GOVERNMENT OF RAJASTHAN

BOARD OF TECHNICAL EDUCATION RAJASTHAN JODHPUR

SEMESTER SCHEME-2020-21

VI SEMESTER

(SESSION 2021-2022 & ONWARDS)

ENTREPRENEURSHIP AND START-UPS

Course Code	CE 6111(Same in All Branches of Engg.)
Course Title	Entrepreneurship and Start-ups
Number of Credits	4 (L- 3,T-1, P-0)
Prerequisites (Course code)	None
Course Category	HS

COURSE LEARNING OBJECTIVES:

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with varioususes ofhuman resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship-its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

LEARNING OUTCOME:

Upon completion of the course, these student will be able to demonstrate knowledge of the following topics:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. StrategicMarketing Planning
6. New Productor Service Development
7. Business Plan Creation

COURSE CONTENTS:

1. INTRODUCTION TO ENTREPRENEURSHIP AND START–UPS

- 1.1. Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- 1.2. Types of Business Structures,
- 1.3. Similarities / differences between entrepreneurs and managers.

2. BUSINESS IDEAS AND THEIR IMPLEMENTATION

- 2.1. Discovering ideas and visualizing the business
- 2.2. Activity map
- 2.3. Business Plan

3. IDEA TO START-UP

- 3.1. Market Analysis– Identifying the target market,
- 3.2. Competition evaluation and Strategy Development,
- 3.3. Marketing and accounting,
- 3.4. Risk analysis

4. MANAGEMENT

- 4.1. Company's Organization Structure,
- 4.2. Recruitment and management of talent.
- 4.3. Financial organization and management

5. FINANCING AND PROTECTION OF IDEAS

- 5.1. Financing methods available for start-ups in India
- 5.2. Communication of Ideas to potential investors– Investor Pitch
- 5.3. Patenting and Licenses

6. EXIT STRATEGIES FOR ENTREPRENEURS ,BANKRUPTCY, AND SUCCESSION AND HARVESTING STRATEGY

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	The Startup Owner's Manual: The Step by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN–978-0984999392
2.	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN–978-0670921607
3.	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN–978-0755388974
4.	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Chris Tensen	Harvard business ISBN:978-142219602

SUGGESTEDSOFTWARE/LEARNINGWEBSITES:

a. https://www.fundable.com/learn/resources/guides/startup
b. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatehstructure/
c .https://www.finder.com/small-business-finance-tips
d. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

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PROJECT MANAGEMENT

CourseCode	CE 62001(Same in All Branches of Engg.)
CourseTitle	Project Management
NumberofCredits	3(L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

•To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.

•To develop an understanding of key project management skills and strategies.

COURSE OUTCOMES

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

CO1	Understand the importance of projects and its phases.
CO2	Analyze projects from marketing, operational and financial perspectives.
CO3	Evaluate projects based on discount and non-discount methods.
CO4	Develop network diagrams for planning and execution of a given project.
CO5	Apply crashing procedures for time and cost optimization.

COURSE CONTENTS

1. CONCEPT OF A PROJECT:

1.1. Classification of projects
1.2. Importance of project management
1.3. The project Life cycle
1.4. Establishing project priorities (scope-cost-time)
1.5. Project priority matrix
1.6. Work break down structure.

2. CAPITAL BUDGETING PROCESS:

2.1. Planning -Analysis-Selection-Financing-Implementation-Review.
2.2. Generation and screening of project ideas
2.3. Market and demand analysis
2.4. Demand forecasting techniques.
2.5. Market planning and marketing research process
2.6. Technical analysis

3. FINANCIAL ESTIMATES AND PROJECTIONS:

3.1. Cost of projects
3.2. Means of financing
3.3. Estimates of sales and production-cost of production
3.4. Working capital requirement and its financing
3.5. Profitability project , cash flow statement and balance sheet.
3.6. Breakeven analysis.

4. BASIC TECHNIQUES IN CAPITAL BUDGETING:

4.1. Non discounting and discounting methods
4.2. pay-back period
4.3. Accounting rate of return
4.4. Net present value
4.5. Benefit cost ratio
4.6. Internal rate of return.
4.7. Project risk.
4.8. Social cost benefit analysis andeconomic rate of return.
4.9. Non-financial justification of projects.

