora S, A course in Railway Engineering, 7/e, Dhanpat Rai and sons, Delhi, 2010
3. Srinivasan R., Harbour, Dock and Tunnel Engineering, 30/e, Charotar Publications, 2022

References:

1. Agarwal M.M., Indian Railway Track, 5/e, Prabha and Co, 2007
2. Anita K.F., "Railway Track", 1/e, New Book Company, 2000
3. Young S.B., and Wells A.T., Airport Planning and Management, 6/e, McGraw-Hill,2011
4. NPTEL Video Course for Transportation Engineering –II https://nptel.ac.in/courses/105107123/

Course Outcomes:

After completion of this course, the student will be able to

1. Summarize the history of the railway development in India, track alignments, construction and maintenance**[L2]**
2. apply the concepts in designing of railway tracks, curves, crossings, signalling and interlocking**[L3]**
3. list the elements of airport engineering and design airport terminals along with runways**[L1]**
4. demonstrate knowledge on helipads, windrose diagrams and air traffic control**[L2]**
5. develop knowledge on harbour and dock engineering such as different types, functional design, navigational aids, types of signals, buoys, beacons, wharves, piers and Bulkheads, Dolphins, Fender and other mooring devices**[L3]**

PE-8	24CIVL6131: TUNNEL ENGINEERING AND CONSTRUCTION METHODS	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble

This course is mainly deals with Principles of underground tunnelling techniques. Emphasis on evaluation of ground conditions, estimation of support requirements, methods of tunnel driving and boring, auxiliary systems & equipment and safety.

Course Educational Objectives (CEO):

- The students will gain an experience in the site investigations and geotechnical considerations involved in Tunnel Engineering.
- The students will get a diverse knowledge of various types of tunnels and their functionalities.
- The students will learn the design concepts and philosophy of tunnel design.
- The students will gain knowledge on various tunneling techniques and tunnel ventilation systems.
- The students will learn about various construction equipment's, risk management and technologies in Tunnel Engineering.

Unit I

Site investigations, Geotechnical Considerations of tunneling, Rock Mass Classification, Rock Mechanics, Geological inputs for DPR & Feasibility Reports

Unit II

Construction & Excavation methods, Types of Tunnels - Tunnel Form - Loads- Mountain Tunnel - Shallow-buried Tunnel or Soft Soil Tunnel - Underwater Tunnel, Rock tunnels.

Unit III

Design of Tunnels- Design Philosophy, Geotechnical design aspects, Rock and rock mass failure criteria, stability analysis of tunnels, emeprical methods of tunnel support design

Unit IV

Micro techniques, Micro tunnelling techniques, Ventilation of tunnels, tunnel utilities, tunnel lining systems, Tunnel Design Management and Safety, QA/QC for tunneling

Unit V

Tunnelling methods, Equipment Planning, Risk assessment and management, latest trends and technologies in tunnelling, Case studies

Course Outcomes:

- The students shall be able to demonstrate geotechnical considerations for tunnels-L2
- The students shall be able to explain different construction and excavations methods of tunnels-L2
- The students will learn to understand the theoretical and practical aspects of Railway, Bridge and Tunnel engineering along with the design and management applications-L4
- The students will get a diverse knowledge of various tunneling techniques and tunnel ventilation systems -l3
- The students shall be able to explain construction equipment's, risk management and technologies in Tunnel Engineering -L2

Text Book(s):

1. Thomas R. Kuesel, Elwyn H. King, John O. Bickel, "Tunnel Engineering Handbook", Charotar Publishing House Pvt. Ltd., 30th Edition, 2022.
2. Bieniawski, Z T, "ROCK MECHANICS DESIGN IN MINING AND TUNNELLING", A.A. Balkema, Rotterdam, 1984.
3. Antonio Bobet, Herbert H. Einstein, "Tunnel Design Methods", CRC Press., 1st Edition, 2023.

References

1. R. Srinivasan, "Harbor, Dock and Tunnel Engineering", Charotar Publishing House Pvt. Ltd., 30th Edition, 2022.
2. U S Army Corps of Engineers, "Tunnels and Shafts in Rock", University Press of the Pacific, 2005.
3. Pietro Lunardi, "Design and Construction of Tunnels: Analysis of Controlled Deformations in Rock and Soils", Springer-Verlag Berlin and Heidelberg Gmb, 1st Edition, 2016.

PE-9	24CIVL6151: Sustainable Development and Management	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble/ Course Description:

Sustainable development agenda has come up in the main agenda of the global research, policy and practice with the conception by the Brundtland commission. The agenda aims at meeting the present generational needs but ensuring that future needs are not compromised. Accordingly, this course focusses on introducing the basic of the agenda of sustainable development, sustainable development goals, various theories that undergird the agenda and a few directions on the assessment/measurement. The course will equip students to develop future goals and objectives in light of the SDGs including framing of their careers, business ideas, questions, objectives, positioning the contributions to the society and nation not only to garner acceptance but also contribute to the industry, policy and practice.

Course Educational Objectives:

1. To familiarize the students in the concepts the sustainable development and its underlying concepts sustainability.
2. To explain the concept of Millennium Development Goals (MGDs) and Sustainable Development Goals (SDGs).
3. To impart knowledge on assessment and measurement of sustainability.
4. To demonstrate various management methodologies and techniques in light of sustainability.

UNIT 1 Introduction and History of Sustainable Development

Introduction to Sustainable Development: The Brundtland Report, The United Nations Conference in Environment and Development, The World Summit on Sustainable Development; Climate Change: Science, Economics, and Policy.

UNIT 2 Millennium/ Sustainable Development Goals

Global climate change issues and responses. Challenges to Sustainable Development: Natural resource depletion and Climate change; Actions of Intergovernmental Panel on Climate Change; Millennium Development Goals (MGDs): the rationale for MDGs and its link with Sustainable Development; Sustainable Development Goals (SDGs).

UNIT 3 Principles of Sustainability

Principles of Sustainability: the precautionary principle and the safe minimum standard; Sustainability Frameworks, Sustainable Development Indicators; Growth and sustainability: Impact, Population, Affluence and Technology (IPAT) model, ecological footprint, green GDP.

UNIT 4 Assessment, Design, and Application of Sustainability

Sustainability practice, National Action Plans of developed and developing countries; Methodologies: life cycle assessment (LCA) and Leadership in Energy and Environmental Design (LEED); Design for the Environment, Ecological Principles, Passive Design and Climatic Design; Leadership and management in the age of sustainability.

UNIT 5 Student Case Studies

Student projects on sustainability applications

Textbooks:

1. Gibson, R. B., Hassan, S., Holtz, S., Tansey, J., & Whitelaw, G. 2005. Sustainability Assessment: Criteria and Processes. London: Earthscan.
2. Gibson, R. B. 2016. Sustainability assessment: Applications and opportunities. London: Routledge. https://doi.org/10.4324/9781315754048.
3. Ghaly, A. M. 2011. Teaching the qualities of leadership and management in the age of sustainability. Leadership and Management in Engineering, 11(2): 113–120.

References:

1. Rogers P P,Jalal, K.F and Boyd, A.J, An Introduction to Sustainable Development, Earthscan, UK, 2007,
2. Daly H.E, Beyond Growth: the economics of sustainable development, Beacon Press, Boston, 1996
3. ISO: 14040 “Environmental management — Life Cycle Assessment — Principles and Framework.” Geneva: ISO, 1997.
4. LEED. “Building Rating System for New Construction and Major Renovations.” Version 2.1.
U.S. Green Building Council, 2002. (PDF)

5. WCED Our Common Future (Brundtland Report), Oxford University Press, 1987. World Bank, Report Sustainable Development in a Dynamic World: Transforming Institutions, Growth, and Quality of Life, World Development Report, 2003

6. Franklin, A., & Blyton, P. (Eds.). 2011. Researching Sustainability: A Guide to Social Science Methods, Practice and Engagement. London: Earthscan from Routledge.

7. Gasparini, P., Manfredi, G., & Asprone, D. (Eds.). 2014. Resilience and Sustainability in Relation to Natural Disasters: A Challenge for Future Cities. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-04316-6.

8. IPCC. 2014. Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. (T. Z. and J. C. M. Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, Ed.). Cambridge and New York, United Kingdom and USA.: Cambridge University Press

.

Course Further Reading:

1. Gates, Bill (2022) How to Avoid a Climate Disaster, Penguin Books Limited, New Delhi, 9780141993010.

Course Outcomes:

At the end of the course, the student will be able to understand, assimilate, and deploy sustainability concepts in engineering applications.

Program Elective-10	24CIVL3371: URBAN TRANSPORTATION PLANNING	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

Urban transportation is an important issue in developing countries such as India. Transportation impacts various aspects such as mobility, health of residents, economic and energy aspects in an urban area. This course covers the challenging need for effective and efficient planning of urban transport addressing the growing travel demand in a sustainable and affordable way. This course will help in capacity building for urban transport planning and decision making, to understand urban transport in all relevant dimensions, and develop urban transport plans, programs and projects.

Course Educational Objectives (CEO):

- Familiarize basic concepts and methods of urban transportation planning in the India.
- Explain methods of designing, conducting and administering surveys to provide the data required for transportation planning.
- Impart knowledge on trip generation and trip distribution models
- Demonstrate Mode choice and traffic assignment models.
- Focus on land use transportation planning and urban goods movement.

UNIT1

Urbanization, Urban Transportation: Impacts, Behavioral Changes, Urban Transportation problems & Externalities- Congestion, Safety, Emissions, etc., Smart approaches for mitigating Externalities. Introduction to Transport planning; Transport Planning Morphology: Problem definition, Solution generation, solution analysis, Evaluation and choice, Implementation.

UNIT2

Information needs for Travel Demand Forecasting: Study Area, Urban Activities, Zoning, Urban Activities, Transportation System, Travel information, Types of Movements Data Collection Techniques (Home-interview survey, Commercial vehicle survey, Innovative Commercial Vehicle Tracking Methods, Intermediate Public Transport Survey, Cordon-Line Survey, Post-Card Questionnaire Survey, Registration – Number Survey, License Plate Follow-Up Survey Technique, Tag-on- Vehicle Survey)

UNIT3

Factors governing trip generation and attraction – Application of Regression Analysis-Methods of trip distribution; Growth and Synthetic Models- Calibration and Application of gravity model-Category analysis. Case studies

UNIT4

Modal split: factors, types of modal split models, aggregate and disaggregate models, utility theory, probabilistic choice theory; Traffic assignment: link cost function, network properties, traffic assignment techniques. Case studies

UNIT5

Land use transportation interaction; accessibility and mobility, land use models. Urban goods movement: factors, modelling approaches, emerging trends in transportation planning

Course Outcomes:

At the end of course the students will be able to

1. Demonstrate urban transportation problems & externalities **[L2]**
2. Analyse information needs for travel Demand Forecasting: **[L3]**
3. Develop and calibrate the trip generation and trip distribution models **[L3]**
4. Develop and calibrate the modal split and traffic assignment models **[L3]**
5. summarise land use – transportation interaction, urban goods movement**[L2]**

Text Books

1. Kadiyali, L.R., Traffic Engineering and Transport Planning, 9/e, Khanna Publishers, 2018
2. Khisty C. J and Lall B. K, Transportation Engineering: An Introduction, 3/e, Prentice Hall India, 2017

Reference Books

1. Hutchinson, B.G., Principles of Urban Transport System Planning, 1/e,Taylor& Francis Inc, 1987

2. NPTEL course on Traffic Engineering: https://archive.nptel.ac.in/courses/105/105/105105208/

PE11	24CIVL6161: PRECAST AND PRESTRESSED CONSTRUCTION	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

The ingredients used for precast concrete, fabrication, construction, and handling techniques and selection of precast concrete elements are explained. Prestressed concrete is often preferred in construction of bridges and buildings. This course further discusses on types of prestressing system and analysis of prestressed concrete beams.

Course Educational Objectives :

- To differentiate between Precast and other forms of construction.
- To understand the Pre-casting and handling techniques.
- To study various joints in Precast Concrete Construction.
- To familiarize prestressing methods and systems.
- To analyze prestressed rectangular beam sections.