5. PROJECT ADMINISTRATION:

5.1. Progress payments,
5.2. Expenditure planning,
5.3. Project scheduling and network planning,
5.4. Use of Critical Path Method(CPM),
5.5. Schedule of payments and physical progress,
5.6. time-cost trade off.
5.7. Concepts and uses of PERT
5.8. Cost as a function of time,
5.9. Project Evaluation and Review Techniques
5.10. Cost mechanisms.
5.11. Determination of least cost duration.
5.12. Post project evaluation.
5.13. Introduction to various Project management softwares.

REFERENCE BOOKS

1.Project planning, analysis, selection, implementation and review –Prasannachandra–Tata McGraw Hill
2.Project Management – the Managerial Process– Clifford F. Gray & Erik W. Larson-McGrawHill
3.Project management- David I Cleland- Mcgraw Hill International Edition, 1999
4.Project Management– Gopala krishnan– Mcmillan India Ltd.
5.Project Management- Harry – Maylor – Peason Publication

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RENEWABLE ENERGY TECHNOLOGIES

CourseCode	CE 62002 (Same in All Branches of Engg.)
CourseTitle	Renewable Energy Technologies
NumberofCredits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

•To understand present and future scenario of world energy use.
•To understand fundamentals of solar energy systems.
•To understand basics of wind energy.
•To understand bio energy and its usage in different ways.
•To identify different available non-conventional energy sources.

COURSE OUTCOMES

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

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

COURSE CONTENTS

1. INTRODUCTION:

1.1. World Energy Use;
1.2. Reserves of Energy Resources;
1.3. Environmental Aspects OF Energy Utilisation;
1.4. Renewable Energy Scenario in India and around the World;
1.5. Potentials; Achievements/ Applications;
1.6. Economics of renewable energy systems.

2. SOLAR ENERGY:

2.1. Solar Radiation;
2.2. Measurements of Solar Radiation;
2.3. Flat Plate and Concentrating Collectors;
2.4. Solar direct Thermal Applications;
2.5. Solar thermal Power Generation
2.6. Fundamentals of Solar Photo Voltaic Conversion;
2.7. Solar Cells;
2.8. Solar PV Power Generation;
2.9. Solar PV Applications.

3. WIND ENERGY:

3.1. Wind Data and Energy Estimation;
3.2. Types of Wind Energy Systems;
3.3. Performance; Site Selection;
3.4. Details of Wind Turbine Generator;
3.5. Safety and Environmental Aspects.

4. BIO-ENERGY:

4.1. Bio mass direct combustion;
4.2. Bio mass gasifiers;
4.3. Bio gas plants;
4.4. Digesters;

4.5. Ethanol production;
4.6. Bio diesel;
4.7. Cogeneration;
4.8. Bio mass Applications.

5. OTHER RENEWABLE ENERGY SOURCES:

5.1. Tidal energy;
5.2. Wave Energy;
5.3. Open and Closed OTEC Cycles;
5.4. Small Hydro Geothermal Energy;
5.5. Hydrogen and Storage;
5.6. Fuel Cell Systems;
5.7. Hybrid Systems.

REFERENCE BOOKS

1. Non-Conventional Energy Sources, Rai. G. D., Khanna Publishers, New Delhi, 2011.
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN SponLtd.,UK,2 006.
3. Solar Energy, Sukhatme. S. P., Tata Mc Graw Hill Publishing CompanyLtd. ,New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, G N Tiwari and M K Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment A Policy Analysis for India ,NH Ravindranath, U K Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, R A Ristinen and J J Kraushaar, second edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, J W T widell and A D Weir, ELBS, 2006.

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PRODUCT DESIGN

CourseCode	CE 63001(Same in All Branches of Engg.)
CourseTitle	Product Design
NumberofCredits	3 (L:3,T:0,P:0)
Prerequisites	NIL
CourseCategory	OE

COURSE LEARNING OBJECTIVES

•To acquire the basic concepts of product design and development process
•To understand the engineering and scientific process in executing a design from concept to finished product
•To study the key reasons for design or redesign.

COURSE OUTCOMES

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

CO1	Understand the basic concepts of product design and development process.
CO2	Illustrate the methods to define thecustomer needs.
CO3	Describe an engineering design and development process.
CO4	Understand the intuitive and advanced methods used to develop and evaluate a concept.
CO5	Apply modelling and embodiment principles in product design and development process.