Unit I
Introduction

Description of Precast Concrete Construction. Difference between Precast and Other forms of Concrete construction. Advantages of this form of construction.

Applications: Pre-cast and pre-fabricating technology for low cost and mass housing schemes. Small pre-cast products like door frames, shutters, Ferro-cement in housing - Water tank service core unit.

Unit II

Techniques of Pre-casting

Pre-casting techniques - Planning, analysis and design considerations - Handling techniques -Transportation Storage and erection of structures.

Unit III

Joint in Structural Members

Joints for different structural connections – Dimensions and detailing – Design of expansion Joints.

Unit IV

Introduction:
Basic concepts of prestressing, Historical Development, Need for high strength steel and concrete, Terminology, Advantages of prestressed concrete, Applications of prestressed concrete.

Systems of prestressing:
Classification of prestressed concrete. Pre tensioning techniques - long line system (Hoyer system), post - tensioning Techniques (a) Freyssinet system and (b) Gifford Udall system.

Unit V
Analysis of prestress and Bending stresses:
Basic assumptions, Analysis of prestress, Resultant stresses at a section, Pressure line or thrust line and internal resisting couple, Concept of load balancing, Stresses in tendons, Cracking moment.

TextBooks:

1. Levitt. M., Precast concrete - Materials, Manufacture Properties and Usage, Applied Science Publs. 1982,
2. Precast Concrete Structures- Elliot Kim
3. **1.** N. Krishna Raju, Prestressed concrete, 4/e, Tata McGraw Hill, 6/e 2018.
4. G.S. Pandit, Prestressed concrete, CBS Publishers, 2019.

References:

1. . IS 15916 BUILDING DESIGN AND ERECTION USING PREFABRICATED CONCRETE — CODE OF PRACTICE
2. P. Dayaratnam, Prestressed Concrete Structures, Oxford and IBH Publishing Company, 2014.
3. T.Y. Lin, and H. Ned, Burhns, Design of Prestressed Concrete Structures, 3/e, John Wiley, and Sons, 2010.
4. H. Arthur, Nilson, Design of prestressed concrete, Wiley India Pvt.ltd, 2011.
J.R. Libby, Modern prestressed concrete,CBS Publishers, 2007.

Course Outcomes:

After completion of this course, the student will be able to

- demonstrate types of precast construction and its advantages.
- illustrate techniques of pre-casting.
- summarize the joint specifications for precast concrete.
- distinguish between different prestressing methods (L4).
- analyze prestressed concrete beams for flexure(L5).

Program Elective-12	24CIVL6171: QUANTITATIVE TECHNIQUES FOR MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:
This course deals with some basic mathematical and statistical concepts and methods common in business applications. The focus is on parametric techniques used to describe and compare samples and populations. The course discusses the importance of some bivariate and multivariate methods and their applications to the business world.

Course Educational Objectives:
This course provides an over view of Quantitative Techniques for Management

- To understand the basic concepts of Contracts, Sale of goods, Agency, etc.
- To acquaint with special legislation dealing with business transactions
- To evaluate with special Case laws dealing with business transactions
- To analyze the recent amendments dealing with business Legislation
- To elucidate the process of formation and winding up of a company

Unit I

Introduction to Basic Mathematics:
Linear Equations in two variables, Basics of Permutations, and combinations (non-reputation), Differentiation, Derivatives – First order and Second order Derivatives, Maxima & Minima, Integration, Business applications of Derivatives and Integration. (Note: Exclude Trigonometric and Logarithmic functions in derivatives and integration and chain rule in integration)

Unit II

Measures of Central Tendency & Measures of Dispersion:
Introduction, Merits, Demerits, Applications. Mean, Geometric Mean, Harmonic Mean, Weighted Mean, Combined Mean, Median, Mode, Standard Deviation, Coefficient of Variance, and Combined Standard Deviation for grouped and ungrouped data, Skewness and Kurtosis.

Unit III

Correlation & Regression analysis:
Positive & Negative correlations, Karl Pearson correlation coefficient, Linear regression, Regression Coefficients & Properties, Linear regression model, simple linear regression, coefficient of determination, testing for significance, estimates through simple regression equation.

Unit IV

Forecasting:
Introduction to Time Series Analysis, Cyclic Variation, Seasonal Variations, types of seasonal effects, smoothing Methods-moving averages, weighted moving averages, exponential smoothing, trend projections Linear Trend.

Unit V

Probability & probability Distributions:
Probability concepts, axioms, Baye's theorem, Random Variables, Mathematical Expectation, Discrete Distributions-Binomial distribution and Poisson distribution, Continuous Distributions-Normal distribution.

Course Outcomes:
At the end of course the students will be able to

- Understand and analyze the properties of Calculus
- Develop the ability to interpret statistical analysis tools commonly used in the workplace
- Learn how many business decisions depend on knowing the specific relationship between two or more variables
- Understand the different approaches to forecasting that can be applied in business
- Apply the concepts of probability distributions to real life problems

Text Books:
• Statistics for Management, Levin et al., Pearson.
• Statistics for Business and Economics, Anderson et al., Thomson South Western pub.

References:
• Business Statistics - A First Course, Levine, Krehbiel and Berenson, Pearson Education.
• Business Statistics Using Excel, David and Pecar, Oxford Univ. Press
• Business Mathematics, R.C. Joshi , Jalandhar: New Academic Publishing Co.

PE-13	24CIVL6181: Construction Safety and Risk Management	L	T	P	S	J	C
		2	1	0	0	0	3

Preamble

Construction sites are crucibles of transformation, where towering structures emerge, and infrastructure takes shape. Yet, amid this metamorphosis, the well-being of those involved and the mitigation of potential risks must be at the forefront. This course serves as a beacon, guiding professionals and stakeholders through the intricacies of safety protocols and proactive risk management strategies.

Course Educational Objectives (CEO):

This course provides an overview of application of BIM in Civil Engineering:

- Develop skills to create comprehensive safety plans and protocols for construction sites.
- Develop leadership skills to promote a positive safety culture among team members.
- Acquire knowledge and skills related to emergency response and crisis management on construction sites.
- Develop effective communication skills to convey safety information clearly to diverse stakeholders.
  Explore how technology and innovation can be leveraged to enhance construction safety.

Unit I

Safety Programmes and organization: Introduction to safety, challenges in the construction sector, accident statistics, accident causation theories, Cost of Safety, Safety acts and Regulations, Safety audit, accident investigation and prevention Techniques, Environmental safety, Social and environmental factors, Application of digital technology in construction safety.

Unit II

Diversity, work/life balance & Employment legislations: Workforce Diversity, Equal Opportunities in construction, Work- life Balance (Case study Discussion). Employee welfare and Employment legislations: Workplace health and safety hazards, employment legislations.

Unit III

Fire protection of buildings: Important considerations in fire protection, Fire resisting, Properties of common building materials, Fire safety and exit requirements.

Unit IV

SAFETY MANAGEMENT - Quality and Safety Concerns in Construction -Organizing for Quality and Safety – Work and Material Specifications -Total Quality Control -Quality Control by Statistical Methods - Statistical Quality Control with Sampling by attributes – Statistical Quality Control with Sampling by Variables – Safety.

Unit V

Project Risk Management: Risk register, identification, evaluation, allocation, avoidance and sharing of risk. Delay Analysis and Case Studies.

Course Outcomes:

At the end of course the students will be able to

- Exhibit a comprehensive understanding of local, national, and international safety regulations and standards relevant to the construction industry.
- Plan various aspects of safety during construction activity.
- Systematically assess and prioritize risks, demonstrating the ability to implement preventive measures.
- Apply the techniques for a real-world project and demonstrate the learning.

Text Books:

1. Introduction to Health and Safety in construction, Phil Hughes and Ed Ferrett, Routledge publications, Fifth Edition, 2016
2. Construction Inspection Handbook: Quality Assurance/Quality Control, James, J.O Brian, Third Edition, 2012

Reference Books:

1. Construction Safety Management, Prof Jha, Patel and Singh, 2021 (In Press)
2. Quality planning and Analysis, Juran Frank, J.M. and Gryna, F.M ,Tata McGraw Hill, 2000
3. Quality Management in Construction Projects, Abdul RazzakRumane, CRC Press, 2018, Second Edition,
4. ISO 9000:2015, Quality management systems — Fundamentals and vocabulary
5. ISO 9001:2015, Quality management systems — Requirements
6. ISO 9004:2018, Quality management — Quality of an organization — Guidance to achieve sustained success
7. OHSAS 18001:2007 Occupation Health and Safety Management Systems
8. National Building Code of India 2016, Bureau of Indian standards, IS SP 7 : 2016

Online Resources:

1. https://nptel.ac.in/courses/105/102/105102206/

PE-14	24CIVL6211: LEAN CONSTRUCTION	L	T	P	S	J	C
		3	0	0	0	0	3

Course Description:

Lean Construction Management is a radical shift from traditional construction management. It is an adaptation of Lean Manufacturing principles to the construction realm. Lean approach seeks to improve project delivery by minimizing waste and maximizing Value to the customer. This course has been designed to impart the key concepts, tools, and practices to Civil Engineering Senior Level under-graduates, post-graduate students to help them in careers such as practicing engineers, architects, and managers/ consultants.

Course Educational Objectives (CEO):

1. This course is designed to introduce students to the fundamental concepts and practices of lean construction.
2. This course provides an overview on optimizing efficiency, reducing waste, and improving project management in the construction industry.
3. This course provides an in-depth exploration of lean principles as applied to the construction industry.
4. This course will help students learn how to identify and eliminate waste, streamline processes.
5. This course will help students learn how to enhance project management to improve the overall efficiency and effectiveness of construction projects.

UNIT 1 : Introduction to Lean Overview; Lean Overview;

History of Lean and other Management Philosophies; Toyota Production System (TPS); What is Lean?, Lean Construction Timeline; Lean Project Delivery vs LC; Project Management vs LC, Key Lean Concepts#1 (Wastes), Key Lean Concepts#1 (Value, Value Stream, Flow, Pull, Perfection), Key Lean Concepts#2 (Continuous Improvement, Collaborative working, Production System, Lean Culture), Key Lean Tools#1 (Productivity Measurement System, Work Sampling, Value Stream Mapping), Lean Overview - Key Lean Tools#2 (5S, CPS/ LPS, Big Room Approach), Lean Overview - Future module,

UNIT 2 : Productivity Measurement System (PMS)

Productivity Measurement and Improvement, Construction Productivity, Productivity levels, What is Productivity, Production?; Illustration, Productivity & Production Impact; Visualizing Activity Productivity & Production Performance, Profit, ROCE, Influences on Operational Productivity; Operational view vs. System view, Summary, Outline, Planning and monitoring levels; Productivity Measurement System, Measuring Output - Level of Effort (LOE), Productivity and Production Calculations: daily, weekly, cumulative, Productivity and Production Calculations: Performance Evaluation, Productivity and Production Calculations: Workhour Forecast and Analysis of Trends, Factors Influencing Productivity, Productivity Improvement Approach, Summary,

UNIT 3

Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping

Sampling/ Surveying Techniques - Data Sources in Construction, Construction Activity with Workers doing VA/ NVAN/ NVA; WS vs PMS; Work Sampling, Sampling basics, Sampling in construction, Steps to Conduct a Work Sampling Study; WS Outcomes, Illustration of Tour-based Work Sampling Approach, Illustration of Crew-based Work Sampling Approach, Explore relationship between WS Categories and Productivity; Summary, Sampling/ Surveying Techniques - Foreman delay survey, Sampling/ Surveying Techniques - Foreman delay survey - Implementation, Foreman delay survey - Illustrations; Comparison - PMS vs WS vs FDS - discussion, Value Stream, Value Stream Mapping (VSM), System vs Process, References, Illustration: Value & Value Stream in Food Delivery, Value, Value Stream, VSM/PM, Language, Basic VSM - current state and future state, Key steps for VSM, Work: Degrees of Granularity, Measurement Metrics, VSM - Example 1 (Reinforcement), VSM - Example 2 (Blockwork); Summary, Flow Process Chart, Symbols, Process mapping - steps and timing, Measurement metrics, Process mapping - Illustration: Reinforcement shifting, VSM vs PM; Process Flow chart - variations; Swim-lane diagrams; Summary,

UNIT 4

5S (Part 1 and 2, Collaborative Planning System (CPS)/ Last PlannerTM System (LPS)

Understand the Basics of 5S, Explanations and 5S Steps, Understand Each in Detail - Sort, Set in Order, Shine, Understand Each in Detail - Standardize, Sustain, 5S: Key Points, Benefits, Signs of a 5S Site, Experiment 5S with Yourself First, Project Implementation, Facilitations, Why 5S May Fail?, Recap, Understand the Applications of 5S through Case Studies_2 cases, Understand the Applications of 5S through Case Studies_3 cases, Understand the Applications of 5S through Case Study - Ms Diamond Barretto (Godrej Construction), Current Project Performance, Workflow Variation, Traditional PM vs Lean Production Management, Some Key Lean Concepts, Focusing on frontline Execution, CPS Collaborative Planning System, CPS Process, Overall Schedules (Master Schedule,Phase Schedule,LAP, Weekly Plan),Constraint Analysis, Collaborative Pull Planning, Percentage Plan Completed (PPC), Daily Huddle, Variance Analysis, RCA, Lean Work Structuring, Impact of PPC on Productivity, Key aspects,Advantages,The Necessary Conditions,Blocks - CPS,Summary, COLPLASSE: Look-Ahead Plan, Constraint Analysis, Weekly Plan, Summary, Lean Project Delivery System, Conclusion, Understand the Applications of CPS/LPS through Case Studies, CPS/LPS implementation in Construction Projects

UNIT 5

Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Sites

Introduction of Big Room Approach, Some Requirements for Efficient Working, Virtual BR Meetings, Big Room Approach through Case Studies, Big Room Approach - Implementation case from URC Construction, Future Construction Site, Lean Tools and Processes, Automation strategies & impact, Programming, Document Management, Workflow Process, Communication/Collab./Authen., Sensing, Mechanisation/ Robots, Visualization, AI/ Analytics, BIM, CPS/ IOT/ Industry 4.0, Digital Twin, Challenges and Causes, Problem?, Lean, BIM?, Traditional vs BIM, Tools/Technology providers, BIM uses; Metrics, BIM and Lean, Implementation Framework, BIM Execution Plan, Evidence Cases, Key takeaway, How to Start Practicing Lean Tools in Project Sites-1: Work Sampling, How to Start Practicing Lean

Tools in Project Sites-1: VSM, How to Start Practicing Lean Tools in Project Sites-1: 5S, How to Start Practicing Lean Tools in Project Sites-1: CPS/ LPS, How to Start Practicing Lean Tools in Project Sites-1: Big Room Approach

Textbooks:

1. Koskela, L., Tzortzopoulos, P., & Kagioglou, M. 2020. Lean construction - Core concepts and New frontiers. ***Lean Construction: Core Concepts and New Frontiers***.

Course Further Reading:

1. NPTEL - Introduction to Lean Construction 105106213

PE15	24CIVL6221: MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

The study of this course helps student in identifying the causes for failure of a structure and adopting a suitable repair or rehabilitation technique. The knowledge gained by the students on repair materials and methods learnt helps in finding solution to problems related to maintenance and repair of existing structures.

Course Educational Objectives (CEO):

- Illustrate durability and corrosion of concrete.
- To assess the damage to structures using various field tests.
- To Familiarize various types and properties of repair materials.
- To list various repair techniques of damaged and corroded structures.
- Demonstrate the principles of rehabilitation and retrofit techniques.

UNIT 1

Durability and Deterioration of Concrete:

Physical causes:

Durability of concrete, causes of distress in concrete structures, Shrinkage in concrete, honeycombing in concrete, creep of concrete, Temperature changes – Internally generated temperature differences, Externally generated temperature differences, Fire on concrete, Thermal movement in concrete,

Corrosion:

Corrosion process, Damages due to corrosion

UNIT 2

Damage Assessment

Investigation of Damage- Observation, Assessment Procedure

Non-Destructive Testing Methods: Introduction, Non-Destructive Testing Methods, Surface Hardness Test, Ultrasonic Pulse velocity test,

Semi-Destructive Testing Systems: Core Sampling and Testing, Half -Cell potential survey

Performing any NDT test in the Laboratory.

UNIT 3

Repair Materials

Polymeric repair materials, Polymeric coatings, Polymer concrete/mortar composites, Fibre reinforced concrete, Glass fiber reinforced concrete, Polyprolene fibre, Carbon fibres, Fiber reinforced polymer composites, Concrete made with industrial wastes, Bacterial concrete.

Case study on use of repair materials (reference to be taken from any journal paper)

UNIT 4

Evaluation and Repair of Cracks:

Symptoms and Diagnosis of Distress, Evaluation of cracks, Selection of Repair Procedure, Repair of cracks-Preparation of Surface, Repair Techniques, Common types of repairs: Sealing of cracks, Flexible sealing, Providing additional steel, Stitching of cracks, Repair by jacketing, Autogenous Healing.

UNIT 5

Rehabilitation and Strengthening Techniques

Rehabilitation Techniques:

Replacement Mortar- Epoxy bonded epoxy mortar, Replacement Concrete- Epoxy-bonded Replacement concrete, Application, Shotcrete or Gunite, Grouting- Portland Cement Grouts, Polymer Grouts, Epoxy Grouting, Resin injection, Sprayed concrete, Slab jacking technique, Cathodic Protection

Strengthening methods:

Introduction-Need for strengthening, Structural Concrete Strengthening, Column Strengthening, Strengthening with external reinforcement, External Post-tensioning, Section Enlargement, Guidelines for Seismic rehabilitation of existing buildings.

Case study on either Rehabilitation and Strengthening method (reference to be taken from any journal paper)

Course Outcomes:

After completion of this course, the student will be able to

1. explain the mechanisms of degradation of concrete structures affecting durability(L2).
2. develop a know how of the Concrete repair industry equipped with variety of repair materials and techniques(L6).
3. select appropriate repair technique and repair material(L5).
4. Identify different types of cracks in concrete(L3)
5. decide the appropriate rehabilitation/retrofitting technique for damaged structural members(L5).

TextBooks:

1. B.Vidivelli, Rehabilitation of Concrete Structures, 1/e, Standard Publishers Distributors, 2018.
2. M.L.Gambhir, Concrete Technology: Theory and Practice, 4/e, Tata McGraw Hill Education Private Limited, 2013.

References:

1. Peter.H.Emmons and Gajanan.M.Sabnis, Concrete Repair and Maintainence, 2/e, Galgotia Publications Pvt Ltd, 1992.
2. S.Mahaboob Basha, A textbook of Concrete Technology, 1/e, Anuradha Publications, 2011.
3. J.Bhattacharjee, Concrete Structures Repair Rehabilitation and Retrofitting, 1/e, CBS, 2017.
4. P.C.Varghese, Maintenance Repair and Rehabilitation and Minor works of Buildings, 1/e, Prentice Hall India Learning Private Limited, 2014.

PE-16	24CIVL3151: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:

Remote Sensing (RS) is the science and art of obtaining information about an object, area or phenomenon, using either recording or real time sensing devices that are not in physical contact with the object. Geographic Information Systems (GIS) and their applications emphasis on cartographic concepts, strengths and limitations of different GIS data formats, spatial statistics, and spatial analysis. Students use a variety of specialized GIS tools to solve spatial problems and map spatial phenomena.

Course Educational Objectives:

This course provides an overview of remote sensing and geographic information systems

- Familiarize about the concept of GIS, its components, along with its advantages
- Focus about different available data formats in GIS
- Impart knowledge on spatial data structures details and input, management and output processes
- Explain different possible areas of GIS application
- Impart the knowledge of GIS in implementing in various case studies

Unit I

Introduction: Definition of terms, Concepts and types of remote sensing; principle/ stages in remote sensing technology.

Basic Principles of Remote Sensing: EMR, EMS, Energy Interaction with earth's atmosphere and earth surface; Definition of radiometry; Black body radiation; Reflectance; spectral reflectance of land covers; Spectral Signatures. Indian space programme - Research and development.

Unit II

Remote sensing technology:

Types of sensors- passive sensors and active sensors; Push broom scanners and whisk-broom scanners; Microwave sensors; Thermal sensors, Hyperspectral sensors.

Types of platforms- airborne remote sensing, space borne remote sensing; Atmospheric condition and altitude; Orbital elements of satellite.

Characteristics of remote Sensing data, Photogrammetry – Satellite data analysis – Visual image interpretation, Digital image processing.

Unit III

Introduction, Information systems, spatial and non-spatial information, basic components of GIS, commercially available GIS hardware and software, Data models: Basic Data Models – raster and vector, Spaghetti model and Topological model. GIS data formats and standards. Co-ordinate systems and Map Projections

Unit IV

Data base management system (DBMS), Primary and secondary methods of acquisition of spatial and non-spatial data. Scanning, Digitizing, topology building-editing- cleaning. Linking of spatial and non-spatial data. Vector and Raster data editing, Vector Data Analysis, Raster Data Analysis, , mapping qualitative and quantitative data.

Unit V

Caste Studies: Applications of GIS in Natural Resources Management, Disaster Management, Agriculture, Water resources management, Land suitability analysis.

Course Outcomes:

At the end of course the students will be able to

- Show knowledge on RS-GIS concepts and terminology along with various commercially available GIS software [L1]
- Develop skills in collecting, editing different types of GIS data [L3]
- Demonstrate expertise on database management in RS- GI S[L2]
- Summarize the applications of GIS [L2]
- Interpret case studies with GIS applications [L3]

Text Books

- Joseph, G., & Jeganathan, C. (2018). Fundamentals of Remote Sensing (3rd ed.). Universities Press
- Lillesand, T. M., Kiefer, R. W., & Chipman, J. (2015). Remote Sensing and Image Interpretation (7th ed.). Wiley.
- Basudeb Bhatta, Remote Sensing and GIS, 3rd edition, OUP India, 2021
- Kang-tsung Chang, Introduction to Geographic Information Systems, Ninth edition, McGraw Hill, 2020

Reference Books

- American Society for Photogrammetry and Remote Sensing. (1983). Manual of Remote Sensing (2nd ed., Vol. 1: Theory, instruments and techniques). Falls Church, VA: American Society of Photogrammetry.
- Curran, P. J. (2015). Physical aspects of remote sensing. John Wiley & Sons.
- Sabins, F. F. (1997). Remote sensing: principles and interpretation (3rd ed.). New York: W.H. Freeman and Co.
- Campbell, J. B. (2011). Introduction to remote sensing (5th ed.). Guilford Press.
- Anji Reddy, Text Book of Remote Sensing and Geographical Information Systems, BS Publications/BSP Books, 2012.

NPTEL Course:

https://archive.nptel.ac.in/courses/105/107/105107201/
https://archive.nptel.ac.in/courses/121/107/121107009/
https://archive.nptel.ac.in/courses/105/103/105103193/
https://nptel.ac.in/courses/105108077

PE-17: 24CIVL6241: INFRASTRUCTURE PLANNING

L T P C

3 0 0 3

This course attempts to introduce students to 'real world' risks and challenges in managing infrastructure. After a brief introduction to the infrastructure planning process as well as the state of infrastructure across sectors in India, we systematically look at various processes and evaluations that undergird infrastructure projects and their planning. We then look at a variety of real-world case studies and novel solutions or fixes that can help us execute infrastructure projects better. The course also involves one or more guest lectures to ensure that what is being discussed is practically applicable. The students would be made industry ready with relevance to construction organisations such as L&T, GMR Infra, consulting firms such as PwC, Deloitte, Quasi-Government Bodies etc., or can become planning and management consultants.