COURSE CONTENTS

1. DEFINITION OF A PRODUCT

1.1. Types of product;
1.2. Levels of product;
1.3. Product-market mix;
1.4. New prod-uct development (NPD) process;
1.5. Idea generation methods;
1.6. Creativity;
1.6.1. Creative attitude;
1.6.2. Creative design process;
1.7. Morpho logical analysis;
1.8. Analysis of inter-connected decision areas;
1.9. Brain storming.

2. PRODUCT LIFECYCLE;

2.1. The challenges of Product development;
2.2. Product analysis;
2.3. Product characteristics;
2.4. Economic considerations;
2.5. Production and Marketing aspects;
2.6. Characteristics of successful Product development;
2.7. Phases of a generic product development process;
2.8. Customer need identification;
2.9. Product development practices and industry-product strategies.

3. PRODUCT DESIGN

3.1. Design by evolution;
3.2. Design by innovation;
3.3. Design by imitation;
3.4. Factors affecting product design;
3.5. Standards of performance and environmental factors;
3.6. Decision making and iteration;
3.7. Morphology of design (different phases);
3.8. Role of aesthetics in design.

4. INTRODUCTION TO OPTIMIZATION IN DESIGN

4.1. Economic factors in design;
4.2. Design for safety and reliability;
4.3. Role of computers in design;
4.4. Modeling and Simulation;
4.5. The role of models in engineering design;
4.6. Mathematical modeling;
4.7. Similitude and scale models;
4.8. Concurrent design;
4.9. Six sigma and design for six sigma;
4.10. Introduction to optimization in design;
4.11. Economic factors and financial feasibility in design;
4.12. Design for manufacturing;
4.13. Rapid Proto typing (RP);
4.14. Application of RP in product design;
4.15. Product Development versus Design.

5. DESIGN OF SIMPLE PRODUCTS DEALING WITH VARIOUS ASPECTS OF PRODUCT DEVELOPMENT;

5.1. Design Starting from need till the manufacture of the product

REFERENCE BOOKS

1.Product Design and Development, Karl T.Ulrichand Steven D.Eppinger, TataMc Graw–Hill edition.
2.Engineering Design– George E. Dieter.
3.An Introduction to Engineering Design methods Vijay Gupta.
4.Merie Crawford: New Product management, McGraw-Hill Irwin.
5.Chitale A K and Gupta R C," Product Design and Manufacturing", Prentice Hall of India, 2005.
6.Kevin Otto and Kristin Wood, Product Design, Techniques in Reverse Engineering and New Product Development, Pears on education.

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DISASTER MANAGEMENT

Course Code	CE 63002 (Same in All Branches of Engg.)
Course Title	Disaster Management
Number of Credits	3 (L: 3, T: 0 ,P :0)
Prerequisites	NIL
Course Category	OE

COURSE LEARNING OBJECTIVES

Following are the objectives of this course:

•To learn about various types of natural and man-made disasters.
•To know pre and post-disaster management for some of the disasters.
•To know about various information and organizations in disaster management in India.
•To get exposed to technological tools and their role in disaster management.

COURSE OUTCOMES:

1.1. After competing this course, student will be:
1.2. Acquainted with basic information on various types of disasters
1.3. Knowing the precautions and awareness regarding various disasters
1.4. Decide first action to be taken under various disasters
1.5. Familiarised with organization in India which are dealing with disasters
1.6. Able to select IT tools to help in disaster management

COURSE CONTENTS

1. UNDERSTANDING DISASTER

1.1. Understanding the Concepts and definitions of Disaster,
1.2. Hazard,
1.3. Vulnerability,
1.4. Risk,
1.5. Capacity–Disaster and Development,
1.6. Disaster management.

2. TYPES, TRENDS, CAUSES, CONSEQUENCES AND CONTROL OF DISASTERS

2.1. Geological Disasters (earth quakes, land slides,tsunami, mining);
2.2. Hydro-Meteorological Di-sasters (floods, cyclones, lightning, thunder-storms, hailstorms, avalanches, droughts, cold and heat waves)
2.3. Biological Disasters (epidemics, pestattacks, forestfire);
2.4. Technological Disasters (chemical, industrial, radiological, nuclear)
2.5. Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters)
2.6. Global Disaster Trends
2.7. Emerging Risks of Disasters
2.8. Climate Change and Urban Disasters.

3. DISASTER MANAGEMENT CYCLE AND FRAME WORK

3.1. Disaster Management Cycle
3.2. Paradigm Shift in Disaster Management.
3.3. Pre-Disaster
3.4. Risk Assessment and Analysis,
3.5. Risk Mapping,
3.6. Zonation and Microzonation,
3.7. Prevention and Mitigation of Disasters,
3.8. Early Warning System
  3.8.1. Preparedness,
  3.8.2. Capacity Development;
  3.8.3. Awareness.
3.9. During Disaster
  3.9.1. Evacuation

3.9.2. Disaster Communication
3.9.3. Search and Rescue
3.9.4. Emergency Operation Centre
3.9.5. Incident Comm and System
3.9.6. Relief and Rehabilitation

3.10. Post-disaster
3.10.1. Damage and Needs Assessment,
3.10.2. Restoration of Critical Infra structure
3.10.3. Early Recovery Reconstruction and Redevelopment;
3.10.4. IDNDR, Yokohama Stretegy, Hyogo Frame-work of Action.

4. DISASTER MANAGEMENT IN INDIA

4.1. Disaster Profile of India
4.2. Mega Disasters of India and Lessons Learnt.
4.3. Disaster Management Act 2005
4.4. Institutional and Financial Mechanism,
4.5. National Policy on Disaster Management,
4.6. National Guidelines and Plans on Disaster Management;
4.7. Role of Government (local, state and national),
4.8. Non-Government and Inter Governmental Agencies

5. APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT

5.1. Geo informatics in Disaster Management (RS, GIS, GPS and RS).
5.2. Disaster Communication System (Early Warning and Its Dissemination).
5.3. Land Use Planning and Development Regulations,
5.4. Disaster Safe Designs and Constructions,
5.5. Structural and Non Structural Mitigation of Disasters
5.6. S & T Institutions for Disaster Management in India

REFERENCES

1.Publications of National Disaster Management Authority (NDMA) on Various Templates and Guide lines for Disaster Management
2.Bhandani, R. K., An over view on natural & man-made disasters and their reduction, CSIR, New Delhi
3.Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries, Daya Publishers, Delhi
4.Alexander, David, Natural Disasters, Kluwer Academic London
5.Ghosh, G .K. ,Disaster Management, APH Publishing Corporation
6.Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

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INDIAN CONSTITUTION

CourseCode	CE 6333(Same in All Branches of Engg.)
CourseTitle	Indian Constitution
NumberofCredits	0 (L:2,T:0;P:0)
Prerequisites(Coursecode)	None
CourseCategory	AU

COURSE CONTENT

1. THE CONSTITUTION –

1.1. Introduction
1.2. The History of the Making of the Indian Constitution
1.3. Preamble and the Basic Structure, and its interpretation
1.4. Fundamental Rights and Duties and their interpretation
1.5. State Policy Principles

2. UNION GOVERNMENT

2.1. Structure of the Indian Union
2.2. President– Role and Power
2.3. Prime Minister and Council of Ministers
2.4. Lok Sabha and Rajya Sabha

3. STATE GOVERNMENT

3.1. Governor– Role and Power
3.2. Chief Minister and Council of Ministers
3.3. State Secretariat

4. LOCAL ADMINISTRATION

4.1. District Administration
4.2. Municipal Corporation
4.3. Zila Panchayat

5. ELECTION COMMISSION

5.1. Role and Functioning
5.2. Chief Election Commissioner
5.3. State Election Commission

SUGGESTED LEARNING RESOURCES:

S.No.	Title of Book	Author	Publication
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L.Fadia	Sahitya Bhawan; New edition(2017)
3.	Introduction to the Constitution of India	D D Basu	Lexis Nexis; Twenty-Third 2018 edition

SUGGESTED SOFTWARE / LEARNING WEBSITES:

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

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PUBLIC HEALTH ENGINEERING

Course Code	CE 6001 (Same as CC 6001)
Course Title	Public Health Engineering
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the principles for identification of sources of surface and subsurface water
- To learn calculation of population and requirement of drinking water
- To understand the plotting of water supply scheme highlighting different features
- To know evaluation of characteristics and treatment of sewage.