Course Educational Objectives:

1. To familiarise the students with the concepts of the infrastructure and its planning activities.
2. To emphasise the Indian infrastructure development and equip abilities to select the best alternative by using scientific methodologies.
3. To enable the student to understand the economic evaluation of infrastructure projects
4. To enable the student to understand the financial evaluation of infrastructure projects
5. To equip the student to make the infrastructure planning process and decision-making with the use of real project analysis cases

UNIT 1 Introduction to Infrastructure Planning 7 Hours

Definitions of infrastructure; Economic multiplier effects of infrastructure; Typical infrastructure planning steps; Planning and appraisal of major infrastructure projects; Screening of project ideas; Life cycle analysis;

UNIT 2 Infrastructure Scenario in India and Alternative Selection 8 Hours

The Infrastructure Scenario in India, Urban Infrastructure in India, The Power Sector in India, The Water Sector in India, Transportation Infrastructure, Telecommunications sector in India, Rural Infrastructure in India, Road Infrastructure, Development in India, Rural Road Development in India - Opportunities and Challenges, Key Issues - Sector-wise;

Multi-criteria analysis for comparison of infrastructure alternatives;

UNIT 3 Economic Analysis 8 Hours

Economic Analysis – Concepts and Applications, Principles of methodologies for economic analysis of public works, Social welfare function, indifference curves and trade-offs, Demand curves and price elasticities; Benefit-cost ratio and internal rate of return; Shadow pricing; Accounting for risk and uncertainty;

UNIT 4 Financial Evaluation 8 Hours

Financial Evaluation - Time value of money, Investment criteria, Project cash flows – elements and basic principles of estimation, Financial estimates and projections, Cost of capital, Rate of return;

UNIT 5 Project Analysis and Student Case Studies 8 Hours

Project risk analysis; Political and social perspectives of infrastructure planning;

Case studies from developed and developing countries of notable megaprojects, smart city projects, major urban infrastructure projects etc. Student presentations on hypothetical case studies (or) with problem-based learning methodology

Textbooks:

1. Goodman, A., & Hastak, M. 2015. ***Infrastructure Planning, Engineering, and Economics*** (2nd ed.). New York: McGraw Hill Professional and ASCE Press.
2. J. Parkin and D. Sharma, *Infrastructure planning*, Thomas Telford, London, 1999.

References:

1. P. Chandra, *Projects: Planning, analysis, selection, financing, implementation, and review*, Tata McGraw-Hill, New Delhi, 2009.
2. J. D. Finnerty, *Project financing - Asset-based financial engineering*, John Wiley & Sons, New York, 1996.
3. L. Squire and H. G.van der Tak, *Economic analysis of projects*, John Hopkins University Press, London, 1975.
4. T. J. Webster, *Managerial economics: Theory and practices*, Elsevier, New Delhi, 2003.

Course Further Reading:

1. Haldea, G. 2011. ***Infrastructure at crossroads: The challenges of governance***. Oxford University Press.

Course Outcomes:

1. At the end of unit 1, the student will be able to understand and identify the various kinds of infrastructure projects, the key requirements, and the planning steps.
2. At the end of unit 2, the student realises the infrastructure demand-supply gap in India concerning all major sectors of infrastructure and applies scientific tools to identify the best alternative among available options
3. At the end of unit 3, the student performs economic analysis and develops economic models for any infrastructure project
4. At the end of unit 4, the student can design financial evaluations and develop financial models for a given infrastructure project.
5. At the end of unit 5, the student will be able to understand, assimilate, and deploy infrastructure planning concepts and methodologies to real projects/contexts

	L	T	P	S	J	C
PE -18: 24CIVL2131: Environmental Impact Assessment	3	0	0	0	0	3

Course Description:

The Environmental Impact Assessment procedure in India has been developed primarily as an aid to the environmental planning of new developmental projects. EIA essentially is a preventive process and it seeks to avoid costly mistakes in project planning and development. The main focus of this course is to expose the students to the need, methodology, documentation and application of Environmental Impact Assessment and to develop the skill to prepare Environmental Management Plan

Course Educational Objectives:

- to introduce basic ideology of EIA
- to expose the procedure of EIA analysis
- to study various EIA methodologies
- to impart about environmental auditing
- to acquaint about the preparation of EIA statements for various industries

UNIT 1

EIA – Introduction -Definition – Basic concepts and principles of EIA – Origin and development of EIA - Short-term and Long- term objectives – EIA guidelines 2006 (Notification of Government of India) — Merits and Demerits of EIA

UNIT 2

Basis for Environment Impact Assessment – Types of impacts (Negative & Positive, Primary & Secondary, Reversible and Irreversible Tangible and Intangible) Components of EIA: Screening of Projects - Public Participation - Preparing environmental impact statements. Factors affecting E-I-A, Impact evaluation and analysis - preparation of Environmental Base map.

UNIT 3

EIA Methodologies: Introduction- Criteria for the selection of EIA Methodology, EIA methods - Adhoc Method, Checklist Approach, Matrix Methods, Network Methods, overlay methods- cost/benefit Analysis - Introduction and Methodology for the assessment of soil and ground water-Delineation of study area- Identification of actives.

UNIT 4

Environmental Auditing: Scope, Objectives and Procedures for environmental auditing. Types of environmental Audit- benefits of environmental audit- stages of Environmental Audit -Post Audit activities. Environmental Management System (EMS): EMS standards, The ISO 14000 series, The ISO 14001.

UNIT 5

Preparation of Environmental Impact assessment statement for various Industries.

Text Books:

1. Y. Anjaneyulu., Environmental Impact Assessment Methodologies, B. S. Publications, Kakinada, 3/e 2020.

2. N. S. Raman, A. R. Gajbhiye, S. R. Khandeshwar., Environmental Impact Assessment, I.K.International Publishing house Pvt,Ltd, New Delhi,2014.

3. Anji Reddy Mareddy , Anil Shah , Naresh Davergave., Environmental Impact Assessment: Theory and Practice, Butterworth-Heinemann , 2017.

References

4. V.V.N. Murty, Madan K. Jha, "Land and Water Management Engineering", Kalyani Publishers, 6 th Edition, 2013.
5. Charles H.Eccleston , Environmental Impact Assessment-A Guide to Best Professional practices, CRC Press, Taylor & Francis

Course Outcomes:

After completion of this course, the student will be able to

1. outline the concepts and principles involved in EIA –L2
2. make use of environmental base map –L3
3. select best EIA methodology to assess the impact – L3
4. summarize the concepts of environmental audit –L2
5. analyze EIA statements of various industries –L5

Program Elective - 19	24CIVL6251: HUMAN RESOURCE MANAGEMENT IN PROJECTS	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:
The purpose of this course is to help students to understand the basic principles and techniques of Human Resource Management. The course takes a practical view that integrates the contributions of the behavioral sciences with the technical aspects of implementing the HR function in the real world. This basic understanding of Human Resource Management in projects is essential for the student when he enters diverse workplaces. The key objective of this course is to give an understanding that HR Management is more than just accepting employment applications and keeping records; it is a central and strategic organizational activity of increasing complexity and importance.

Course Educational Objectives:
This course provides an overview of Human Resource Management in Projects

- To provide conceptual understanding of Management Concepts
- To familiarize the students with the contemporary issues in Management
- To understand and appreciate the human behavior in organizations
- To Comprehend in-depth the theoretical framework, functions and the basic principles of Human Resource Management in Projects
- To apply the principles and techniques of Human Resource Management in Projects gained through this course to the discussion of major personnel challenges and the solution of real project problems

Unit I
Human Resource management: Introduction - Fundamentals of HRM - The Nature and Scope of HRM - Evolution of HRM Models of HRM -The Formbrun -The Harvard Model - The Guest -The Warwick-Dave Ulrich Model Functions and Role of HR Manager - Skills for HR Professionals - Challenges of HRM**. Case studies based on The Harvard and Warwick-Dave Ulrich model.**

Unit II
Procurement: - Job Analysis - Process of Job Analysis, Job Description and Job Specification, Job Design Steps in job design, contemporary issues in Job Design - Job Evaluation - Methods of Job Evaluation Human Resource Planning, Importance, HR Planning Process - Recruitment - Nature, Sources of Recruitment - Latest Methods of Recruitment - Selection - Significance of Selection - Selection Process, Barriers of selection - Onboarding process

Unit III

Development: Training - Need, Training Process – Designing the Training Program - Methods of Training, the Difference between Training and Development Career Development, Roles for Career Development - Performance Appraisal – Objectives Methods of Performance Appraisal.

Unit IV

Compensation and Maintenance: Compensation - Meaning, Components of Compensation, Ideal Compensation System Factors Influencing Employee Compensation, Pay Rates, Basic and Supplementary Pay Executive Remuneration, Components of Executives pay, Trends in

Executives' Pay Employee Safety, Need for safety, Safety Standards -Types of Accidents, Health - Physical and Mental Health, Work Stress. Case studies of latest technologies.

Unit V

HRM in projects: Comparative Management Styles and approaches for project - Management Practices Organizational Creativity and Innovation in project - Management of Innovation - Entrepreneurial Management – Benchmarking, Best Management Practices across the world - Select cases of Domestic & International Corporations - Management of Diversity for handling projects. **Case studies of successful strategic human resource planning in project (challenges and solution).**

Course Outcomes:

At the end of course the students will be able to

1. Understand the fundamentals, evolution & challenges of HRM
2. Explore the role of HRM in procurement of human resources
3. Evaluate training needs, methods of appraisal and perceptual errors
4. Analyze the basic factors in designing the compensation
5. Implement and understand the role of HRM in projects

Text Books

1. Gary Dessler & Biju Varkkey, "Human Resource Management", Pearson, New Delhi, 16th edition 2020.
2. George W Bohlander, Scott A Snell, "Principles of Human Resource Management", Cengage Learning, 2017.16th edition.
3. Aswathappa, K., Human Resource and Personnel Management: Text & Cases, TMGH
4. Subba Rao, P., Personnel and Human Resource Management (Text & Cases), Himalaya Additional Reading
5. Edwin B Flippo, "Personnel Management", Tata McGraw Hill Publishing, New Delhi, 1984
6. John H. Bernardin, "Human Resource Management - An Experiential Approach", Tata McGraw Hill, New Delhi, 2013
7. Mirza, Saiyadain, "Human Resource Management", Tata McGraw Hill, New Delhi, 2013 •Gary Journal(s)
8. Harvard Business Review, Harvard Business School Publication USA
9. People Matters online Magazine
10. Human Capital Magazine 11. Vikalpa, Indian Institute of Management, Ahmedabad

Reference Books

1. Tripathi & Reddy, Principles of Management, Tata Mcgraw-Hill, New Delhi,2021
2. Laurie Mullins, Management and Organisational Behaviour, Pearson, New Delhi,2023
3. Meenakshi Gupta, Principles of Management, PHI Learning, New Delhi, 2009
4. Fred Luthans, Organisational Behaviour, Tata Mcgraw-Hill, New Delhi 2011.
5. Stephen Robbins, Organisational Behaviour, Pearson, New Delhi 2018.
6. Ricky Griffin, Management: Principles & Applications, Cengage, New Delhi,2009
7. Koontz, Weirich & Aryasri, Principles of Management, Tata Mcgraw-Hill, New Delhi,2004

Human Resource Management in Projects NPTEL Course:
https://archive.nptel.ac.in/courses/110/105/110105069/

Program Elective-20	24CIVL6261: ORGANIZATION MANAGEMENT	L	T	P	S	J	C
		3	0	0	0	0	3

Preamble:
This introductory course is designed for students to improve their effectiveness as a manager and leader by introducing you to frameworks for understanding organizations and organizational processes. Organizations have been studied from the perspective of several social science disciplines, including psychology, sociology, economics, anthropology and political science. The field on which this course is based, organizational behavior, draws from all of these disciplines and applies the insights derived from the pertinent research. This course will introduce you to this research and ways to apply the knowledge to particular situations through your analysis and subsequent class discussion of case studies.

Course Educational Objectives:
This course provides an over view of Organization Management

- To acquaint the students with the concept of business organization and concepts of general management and its implementation in organizations
- To understand the holistic approach to addressing issues facing an organization
- To apply frameworks and theories to analyze situations in which organizations are undergoing change.
- To apply frameworks and theories to analyze tools and methods used to empower, inspire and hold accountable members of an organization.
- To identify and clearly define a problem/issue; analyze and question data and information in a rigorous manner.