COURSE OUTCOMES

After completing this course, student will be able to:

- Know the procedure to identify the sources of surface and subsurface water
- Estimate the quantity of drinking water required for a population
- Draw labeled layout for water supply scheme.
- Device suitable water treatment technique.
- Evaluate the characteristics and suggest treatment of sewage.

COURSE CONTENT

1. Sources, Demand and Quality of water

1.1 Water supply schemes –
- 1.1.1 Objectives
- 1.1.2 Components

1.2 Sources of water:
- 1.2.1 Surface and Subsurface sources of water
- 1.2.2 Intake Structures
- 1.2.3 Definition and types
- 1.2.4 Factors governing the location of an intake structure

1.3 Demand of water:
- 1.3.1 Factors affecting rate of demand
- 1.3.2 Variations of water demand
- 1.3.3 Forecasting of population
- 1.3.4 Methods of forecasting of population
- 1.3.5 Simple problems on forecasting of population
- 1.3.6 Design period
- 1.3.7 Estimating of quantity of water supply required for city or town

1.4 Quality of water**:**
- 1.4.1 Need for analysis of water,
- 1.4.2 Characteristics of water-
  - 1.4.2.1 Physical, Chemical and Biological (only introduction)
  - 1.4.2.2 Testing of water for Total solids, hardness, chlorides, dissolved Oxygen, pH, Fluoride, Nitrogen and its compounds, Bacteriological tests, E coli, B coli index, MPN
  - 1.4.2.3 Sampling of water
  - 1.4.2.4 Water quality standards as per IS 10500

2. Purification of water

2.1 Purification of Water:
- 2.1.1 Objectives of water treatment,
- 2.1.2 Aeration- objects and methods of aeration

2.2 Plain sedimentation (No Numerical Problem)
- 2.2.1

2.2.2 Sedimentation with coagulation
2.2.3 Types Of Coagulants
2.2.4 Jar Test
2.2.5 Process Of Coagulation
2.2.6 Types Of sedimentation tanks
2.2.7 Clariflocculator.

2.3 Filtration –
2.3.1 Mechanisation Of Filtration,
2.3.2 Classification Of filters:
2.3.2.1 Slow Sand Filter
2.3.2.2 Rapid Sand Filter
2.3.2.3 Pressure filter
2.3.3 Construction and working of
2.3.3.1 Slow Sand Filter
2.3.3.2 Rapid Sand Filter,
2.3.4 Operational problems in filtration.
2.3.5 Disinfection:
2.3.5.1 Objects,
2.3.5.2 Methods of disinfection
2.3.5.3 Chlorination-
2.3.5.3.1 Application Of Chlorine
2.3.5.3.2 Forms Of Chlorination
2.3.5.3.3 Types Of Chlorination Practices
2.3.5.3.4 Residual Chlorine And Its Importance
2.3.5.3.5 Flow Diagram of water treatment plants.

3. Conveyance and Distribution of water

3.1 Conveyance:
3.1.1 Types of Pipes used for conveyance of water
3.1.2 Choice of pipe material
3.1.3 Types of joints & Types of valves- their use, location and function on a pipeline

3.2 Distribution of water:
3.2.1 Methods of distribution of water-
3.2.1.2 Gravity
3.2.1.3 Pumping, and combined system
3.2.1.4 Service reservoirs - functions and types
3.2.1.5 Layouts of distribution of Water-
3.2.1.5.1 Dead End System
3.2.1.5.2 Grid Iron System
3.2.1.5.3 Circular System
3.2.1.5.4 Radial System
3.2.1.5.5 Their Suitability, advantages and disadvantages.

4. Domestic sewage and System of Sewerages

4.1 Building Sanitation:
4.1.1 Necessity of sanitation,
4.1.2 Necessity to treat domestic sewage
4.1.3 Definitions –
4.1.3.1 Sewage
4.1.3.2 Sullage
4.1.3.3 Types of sewage
4.1.4 Definition of the terms related to Building Sanitation-
4.1.4.1 Water pipe
4.1.4.2 Rain water pipe
4.1.4.3 Soil pipe, Sullage pipe, Vent pipe
4.1.5 Building Sanitary fittings-
4.1.5.1 Water closet –
4.1.5.1.1 Indian type

4.1.5.1.2 European type,
4.1.5.2 Flushing cistern,
4.1.5.3 Wash basin,
4.1.5.4 Sinks,
4.1.5.5 Urinals.
4.1.5.6 Traps-
4.1.5.6.1 Types
4.1.5.6.2 Qualities of good trap
4.1.5.7 Systems of plumbing –
4.1.5.7.1 One Pipe
4.1.5.7.2 Two Pipe
4.1.5.7.3 Single Stack
4.1.5.7.4 Choice Of System
4.1.5.7.5 Inspection and junction chambers, their necessity, location, size and shape.

4.2 Systems of Sewerage and Sewer Appurtenances:
4.2.1 Types of Sewers
4.2.2 Systems of sewerage
4.2.3 self-cleansing velocity and non-scouring velocity
4.2.4 Laying, Testing and maintenance of sewers
4.2.5 Manholes and Drop

5. Characteristics and treatment of Sewage

5.1 Analysis of sewage:
5.1.1 Characteristics of sewage
5.1.2 B.O.D and its significance
5.1.3 C.O.D. and its significance
5.1.4 Central Pollution Control Board Norms for discharge of treated sewage
5.1.5 Objects of sewage treatment
5.1.6 Flow diagram of conventional sewage treatment plant.

5.2 Treatment of Sewage: (Only introduction to terms)
5.2.1 Screening
5.2.2 Types of screens
5.2.3 Grit removal
5.2.4 Skimming
5.2.5 Sedimentation of sewage
5.2.6 Aerobic and anaerobic process
5.2.7 Sludge digestion
5.2.8 trickling filters
5.2.9 Activated sludge process
5.2.10 Disposal of sewage
5.2.11 Oxidation pond
5.2.12 Oxidation ditch
5.2.13 Septic tank
5.2.14 Recycling and Reuse of domestic waste

SUGGESTED LEARNING RESOURCES

1. Sharma S.C, Environmental Engineering, Khanna Publishing House, New Delhi
2. Garg, S.K., Environmental Engineering Vol. I and Vol. II, *Khanna Publishers*
3. Birdie, G. S. and Birdie, J. S.Water Supply and Sanitary Engineering, Dhanpat Rai
4. Gupta, O.P., Elements of Environmental Pollution Control, Khanna Publishing House, Delhi
5. Rao, C.S., Environmental Pollution Control Engineering, New Age International
6. Punmia, B C, Environmental Engineering, vol. I and II, Laxmi Publishers
7. Peavy H S, Rowe D R, and Tchobanoglous G, Environmental Engineering, McGraw
8. Basak N N, Environmental Engineering, McGraw Hill Publishers.

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REPAIRS AND MAINTENANCE OF STRUCTURES

Course Code	CE 60021(Same as CC 60021)
Course Title	Repairs and Maintenance of Structures
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PE

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn about types of maintenance techniques
- To understand causes of various types of damages.
- To know about relevant materials for repair.
- To learn methods of retrofitting for different structures.

COURSE OUTCOMES

After completing this course, student will be able to:

- Decide which type of maintenance is needed for a given damaged structure
- Assess causes of damages various types of structures.
- Select the relevant material for repair of the given structure.
- Apply relevant method of retrofitting for re-strengthening of structures.
- Suggest relevant technique to restore the damages of the given structural elements.

COURSE CONTENT

1. Basics of maintenance

1.1 Types of Maintenances –
- 1.1.1 Repair,
- 1.1.2 Retrofitting,
- 1.1.3 Re-Strengthening
- 1.1.4 Rehabilitation
- 1.1.5 Restoration

1.2 Necessity, objectives and importance of maintenance.

1.3 Approach of effective management for maintenance.

1.4 Periodical maintenance:
- 1.4.1 Check List,
- 1.4.2 Maintenance Manual Containing Building Plan
- 1.4.3 Reinforcement Details
- 1.4.4 Material Sources
- 1.4.5 Maintenance Frequency
- 1.4.6 Corrective Maintenance Procedures and Sources
- 1.4.7 Pre and Post monsoon maintenance.

2. Causes and detection of damages

2.1 Causes of damages due to distress, earthquake, wind, flood, dampness, corrosion, fire, deterioration, termites, pollution and foundation settlement.