Unit I
Fundamental concepts: Concepts: Business, trade, industry and commerce – Business: Features of business- Trade: Classification, Aids to trade – Industry: Classification – Commerce – Relationship between trade industry and commerce – Functions of Business. Forms of Business Organization Sole Proprietorship: meaning – characteristics – Advantages &disadvantages Partnership - -Meaning – Characteristics – Kinds of Partners – Registration of Partnership – Partnership Deed – Limited liability Partnership (LLP) Joint Hindu family: Characteristics – Advantages and limitations. Joint Stock Company: Meaning-characteristics-advantages- kinds of companies – difference between private and public companies

Unit II
Nature of management: - Definition – Management an Art, Science or Profession – Manager Defined – Manager vs Leader - Levels of Management – Skills of Management. Management Thought: Contributions of Henry Fayol (14 principles) – F. W. Taylor's Scientific Management – Max Weber's theory of Bureaucracy. Case study based on Henry Fayol principles and Max Weber's theory.

Unit III
Planning and decision making: Planning: Definition - Importance - Steps in planning – limitations - Types of Plans Decision making: Definition – Process – types of decisions: – Programmed and non-programmed decisions – Strategic and routine decisions- major and

minor decisions – Individual and group decisions. Case studies on organization behavior and management.

Unit IV

Organizing, delegation and decentralization: Meaning – Organization Structure – Organization chart – Formal and informal Organization – Span of Management – Factors determining Span of Management – Line and Staff concepts. Elements of Organization: Delegation of authority: Meaning – advantages and disadvantages Decentralization: Meaning – advantages and disadvantages

Unit V

Directing, co-ordination and control: Motivation: Definition – Meaning-Types-Theories of motivation: The Need Hierarchy Theory – Hygiene approach to motivation Leadership: Definition - Leadership styles: Autocratic, Democratic, Free Reign – Managerial Grid. Communication: Definition – Importance – Process – Barriers to effective communication. Coordination- Definition –need -Difficulties-Effectiveness-Definition –Control process Control -Definition –Control Process-Essential of good control system-merits and demerits. Exposure to AI based operational management software.

Course Outcomes:

At the end of course the students will be able to

1. To understand the concepts and form of Business organizations L1
2. To study contributions of Taylor, Henry Fayol and understand various systems and approaches to management L1
3. To demonstrate the planning and decision-making approaches by using appropriate strategies to accomplish a given job L3
4. To understand the need and importance of organization process &, structure, span of control, departmentation and delegation of authority L1
5. To analyze the need and importance of motivation, good communication and to interpret various leadership styles with effective coordination and control mechanisms L4.

Text Books

1. R.K.Sharma and Shashi k Gupta : Industrial Organisation and Management - Kalyani Publications 2021.
2. CB.Gupta - Management Theory and practice, - Sultan Chand 2021.
3. V.S.P.Rao - Management Excel Books India 2023.
4. Stephens Robbbins - Management,Pearson Education 2021.

Reference Books

1. Sherlekar - Business Organisation and Management - Himalaya Publishers 2017.
2. C.B.Gupta - Industrial Organisation and Management - Sultan Chand 2017.
3. Harold Koontz Heinz Weihrich and A. Ramachandra Aryasri : Principles of management,McgrawHill 2016.
4. Y.K.Bhushan - Business organization and management - Sultan Chand 2016.
5. L.M. Prasad - Principles & Practice of Management, Sultan Chand 2019.

Organization Management NPTEL Course:

https://archive.nptel.ac.in/courses/110/102/110102016/#

AUDIT COURSES I and II

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EAC741	English For Research Paper Writing	AC	2	0	0	0
2	19EAC742	Disaster Management	AC	2	0	0	0
3	19EAC743	Sanskrit for Technical Knowledge	AC	2	0	0	0
4	19EAC744	Value Education	AC	2	0	0	0
5	19EAC745	Constitution of India	AC	2	0	0	0
6	19EAC746	Pedagogy Studies	AC	2	0	0	0
7	19EAC747	Stress Management by Yoga	AC	2	0	0	0
8	19EAC748	Personality Development through Life Enlightenment Skills	AC	2	0	0	0
9	19EAC750	Developing Soft Skills And Personality	AC	3	0	0	0

19EAC741: ENGLISH FOR RESEARCH PAPER WRITING

L	T	P	C
2	0	0	0

This course introduces the student, to the different aspects of research paper writing including planning, preparation, layout, literature review write-up etc. Specifically the perspective and style of writing in different sections of a research paper is highlighted. Students will exposed to English language skills relevant to research paper writing.

Course Objectives:

- To write clearly, concisely and carefully by keeping the structure of the paper in mind.
- To use standard phrases in English and further improve his command over it.
- To write with no redundancy, no ambiguity and increase the readability of the paper.
- To plan and organize his paper by following a logical buildup towards a proper conclusion.
- To decide what to include in various parts of the paper.
- To write a suitable title and an abstract in order to attract the attention of the reader.
- To identify the correct style and correct tense.
- To retain the scientific value of the paper by using minimum number of words.

Unit I **5L**

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Learning Outcomes:

After the completion of this unit, the student will be able to

- To know the expectations of various journals and referees (L2)
- To know the typical structure of a paper (L3)
- Learn to put words in a sentence in the correct order (L4)
- To write short and clear sentences from the very beginning of the paper (L4)
- To increase the readability of the paper by making it easy to read and 100% clear (L4)
- Learn to be concise without losing any important content (L4)
- To avoid some typical grammar mistakes made in research papers (L4)

Unit II **5L**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Learning Outcomes:

After the completion of this unit, the student will be able to

- Learn to make useful contribution worth recommending for publication (L4)
- Learn good use of language to make readers notice the key findings (L4)
- Learn to anticipate or predict possible objections to the claims made in the paper(L5)
- To understand what is plagiarism, and how to paraphrase other people's work (L4)
- Learn to attract the right kind of readers with a suitable title(L3)
- Learn to sell the abstract to potential readers by attracting their curiosity (L2)

Unit III **6L**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Learning Outcomes:

After the completion of this unit, the student will be able to

- have a deep knowledge about everything that has been previously written on the topic and decide what is important to know in Introduction. (L3)
- Learn to provide the right amount of literature regarding the sequence of events leading up to the current situation in the Literature review(L4)

Unit IV **6L**

Writing Skills: skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Learning Outcomes:

After the completion of this unit, the student will be able to

- Learn to describe the materials used in experiments and/or the methods used to carry out the research (L2)
- The key skill is in reporting the results simply and clearly (L3)
- Learn to structure the Discussion and satisfy the typical requirements of the referees (L4)
- Learn to provide a clear and high-impact take-home message in the conclusion (L5)

Unit V **6L**

Good Paper Writing: Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.

Learning Outcomes:

After the completion of this unit, the student will be able to

- Learn various lists of frequently used phrases that have a general acceptance in all disciplines and use in specific sections of the paper (L3)
- Learn various kinds of things one should look for when doing the final check (L3)

Text Book (s**):**

1. Goldbort R, Writing for Science, Yale University Press, 2006
2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006
3. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM, Highman, 1998.

References:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Course Outcomes:

By the end of the course the students will be able to:

- Frame the structure of the paper precisely. (L2).
- Improve his command over English by using standard phrases. (L3).
- Avoid repetition and mistakes in the paper and increase its readability. (L3).
- Organize the paper logically towards a proper conclusion. (L4).
- Decide on the content to be included in various parts of the paper. (L5).
- Identify whether to use personal or impersonal style in the paper. (L5).
- Express the content in a clear and concise way. (L6).
- Attract the attention of the reader by providing a suitable title and an appropriate abstract. (L6).

19EAC742: DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

This course is intended to provide fundamental understanding of different aspects of Disaster Management. It will expose the students to the concept and functions of Disaster Management and to build competencies of Disaster Management professionals and development practitioners for effective supporting environment as put by the government in legislative manner. It would also provide basic knowledge, skills pertaining to Planning, Organizing and Decision-making process for Disaster Risk Reduction.

Course Objectives

- to provide students an exposure to disasters, their significance, types & Comprehensive understanding on the concurrence of Disasters and its management.
- to ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention, risk reduction and the basic understanding of the research methodology for risk reduction measures.
- equipped with knowledge, concepts, and principles, skills pertaining to Planning, Organizing, Decision-making and Problem solving methods for Disaster Management.
- to develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Unit I **5L**

Introduction Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning, list the factors and mention the significance of disaster (L1)
- distinguish between hazard and disaster (L3)
- compare manmade and natural disaster (L3)
- list the types of disaster and describe their magnitude (L2)

Unit II **5L**

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Learning Outcomes

After the completion of this unit, the student will be able to

- list the different repercussions of disasters and hazards(L1)
- describe the characteristics of natural disasters and the magnitude of their losses(L2)
- describe the characteristics of man-made disasters and the magnitude of their losses(L2)
- elaborate the outbreaks of diseases and epidemics after disasters (L3)

Unit III **6L**

Disaster Prone Areas in India Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the seismic zones and their characteristics(L2)
- identify the areas prone to floods and droughts(L1)
- distinguish between landslides and avalanches(L3)
- identify areas prone to cyclonic and costal hazards(L4)
- enumerate the post disaster diseases and epidemics(L2)

Unit IV **6L**

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, media reports: governmental and Community Preparedness.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the monitoring of phenomena triggering a disaster/hazard(L2)
- evaluate the risk with the use of remote sensing and meteorological data(L5)
- list the governmental and community measures for disaster preparedness(L2)

Unit V **6L**

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Learning Outcomes

After the completion of this unit, the student will be able to

- define and list the elements of disaster risk(L1)
- enumerate the measures for risk reduction(L2)
- apply the techniques of risk assessment (L4)
- identify the means of people's participation in risk assessment(L2)

Text Book(s):

1. R. Nishith, Singh A.K., Disaster Management in India: Perspectives, issues and strategies, New Royal Book Company., 2008.
2. Sahni, Pardeep, Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi., 2012
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep and Deep Publication, 2007.

Course Outcomes

At the end of the course, student will be able to

- Identify management activities in pre, during and post phases of Disasters. (L1)
- Plan disaster management activities and specify measure for risk reduction(L4)
- apply risk assessment techniques in real life disaster scenarios(L4)

19EAC743: SANSKRIT FOR TECHNICAL KNOWLEDGE

L	T	P	C
2	0	0	0

This course is intended to expose the student to the fundamentals of Sanskrit language and its technical utility in forming the core principles of many engineering branches. Students taking this course shall be able to relate the core principles of engineering branches to semantics of Sanskrit language

Course Objectives

- to provide the knowledge of Sanskrit alphabets
- to expose the students to the basic grammar and sentence formation in past/present/future tenses
- to provide a classification of Sanskrit literature and its associated roots
- to demonstrate the relation of core engineering principles to the roots of Sanskrit literature

Unit I **9L**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Learning Outcomes

After the completion of this unit, the student will be able to

- List the different alphabets in Sanskrit (L1)
- Form sentences in past, present and future tenses (L4)
- Form concise/simple sentences with the right usage of words (L4)

Unit II **9L**

Order, Introduction of roots, Technical information about Sanskrit Literature.

Learning Outcomes

After the completion of this unit, the student will be able to

- classify the different branches of Sanskrit literature (L3)
- describe the order and roots of Sanskrit literature (L2)
- relate the applicability of Sanskrit literature to technical principles (L5)

Unit III **9L**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Learning Outcomes

After the completion of this unit, the student will be able to

- relate the technical concepts of engineering to principles of electrical technology (L2)
- relate the technical concepts of engineering to principles of mechanical engineering (L2)
- apply the use of Sanskrit knowledge to describe the mathematical principles (L4)

Text Book(s):

1. Dr.Vishwas, Abhyaspustakam, Samskrita Bharti Publication, New Delhi, 2005.
2. Vempati Kutumb Shastri, Teach Yourself Sanskrit, Prathama Deeksha, Rashtriya Sanskrit Sansthanam, New Delhi Publication, 2003.
3. Suresh Soni, India's Glorious Scientific Tradition, Ocean books, New Delhi, 2011.