2.2 Various aspects of visual observations for detection of damages.

2.3 Load test and non-destructive tests (brief description).
- 2.3.1 NDT tests on damaged structure
  - 2.3.1.1 Rebound Hammer
  - 2.3.1.2 Ultrasonic Pulse Velocity
  - 2.3.1.3 Rebar Locator
  - 2.3.1.4 Crack Detection Microscope
  - 2.3.1.5 Digital Crack Measuring Gauge

2.4 Chemical test –
- 2.4.1 Chloride Test
- 2.4.2 Sulphate Attack

2.4.3 Carbonation test
2.4.4 ph Measurement
2.4.5 Resistivity Method
2.4.6 Half-Cell Potential Meter (Introduction and demonstration only)

3 Materials for maintenance and repairs

3.1 Types of repair material, material selection.
3.2 Essential parameters for maintenance and repair materials such - bond with substrate, durability.
3.3 Waterproofing materials based on
3.3.1 Polymer modified cement slurry,
3.3.2 UV resistant acrylic polymer,
3.3.3 Ferro-cement.
3.4 Repairing materials for masonry:
3.4.1 Plastic/Aluminum Nipples
3.4.2 Non-Shrink Cement
3.4.3 Polyester Putty Or 1:3 Cement Sand Mortar
3.4.4 Galvanized Steel Wire Fabrics And Clamping Rods
3.4.5 Wire Nails
3.4.6 Ferro-Cement Plates.
3.5 Repairing materials for RCC:
3.5.1 Epoxy Resins
3.5.2 Epoxy Mortar
3.5.3 Cement Mortar Impregnated With Polypropylene And Silicon
3.5.4 Polymer Concrete Composites
3.5.5 Sealants
3.5.6 Fiber Reinforcement Concrete
3.5.7 Emulsions And Paints

4 Maintenance and repair methods for masonry Construction

4.1 Causes of cracks in walls
4.1.1 Bulging Of Wall, Shrinkage
4.1.2 Bonding, Shear
4.1.3 Tensile
4.1.4 Vegetation
4.2 Probable crack location:
4.2.1 Junction Of Main And Cross Wall
4.2.2 Junction Of Slab And Wall
4.2.3 Cracks In Masonry Joints
4.3 Repair methods based on crack type –
4.3.1 For minor & medium cracks (width 0.5 mm to 5mm): grouting
4.3.2 For major cracks (width more than 5mm): fixing mesh across cracks,
4.3.3 RCC band,
4.3.4 Installing Ferro-Cement Plates At Corners
4.3.5 Dowel Bars
4.3.6 Propping Of Load Bearing
4.4 Remedial measures for dampness & efflorescence in wall.

5 Maintenance and repair methods for RCC Construction

5.1 Repair stages such as concrete removal and surface preparation, fixing suitable formwork, bonding/passive coat and repair application, various methods of surface preparation.
5.2 Repair options such as grouting, patch repairs, carbonated concrete, cleaning the corroded steel, concrete overlays, latex concrete, epoxy bonded mortar and concrete, polymer concrete, corrosion protection such as jacketing.
5.3 Building cracks and its prevention, common methods for dormant crack repairs such as Epoxy injection, grooving and sealing, stitching, grouting and guniting/ shotcreting.
5.4 Strengthening methods for live cracks such as addition of reinforcements, Jacketing, brackets, collars, supplementary members i.e. shoring, underpinning and propping of framed structure.

SUGGESTED LEARNING RESOURCES

1. Gahlot, P. S., Sharma, S., Building Repair and Maintenance Management, CBS Publishers & Distributors Pvt. Ltd., New Delhi
2. Guha, P. K., Maintenance and Repairs of Buildings, New Central Book Agencies
3. Hutchin Son, B. D., Maintenance and Repairs of Buildings, Newnes-Butterworth
4. Relevant BIS codes

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TENDERING AND ACCOUNTS

Course Code	CE 60022 (Same as CC 60022)
Course Title	Tendering and Accounts
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand terminologies in contract and tender document and their significance.
- To know different types of contracts and their uses.
- To learn preparation of typical Tender documents for civil engineering work.
- To get acquainted with rent fixation and valuation of civil structures.

COURSE OUTCOMES

After completing this course, student will be able to:

- Understand various types of contract and when they are used
- Suggest the relevant type of contract for the given civil engineering work.
- Prepare the typical Tender document for the given civil engineering work.
- Decide type of payment for the executed work.
- Justify the rent fixation and valuation of given civil structure.