Course Outcomes

After successful completion of the course, the student will be able to

- get a working knowledge in illustrious Sanskrit, the scientific language in the world (L3)
- get a Learning of Sanskrit to improve brain functioning (L4)
- develop the logic in mathematics, science & other subjects with principles of sanskrit(L4)
- explore the huge knowledge from ancient literature with the help of sanskrit(L5)

19EAC744: VALUE EDUCATION

L	T	P	C
2	0	0	0

This course is intended to expose the student to the need for human values and methods to cultivate them for leading an ethical life with good moral conduct. Students taking this course will be able to experience a change in personal and professional behavior with these ethical principles guiding him throughout life

Course Objectives

- to expose the student to need for values, ethics, self-development and standards
- to make the student understand the meaning of different values including duty, devotion, self-reliance etc.
- to imbibe the different behavioral competencies in students for leading an ethical and happy life
- to expose the student to different characteristic attributes and competencies for leading a successful, ethical and happy profession life.

Unit I **7L**

Values and self-development –social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

Learning Outcomes

After the completion of this unit, the student will be able to

- define the social values and individual attitudes for self development(L1)
- describe the Indian vision of humanism(L2)
- distinguish between moral and non-moral acts (L3)
- list the standards and value principles for moral conduct (L2)

Unit II **7L**

Importance of cultivation of values. Sense of duty. Devotion, self-reliance. Confidence, concentration. Truthfulness, cleanliness. Honesty, humanity. Power of faith, national unity. Patriotism, love for nature, discipline.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the importance of cultivating values(L2)
- list the different traits of self-developed individual(L1)
- explain the need for loving nature/country/humanity(L2)

Unit III **7L**

Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the benefits of positivie thinking, integrity and discipline(L2)
- list the different methods for avoiding fault finding, anger(L1)
- explain the methods to overcome suffering, religious intolerance, self-destructive habits(L2)

Unit IV **7L**

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the science of reincarnation(L2)
- explain the relation between self-management and good health(L1)
- elaborate the role of different religions in reaching the common goal(L3)
- list the different techniques for mind-control to improve personality and studies(L1)

Text Book(s):

1. Chakroborty S.K., "Values and ethics for organizations: Theory and Practice", Oxford University Press, 1998.

Course Outcomes

After successful completion of the course, the student will be able to

- describe the need for human values and methods for self development (L2)
- elaborate the different traits and benefits of a self-developed individual (L1)
- list the different attributes of self-developed individual (L1)
- elaborate the role and scope of books/faith/health/religions in character building and competence development(L3)

19EAC745: CONSTITUTION OF INDIA

L	T	P	C
2	0	0	0

This course is intended to expose the student to the philosophy of Indian constitution. Students will be able to understand their fundamental rights/duties and governance structure. Students also appreciate the role of election commission in establishing a democratic society.

Course Objectives

- to familiarize the student about the need for a constitution
- to make the student understand the role of constitution in a democratic society
- to acquaint the student with key constitutional features and fundamental rights of a citizen
- to impart the organs of governance and local administration hierarchy and their responsibilities
- to familiarize the student with the role, responsibilities and administration hierarchy of election commission

Unit I **5L**

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working). **Philosophy of the Indian Constitution**: Preamble, Salient Features

Learning Outcomes

After the completion of this unit, the student will be able to

- list the outline of drafting committee and their roles in the making of Indian constitution (L1)
- describe the need and role of a constitution in a democratic society(L2)
- elaborate the salient features of Indian constitution(L3)

Unit II **5L**

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Learning Outcomes

After the completion of this unit, the student will be able to

- list the fundamental rights of a citizen(L1)
- explain the intricacies in the different rights(L2)
- elaborate the fundamental duties of a citizen(L3)
- describe the principles of state policy(L2)

Unit III **6L**

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Learning Outcomes

After the completion of this unit, the student will be able to

- present the hierarchy of governance (L2)
- list the role/responsibilities/powers of different organs of governance(L1)
- elaborate the guidelines for appointment/transfer of judges(L2)

Unit IV **6L**

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and

role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the administrative organizational hierarchy of municipalities and panchayats(L2)
- appreciate the role/responsibilities/powers of mayor, CEO, elected officials(L3)
- appreciate the importance of grass root democracy(L3)

Unit V **6L**

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the administrative hierarchy of election commission(L2)
- elaborate the roles/responsibilities/powers of election commissioners at different levels of hierarchy(L3)
- outline the welfare activities of SC/ST/OBC/Women by different bodies(L3)

Text Book(s):

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1/e, 2015.
3. M. P. Jain, Indian Constitution Law, 7/e, Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes

After successful completion of the course, the student will be able to

- describe the philosophy and salient features of Indian constitution(L2)
- list the constitutional rights and duties of a citizen(L1)
- elaborate the central and local administrative hierarchy and their roles(L2)
- describe the roles/responsibilities/powers of different governing and administrative bodies(L2)
- explain the structure/functioning and power of election commission(L2)

19EAC746: PEDAGOGY STUDIES

L	T	P	C
2	0	0	0

This course is aimed to familiarizing the student with pedagogical principles, practices and methodologies. This course is intended for students interested in pursuing a career in teaching and research.

Course Objectives

- to familiarize the student about the need for pedagogy studies, background and conceptual framework
- to expose the student to pedagogical practices in formal/informal classrooms
- to acquaint the student with type of curriculum and guidance materials for effective pedagogy
- to familiarize the student with classroom practices and curriculum assessment procedures
- to make the student understand the effect of undertaking research on teaching quality

Unit I **5L**

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the aim and rationale behind teacher education(L1)
- classify the different theories of learning (L1)
- elaborate the need and role of curriculum, teacher education (L1)

Unit II **5L**

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the different pedagogical practices used by teachers in formal and informal classrooms(L1)
- explain the pedagogical practices employed in developing countries (L1)
- enumerate the duties of faculty in terms of teaching, research, consultancy, administration (L1)

Unit III **6L**

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Learning Outcomes

After the completion of this unit, the student will be able to

- list the measures for effective pedagogy(L1)
- identify the different documentation required to formalize curriculum implementation and quality assessment(L1)
- describe the teachers attitudes and beliefs in pedagogic strategies(L2)

Unit IV **6L**

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the organizational hierarchy in a school administration system(L1)
- list the different barriers to learning(L3)
- enumerate the methods to overcome limited resources and handle large class sizes(L3)
- describe the follow-up support and peer-support in classroom practices(L2)

Unit V **6L**

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the need for and role of research in teaching profession(L2)
- list the different research activities to be taken up by teachers(L1)
- describe the impact of research on teaching quality and learning process(L2)

Text Book(s):

1. Ackers J, Hardman F, Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261, 2001
2. Agrawal M, Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379, 2004.
3. Akyeampong K, Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID., 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282., 2013.
5. Alexander RJ, Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell., 2001.
6. Chavan M, Read India: A mass scale, rapid, ‘Learning to Read’ campaign., 2003.

Course Outcomes

After successful completion of the course, the student will be able to

- describe the theories of learning and conceptual framework of pedagogy(L2)
- explain the pedagogical practices used by teachers in formal and informal classrooms(L2)
- visualize the administrative hierarchy of schools and colleges and define the role(L3)
- appreciate the need for research and define the future direction of teaching career(L3)
- describe the impact of curriculum and assessment on the teaching learning process of a student(L3)

19EAC747: STRESS MANAGEMENT BY YOGA

L	T	P	C
2	0	0	0

This course is aimed to familiarize the student with basic principles of yoga and different physical/mental practices for managing mind and body. This course helps the student in managing stress during education, home and workplace. Further, principles learnt in this course help in building overall personality for a stress-free, happy and independent life.

Course Objectives

- to familiarize the student about eight parts of yoga and their significance
- to expose the student to the importance and meaning of Yam and Niyam
- to make the student understand the meaning and importance of yogic principles including Ahimsa, Satya, Astheya etc
- to introduce the different yogic poses with a knowledge of their benefits for mind and body
- to familiarize the effect of different types of breathing techniques in concept and in activity

Unit I **9L**

Definitions of Eight parts of yoga (Ashtanga).

Learning Outcomes

After the completion of this unit, the student will be able to

- list the eight parts of yoga (L1)
- describe the effects of different parts of yoga on mind and body(L2)
- elaborate the importance of yoga in stress management and personality development(L3)

Unit II **9L**

Yam and Niyam.

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

Learning Outcomes

After the completion of this unit, the student will be able to

- elaborate the importance of Yam and Niyam(L2)
- describe the meaning and significance of Ahinsa, satya, astheya etc(L2)
- explain the need for shaucha, santosh, tapa, swadhyay in leading a healthy and fruitful life(L3)

Unit III **9L**

Asan and Pranayam

i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its Effects-Types of pranayam.

Learning Outcomes

After the completion of this unit, the student will be able to

- demonstrate the different physical asanas and explain their physical and phychological effects(L4)
- demonstrate the different breathing techniques and describe their physical and mental effects (L4)
- distinguish between different types of pranayamam(L5)

Text Books

1. Janardan, Yogic Asanas for Group Tarining-Part-I, Swami Yogabhyasi Mandal, Nagpur

2. Swami Vivekananda, “Rajayoga or conquering the Internal Nature”, Advaita Ashrama, Kolkata

Course Outcomes

After successful completion of the course, the student will be able to

- describe the eight parts of yoga and their significance(L1)
- explain the the importance and meaning of Yam and Niyam(L2)
- define the meaning and importance of yogic principles including Ahimsa, Satya, Astheya etc(L1)
- demonstrate the different yogic poses and explain their benefits for mind and body(L4)
- demonstrate the different types of breathing techniques and explain their physical and mental benefits(L5)

19EAC748: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L	T	P	C
2	0	0	0

This course is aimed to familiarize the student with life enlightenment skills for personality development. This course helps the student in building his holistic personality through human values, ethics and spiritual attributes.

Course Objectives

- to familiarize the student to good personality traits through moral stories
- to make the student understand the goal of human life and importance of good personality in reaching the goal
- to expose the student to the study of Shrimad-Bhagwad-Geeta for developing his/her personality and achieve the highest goal in life
- to familiarize the student to leadership skills for driving nation and mankind to peace and prosperity
- to expose the role of Neetishatakam for developing versatile personality of students.

Unit I **9L**

Neetisatakam-Holistic development of personality
Verses- 19,20,21,22 (wisdom)
Verses- 29,31,32 (pride & heroism)
Verses- 26,28,63,65 (virtue)
Verses- 52,53,59 (dont's)
Verses- 71,73,75,78 (do's).

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the moral stories illustrating the traits of good personality(L2)
- define the meaning and importance of wisdom, pride, heroism, virtue etc(L1)
- identify do and donts in life from the foundations of human morals/ethics(L5)

Unit II **9L**

Approach to day to day work and duties.
Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
Chapter 18-Verses 45, 46, 48.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the characteristics and principles of bhakti yogam, jnana yogam and karma yogam (L1)
- identify the use of different yogic characteristics in different activities of daily life/duties(L4)
- apply the use of yogic principles for leading a stress-free, happy and fruitful life with good developed personality(L4)

Unit III **9L**

Statements of basic knowledge.
Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18
Personality of Role model. Shrimad BhagwadGeeta:
Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63

Learning Outcomes

After the completion of this unit, the student will be able to

- list the characteristics of role model proposed by verses of bhagavad gita(L1)
- explain the methods for obtaining life enlightenment through the practice of four yoga appropriately (L2)
- describe the characteristics of karma yogi/jnana yogi for developing leadership personality (L2)

Text Book(s):

1. Swami Swarupananda, "Srimad Bhagavad Gita", Advaita Ashram (Publication Department), Kolkata
2. P. Gopinath, Bhartrihari's Three Satakam (Niti-Sringar-vairagya), Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

After successful completion of the course, the student will be able to

- List the different parables of neethisathakam and identify their morals(L1)
- enumerate the different traits of human personality for life enlightenment(L2)
- describe the leadership attributes for driving nation and mankind to peace and prosperity(L2)
- explain the applicability of different types of yoga to day-to-day work and duties resulting in responsible personality (L2)

19EAC750: DEVELOPING SOFT SKILLS AND PERSONALITY

L	T	P	C
3	0	0	0

Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. The course aims to cause a basic awareness within the students about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality.

Course Objectives

- to familiarize the student to the criteria for self assessment and significance of self-discipline
- to expose the student to attitudes, mindsets, values and beliefs
- to acquaint the student to plan career and goals through constructive thinking
- to enable the student to overcome barriers for active listening and persuasive speaking
- to familiarize the skill of conducting meetings, writing minutes and involving in active group discussions

Unit I **(8L)**

Self-Assessment; Identifying Strength & Limitations; Habits, Will-Power and Drives; Developing Self-Esteem and Building Self-Confidence, Significance of Self-Discipline

Learning Outcomes

After the completion of this unit, the student will be able to

- identify strengths & limitations through self-assessment(L3)
- list the attributes of personalities will good will-power and self-drives(L1)
- describe the reasons for building self-esteem and self-confidence(L2)
- explain the significance of self discipline(L2)

Unit II **(8L)**

Understanding Perceptions, Attitudes, and Personality Types: Mind-Set: Growth and Fixed; Values and Beliefs

Learning Outcomes

After the completion of this unit, the student will be able to

- define the characteristics of different perceptions, attitudes and personality types(L1)
- distinguish between fixed and growing mindsets(L3)
- define the importance and meaning of values and beliefs(L2)

Unit III **(8L)**

Motivation and Achieving Excellence; Self-Actualisation Need; Goal Setting, Life and Career Planning; Constructive Thinking

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the need for having high motivation and achieving excellence(L2)
- define the need for self-actualization(L1)
- plan the life and career goals based on self assessment(L4)
- explain the attributes of constructive thinking(L2)

Unit IV **(8L)**

Communicating Clearly: Understanding and Overcoming barriers; Active Listening; Persuasive Speaking and Presentation Skills.

Learning Outcomes

After the completion of this unit, the student will be able to

- self-assess the barriers for communicating clearly (L4)
- list the attributes of active listening(L1)
- describe the minimal aspects of effective presentation(L2)
- organize ideas resulting a persuasive talk(L3)

Unit V **(8L)**

Conducting Meetings, Writing Minutes, Sending Memos and Notices; Netiquette: Effective E-mail Communication; Telephone Etiquette; Body Language in Group Discussion and Interview.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the format and structure of writing meeting minutes(L2)
- identify the essential components of memos and notices(L3)
- explain the principles of effective email communication(L2)
- list the basic etiquette of telephone conversation(L1)
- describe the effective body traits during group discussion and interviews(L2)

Text Books

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman& Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.

Course Outcomes

After successful completion of the course, the student will be able to

- carry out self assessment and describe the significance of self-discipline(L4)
- define, classify and compare attitudes, mindsets, values and beliefs(L3)
- plan career and goals through constructive thinking and personal assessment(L4)
- overcome barriers for active listening and persuasive speaking (L5)
- conduct meetings, write minutes and involve in active group discussions(L3)

OPEN ELECTIVES

S.No	Course Code	Course Title	Category	L	T	P	C
1	19EOE742	Business Analytics	OE	3	0	0	3
2	19EOE744	Industrial Safety	OE	3	0	0	3
3	19EOE746	Operations Research	OE	3	0	0	3
4	19EOE748	Cost Management of Engineering Projects	OE	3	0	0	3
5	19EOE752	Waste to Energy	OE	3	0	0	3
6	19EOE754	Green Buildings	OE	3	0	0	3

19EOE742: BUSINESS ANALYTICS

L	T	P	C
3	0	0	3

This course introduces students to the science of business analytics. The goal is to provide students with the foundation needed to apply data analytics to real-world challenges they confront daily in their professional lives. Students will learn to identify the ideal analytic tool for their specific needs; understand valid and reliable ways to collect, analyze, and visualize data; and utilize data in decision making for managing agencies, organizations or clients in their workspace

Course Objectives

- To familiarize the scope, process and advantages of business analytics
- To acquaint the student with the modeling and problem solving skills in business analytics
- To impart the organization and management of business analytics
- To introduce the forecasting models and techniques used in analytics
- To expose the formulation and decision strategies used in business analytics

Unit I **8L**

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview

Learning Outcomes

After the completion of this unit, the student will be able to

- define the scope and process of business analytics (L1)
- choose an organizational structure to implement a business analytics process (L3)
- describe the statistical tools and methods used for data modeling and analysis (L2)
- identify the sampling and estimation requirements for data analysis (L1)

Unit II **8L**

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Learning Outcomes

After the completion of this unit, the student will be able to

- identify the relationships and trends in data (L1)
- utilize linear regression methods for identifying data relationships (L4)

- list the types of data and their models used for business analytics (L1)
- describe the methods for visualization and exploration of data (L2)

Unit III **8L**

Organization Structures of Business analytics: Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the management issues in the organization structures (L2)
- define the designing information policy and its usage (L1)
- list the methods for ensuring data quality measuring contribution (L1)
- explain the use of data mining methodologies for predictive analytics analysis (L3)
- describe the use of prescriptive analytics methods in business analytics process (L2)

Unit IV **10L**

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Learning Outcomes

After the completion of this unit, the student will be able to

- classify and describe the use of forecasting models (L3)
- model the use of regression forecasting with casual variables (L5)
- identify the appropriate forecasting model for a given data (L5)
- explain the use of monte carlo simulation for forecasting and identify the involved risk (L2)

Unit V **8L**

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Learning Outcomes

After the completion of this unit, the student will be able to

- formulate decision problems (L2)
- list the decision strategies with and without probabilities (L1)
- use the decision trees for analysis (L4)
- describe the value of information, utility and its use in decision making (L4)

Textbook(s):

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications Pearson FT Press, 2014.
2. James Evans, Business Analytics, Pearson Education, 2013.

Course Outcomes

Upon successful completion of the course, the student will be able to

- define the scope, process and advantages of business analytics (L1)
- explain the modeling and problem solving skills in business analytics (L2)
- describe the organization and management of business analytics (L3)
- utilize the forecasting models and techniques used in analytics (L4)
- enumerate and utilize the formulation and decision strategies (L2)

19EOE744: INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

Safety by design or prevention through design is in the core for maintaining engineering systems safe. The students will be equipped with concepts of engineering systems safety, dimensions of engineering systems safety, safety design and analysis mathematics, design for engineering systems safety and control for safety, and integrating safety with other operational goals such as quality and reliability

Course Objectives

- to impart knowledge on different facets and aspects of industrial systems safety
- to familiarize the student with tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings
- to impart the knowledge of definition, function and types of maintenance activities
- to familiarize the different wear and corrosion mechanisms and their prevention methods
- to expose the students to different faults and their tracing mechanisms
- to impart the art of planning periodic and preventive maintenance mechanisms

Unit I **8L**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Learning Outcomes

After the completion of this unit, the student will be able to

- list the different types of mechanical and electrical hazards in industrial systems(L1)
- enumerate the salient points of factories act 1948(L2)
- describe the health and safety measures to be enforced for industrial safety(L3)
- elaborate the different fire prevention and firefighting arrangements to be made(L2)

Unit II **8L**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning and aim of maintenance engineering(L1)
- elaborate the primary and secondary functions of maintenance department(L2)
- classify the different types and applications of maintenance(L3)
- relate the replacement economy with maintenance cost(L5)
- estimate the service life of equipment from the specifications of individual components(L4)

Unit III **8L**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the different types, causes and effects of Wear(L2)
- elaborate the different methods for reducing wear(L2)
- list the different types of lubricants and mention their applications(L1)
- define the principle and factors affecting corrosion(L1)
- classify the different types of corrosion and identify their prevention methods(L3)

Unit IV **8L**

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the different types, causes and effects of Wear(L2)
- use the concept of decision tree for fault tracing in machine tools(L4)
- build decision trees for different machine tools including pump, air compressor etc(L4)
- classify the different types of faults in machine tools and their causes(L3)

Unit V **10L**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the concept of periodic inspection and its need(L2)
- list the common troubles and remedies of electric motor(L1)
- define the need for preventive maintenance and list its steps(L3)
- elaborate the steps/procedure of periodic and preventive maintenance of diesel generating sets, pumps etc(L2)

Text Book(s):

1. Lindley R. Higgins, Lester Coridon Morrow, Maintenance Engineering Handbook, Da Information Services, 1977.
2. H. P. Garg, Maintenance Engineering, S. Chand and Company, 1987.
3. Audels, Pump-hydraulic Compressors, Mc Graw Hill Publication, 1992.
4. Winterkorn, Hans, Foundation Engineering Handbook, Chapman & Hall London, 1975

Course Outcomes

Upon successful completion of the course, the student will be able to

- describe the different facets and aspects of industrial systems safety(L2)
- demonstrate the use of tools, techniques and methodologies needed for prevention of occurrences of unsafe operations and accidents under different industrial settings(L4)
- define the function and list the types of maintenance activities(L1)
- describe the concept of wear and corrosion mechanisms and their prevention methods(L2)
- enumerate the different faults and their tracing mechanisms (L3)
- elaborate the planning periodic and preventive maintenance mechanisms needed for industrial safety(L4)

19EOE746: OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

Optimization problems arise in all walks of human activity- particularly in engineering, business, finance and economics. The simplest optimization problems are linear in nature which may be subject to a set of linear constraints. This course will equip the student with the expertise to mathematically model real life optimization problems as Linear Programming (Optimization) Problems and subsequently educate the student to solve these models with the help of the available methods.

Course Objectives

- to impart knowledge on developing mathematical formulation for linear programming and transportation problem
- to familiarize the student in the construction of the required activities in an efficient manner to complete it on or before a specified time limit and at the minimum cost.
- to expose the development of mathematical model for interactive decision-making situations, where two or more competitors are involved under conditions of conflict and competition.
- to illustrate PERT and CPM techniques for planning and implementing projects.
- To impart the knowledge of formulating and analysis of real life problems using advanced tools and techniques for resource optimization
- to provide frameworks for analyzing waiting lines using advanced queuing theory concepts

Unit I **8L**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Learning Outcomes

After completing this unit, the student will be able to

- identify and develop operational research models from the verbal description of the real system. **(L4)**
- understand the classification systems of effective Inventory control models **(L2)**

Unit II **8L**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Learning Outcomes

After completing this unit, the student will be able to

- translate a real-world problem, given in words, into a mathematical formulation. **(L2)**
- utilize the mathematical tools that are needed to solve optimization problems. **(L2)**

Unit III **8L**

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Learning Outcomes

After completing this unit, the student will be able to

- describe the need and origin of the optimization methods **(L2)**
- classify optimization problems to suitably choose the method needed to solve the particular type of problem **(L3)**

Unit IV **8L**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Learning Outcomes

After completing this unit, the student will be able to

- choose linear programming problems to suitably choose the method needed to solve the particular type of problem **(L1)**
- identify industrial problems involved in inventory, MRP and scheduling **(L2)**

Unit V **8L**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Learning Outcomes

After completing this unit, the student will be able to

- identify the values, objectives, attributes, decisions, uncertainties, consequences, and trade-offs in a real decision problem **(L2)**
- Apply the models to incorporate rational decision-making process in real life situations.**(L3)**
- Analyze various modeling alternatives & select appropriate modeling techniques for a given situation.. **(L3)**

Text Book(s):

1. H.A. Taha, Operations Research, An Introduction, Prentice Hall of India, 2008
2. H.M. Wagner, Principles of Operations Research, Prentice Hall of India, Delhi, 1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, 2008
4. Hitler Libermann Operations Research: McGraw Hill Publishers, 2009
5. Pannerselvam, Operations Research: Prentice Hall of India, 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India, 2010

Course Outcomes

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

- Understand the basic concepts of different advanced models of operations research and their applications. (L2)
- Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for action. (L4)
- Apply the models to incorporate rational decision-making process in real life situations. (L4)
- Analyze various modeling alternatives & select appropriate modeling techniques for a given situation. (L3)
- Validate output from model to check feasibility of implementations. (L5)
- Create innovative modeling frameworks for a given situation. (L6)
- Conduct and interpret post-optimal and sensitivity analysis and explain the primal-dual relationship. (L3)

19EOE748: COST MANAGEMENT OF ENGINEERING PROJECTS

L	T	P	C
3	0	0	3

This course will equip the student with the expertise to mathematically model engineering projects and use effective methods and techniques to plan and execute engineering activities.

Course Objectives

- to introduce the basic principles of strategic cost management and the related terminology
- to familiarize the project planning and execution process involving technical/nontechnical activities
- to acquaint the student with detailed engineering activities and their cost management analysis
- to impart the knowledge of cost analysis and profit planning of engineering projects
- to familiarize the quantitative techniques for optimization of budget allocation

Unit I **8L**

Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational
control; Provision of data for Decision-Making.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the cost concepts in decision making(L2)
- define the various costs involved in the cost management process(L2)
- list the objectives of cost control(L2)
- identify the different fields of a database for operational control(L2)

Unit II **8L**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.

Learning Outcomes

After the completion of this unit, the student will be able to

- define the meaning of a project and list the different types(L2)
- identify the measures to manage cost overruns(L2)
- describe the various stages of project execution from conception to commissioning(L2)
- plan the proper order of technical/nontechnical activities as part of project execution(L2)

Unit III **8L**

Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

Learning Outcomes

After the completion of this unit, the student will be able to

- identify the different clearance norms required in the pre-project execution phase(L2)
- describe the hierarchy of project team and identify the role of each member(L2)
- list the different contents of project contracts(L2)
- present the project cost control and planning through bar charts, network diagrams etc(L2)

Unit IV **8L**

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

Learning Outcomes

After the completion of this unit, the student will be able to

- describe the cost behavior and profit planning(L2)
- distinguish between marginal costing and absorption costing(L2)
- analyze the variance of standard costing(L2)
- analyze the pricing strategies in project costing(L2)
- identify the quality measures satisfying the appropriate constraints(L2)

Unit V **10L**

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory

Learning Outcomes

After the completion of this unit, the student will be able to

- define and compare the different budgeting strategies(L2)
- model the cost management as a linear programming problem(L2)
- measure the divisional profitability and decide the appropriate pricing(L2)

Textbook(s):

1. Charles T. Horngren, Srikant M. Datar, George Foster, Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi, 2006.

References:

1. Charles T. Horngren, George Foster, Advanced Management Accounting, Greenwood Publishing, 2001.
2. Robert S Kaplan, Anthony A. Alkinson, Management & Cost Accounting, 1998.
3. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting, Wheeler Publisher, 2004.
4. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book, 2006.

Course Outcomes

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

- list the basic principles of strategic cost management and define the related terminology(L1)
- plan the project execution process involving technical/nontechnical activities(L4)
- describe the detailed engineering activities and their cost management analysis(L2)
- carry out the cost analysis and profit planning of engineering projects(L5)
- utilize quantitative techniques for optimization of budget allocation(L6)

19EOE752: WASTE TO ENERGY

L	T	P	C
3	0	0	3

This course introduces the basic principles and different technologies of converting waste to energy. Student will be able to appropriately identify the methods and build biomass gasification systems of different capacities depending on application requirements.

Course Objectives

- to introduce the classification of waste for its usefulness in preparing different fuels
- to familiarize the biomass pyrolysis process and its yield issues
- to acquaint the student with biomass gasification processes and construction arrangements
- to impart the types and principles of biomass combustors
- to familiarize the calorific values and composition of biogas resources

Unit I **8L**

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Learning Outcomes

After the completion of this unit, the student will be able to

- distinguish between different types of waste (L1)
- classify the different types of waste for manufacturing different types of fuel (L3)
- identify the different conversion devices and their applications(L4)

Unit II **8L**

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Learning Outcomes

After the completion of this unit, the student will be able to

- classify the different types of pyrolysis methods based on speed(L1)
- describe the different methods of manufacturing charcoal (L2)
- explain the chemical processes involved in the manufacture of pyrolytic oils and gases(L2)

Unit III **8L**

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the design, construction and operation of different gasifiers(L2)
- describe the burner arrangement for thermal heating(L2)
- elaborate the gasifier engine arrangement for equilibrium and kinetic considerations(L3)

Unit IV **8L**

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Learning Outcomes

After the completion of this unit, the student will be able to

- explain the basic principle of biomass combustors(L2)
- classify different combustors based on their capacity and efficiency(L3)

- describe the construction and operation of fixed bed inclined grate, fluidized bed combustors (L2)

Unit V **10L**

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Learning Outcomes

After the completion of this unit, the student will be able to

- list the properties of biogas(L1)
- elaborate the design, construction and operation of biogas plant(L2)
- classify the different biomass resources and their conversion process(L3)
- distinguish between different biogas plants and identify their applications(L5)

Text Book(s)

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Outcomes

After the successful completion of the course, the student will be able to

- classify different types of waste for their usefulness in preparing different fuels(L3)
- describe the biomass pyrolysis process and its yield issues(L2)
- outline the different biomass gasification processes and their construction arrangements(L3)
- explain the types and principles of biomass combustors(L2)
- analyze the calorific values and composition of biogas resources(L5)

19EOE754: GREEN BUILDINGS

L	T	P	C
3	0	0	3

Green Buildings are the need of the 21st century as the construction industry must contribute towards reducing the effects of climate change. This course is designed to provide basic guidelines for the construction of Green Buildings and it gives an overview of all the processes involved from the start of site construction management to material selection, services management, energy & resources management and managing the indoor environment quality during building operation.

Course Objectives:

- To emphasize the need for energy efficient buildings
- To understand the considerations for an Energy Efficient building design.
- To have an insight into the existing Green Rating Systems in India.
- To illustrate various techniques that can be applied in buildings to make them green.

Unit I **8L**

Introduction to green buildings: Concept of green building design. Need for energy and resource efficient design. Factors affecting the Energy use in Buildings – Pre-Building Stage, Construction Stage & Post Occupancy stages. Building life cycle analysis. Need for Green Building rating Systems. Brief introduction to green rating systems in India.

Learning Outcomes:

Post completion of the unit the student will be able to:

- *Define the concept of Green Buildings. (L1)*
- *Explain the need of resource conservation. (L2)*
- *Illustrate the energy use in buildings as different stages. (L2)*
- *Select appropriate building rating systems. (L3)*

Unit II **8L**

Sustainable site construction and management – Selection of site, preserving and protecting landscape during construction, Top soil conservation, reducing hard paving on site, provide sanitation and safety facilities for construction workers Efficient design of services – water management: water supply and treatment methods, rain water harvesting, water recycling, reuse of water and installation of water efficient fixtures. Waste management: reduction of waste during construction, efficient segregation of waste, resource recovery from waste.

Learning Outcomes:

Post completion of the unit the student will be able to:

- *Choose appropriate methods of construction management. (L1)*
- *Summarise the process of site management. (L2)*
- *Identify the techniques of energy, water and waste management in buildings. (L3)*

Unit III **8L**

Building physics: heat transfer in buildings (conduction, convection and radiation) and importance material selection for building envelope. Specification of materials for walls and roofs in different climates. Building materials and resources: Sustainable Building Materials– Biodegradable & Non- Biodegradable Materials, resource reuse, recyclable materials, recycled content, Regional materials. Energy Efficient Construction Technology – Filler Slab, Rat trap Bond. Technologies developed by CBRI. Contemporary and future trends- Nanotechnology, smart materials.

Learning Outcomes:

Post completion of the unit the student will be able to:

- *Show the process of heat transfer through buildings. (L2)*
- *Examine the performance of building envelopes for heat transfer. (L4)*
- *Identify appropriate building materials. (L3)*
- *Demonstrate various energy efficient construction technologies being developed. (L2)*

Unit IV **8L**

Energy conservation: Optimizing building design to reduce conventional energy demand, reducing material usage and time of construction by adopting efficient technologies, conserving energy through selection energy efficient equipment. Alternative sources of energy: Renewable energy sources, Photo Voltaic Cells, small scale hydro and wind systems, photovoltaic cells.

Learning Outcomes:

Post completion of the unit the student will be able to:

- *Relate the process of building design with energy conservation. (L1)*
- *Outline the process of time & cost reduction in construction projects. (L2)*
- *Identify alternate sources of renewable energy on-site. (L3)*

Unit V **10L**

Indoor environmental quality: Need to improve indoor air quality-sick building syndrome, building related illness, multiple chemical sensitivity. Reducing indoor air pollutants- low-VOC paints / adhesives /sealants, Minimize ozone depleting substances, required levels of indoor ventilation. Indoor and outdoor noise levels. Case Study/Desktop Study: Case study of a live project on Green Buildings or a desktop study of a Green building.

Learning Outcomes:

Post completion of the unit the student will be able to:

- *Explain the need for high indoor air quality. (L2)*
- *List the indoor air pollutants and their sources like VOC, dust, noise, etc. (L1)*
- *Analyse the green aspects of a live project/case study. (L4)*

Text Book(s):

1. Abridged Version reference guide for New Buildings (IGBC rating system)
2. ECBC reference guide.

References:

1. New buildings reference guide
2. Heather L. Venhaus, Designing the Sustainable Site: Integrated Design Strategies for Small Scale Sites and Residential Landscapes
3. Faisal Zia, Vasudevan Rajaram, Solid and liquid waste management,
4. Siddiqui, Sanjeev Agrawal, Mohammed Emran Khan, Introduction to Architectural Science
5. S. V. Szokolay, The Basis of Sustainable Design
6. Sustainable Construction Techniques. From structural design to interior fit-out:
7. Sebastian / John, Viola / Zeumer, Martin Assessing and improving the environmental impact of buildings by El khouli.

Course Outcomes:

- The students will understand the importance of green building design. (L2)
- The students will simultaneously outline efficient techniques of optimizing resource usage in the process of building construction, building operation and post demolition. (L2)
- The students will evaluate effective selection of materials and other equipment.. (L5)
- The students will be able to analyze the sustainability any building and check for green features. (L4)

HSMCH102: UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

L T P C 2 1 0 3

Human Values Courses: During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

Course Objectives:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

COURSE TOPICS: The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
4. Understanding the characteristics and activities of 'I' and harmony in 'I'.
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available tome. Identifying from one's own life.

Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.

2. Understanding the meaning of Trust; Difference between intention and competence.

3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature

2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature.

3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.

4. Holistic perception of harmony at all levels of existence.

5. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values

2. Definitiveness of Ethical Human Conduct

3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

5. Case studies of typical holistic technologies, management models and production systems

6. Strategy for transition from the present state to Universal Human Order:

7. At the level of individual: as socially and ecologically responsible engineers, technologists and managers

8. At the level of society: as mutually enriching institutions and organizations

9. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

READINGS:

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.

24CIVL6071: TECHNICAL SEMINAR

L T P C

0 0 4 2

Scope & Overview: Students are expected to identify a research problem/case study from any domain of Construction Technology and Management to carry out a reconnaissance research on the topic and suggest innovative solutions for the same. It is advisable for students to choose a topic of interest to be continued as M.Tech Project in the 3rd & 4th Semester. The guidelines to carry out the research shall include the following:

1. Literature Review
2. Identification of Gap of Research
3. Objectives and Expected Outcomes
4. Methodology / Innovative solution

Each student has to prepare a power point presentation on a selected technical topic with a novelty and get it evaluated by the faculty assigned for this purpose.

24PROJ7888: PROJECT WORK - I

L	T	P	C
0	0	26	13

Each student is required to submit a report of first part of project work i.e. about the problem definition, literature review and methodology to be adopted including experiments and tests to be performed on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semester end.

24PROJ7999: PROJECT WORK - II

L	T	P	C
0	0	26	13

Each student is required to submit a detailed project report about the work on topic of project as per the guidelines decided by the department. The project work is to be evaluated through Presentations and Viva-Voce during the semester and Final evaluation will be done at the end of semester as per the guidelines decided by the department from time to time. The candidate shall present/publish one paper in national/international conference/seminar/journal of repute. However candidate may visit research labs/institutions with the due permission of chairperson on recommendation of supervisor concerned.

GITAM School of Technology

GITAM (Deemed to be University)

Visakhapatnam | Hyderabad | Bengaluru