COURSE CONTENT

1. Procedure to execute the work

1.1 Administrative approval,
1.2 Technical sanction
1.3 Budget provision
1.4 Expenditure sanction.
1.5 Methods for carrying out works-
  1.5.1 Contract Method
  1.5.2 Departmental Method
  1.5.3 Rate List Method
  1.5.4 Piece Work Method
  1.5.5 Day's Work Method
  1.5.6 Employing Labours On Daily Wages Basis

2. Contracts

2.1 Definition of contract, objects of contract, requirements of contract, overview of Indian Contract Act.
2.2 Types of engineering contract with advantages, disadvantages and their suitability –
  2.2.1 Lump Sum Contract
  2.2.2 Item Rate Contract
  2.2.3 Percentage Rate Contract
  2.2.4 Cost Plus Percentage
  2.2.5 Cost Plus Fixed Fee
  2.2.6 Cost Plus Variable Percentage AndCost Plus Variable Fee Contract
  2.2.7 Labour Contract
  2.2.8 Demolition Contract
  2.2.9 Target Contract
  2.2.10 Negotiated Contract
  2.2.11 Engineering Procurement Construction Contract (EPC)
  2.2.12 Annuity Contract
2.3 Introduction of FIDIC Conditions of contract.
2.4 Classification of contractor on basis of financial limits, Requirement of documents for registration of contractor.
2.5 Build Operate Transfer (BOT) Project,
2.6 BOT Toll contract,

2.7 BOT (Annuity) contract,
2.8 Design, Build, Finance, Operate and Transfer (DBFOT) contract,
2.9 Hybrid Annuity contract,
2.10 Operate Maintain and Transfer (OMT) contract,
2.11 Operation & Maintenance contract (Introduction only).

3. Tender and Tender Documents

3.1 Definition of tender, necessity of tender
- 3.1.1 Types of tender-
  - 3.1.1.1 Local
  - 3.1.1.2 Global
  - 3.1.1.3 Limited

3.2 E -Tendering System –
- 3.2.1 Online procedure of submission and opening of bids (Technical and Financial).

3.3 Notice to invite tender (NIT)-
- 3.3.1 Points to be included while drafting tender notice
- 3.3.2 Drafting of tender notice

3.4
- 3.4.1 Procedure of submitting filled tender Documents (Two envelope system)
- 3.4.2 Procedure Of Opening Tender
- 3.4.3 Comparative Statement
- 3.4.4 Scrutiny Of Tenders
- 3.4.5 Award Of Contract
- 3.4.6 Letter of Award

3.5 Meaning of terms –
- 3.5.1 Earnest Money Deposit (EMD)
- 3.5.2 Performance Security Deposit
- 3.5.3 Validity period
- 3.5.4 corrigendum to tender notice and its necessity
- 3.5.5 Unbalanced bid

3.6 Tender documents –
- 3.6.1 Index,
- 3.6.2 Tender Notice,
- 3.6.3 General Instructions,
- 3.6.4 Special Instructions,
- 3.6.5 Schedule A, Schedule B, Schedule C Etc.

3.7 Terms related to tender documents –
- 3.7.1 Contract conditions-
  - 3.7.1.1 Time Limit
  - 3.7.1.2 Time Extension
  - 3.7.1.3 Penalty
  - 3.7.1.4 Defective Material And Workmanship
  - 3.7.1.5 Termination Of Contract
  - 3.7.1.6 Suspension Of Work
  - 3.7.1.7 Subletting Of Contract
  - 3.7.1.8 Extra Items
  - 3.7.1.9 Price Variation Clause(Escalation)
  - 3.7.1.10 Defect Liability Period
  - 3.7.1.11 Liquidated Damages

3.8 Arbitration-
- 3.8.1 Meaning
- 3.8.2 Qualification of an arbitrator
- 3.8.3 Appointment
- 3.8.4 Dispute and Settlement of disputes
- 3.8.5 Arbitration and Conciliation Act
- 3.8.6 Arbitration award

3.8.7

4. Accounts

4.1 Various account forms and their uses –
- 4.1.1 Measurement Books
- 4.1.2 E- Measurement book (E-MB)
- 4.1.3 Nominal Muster Roll(NMR)
- 4.1.4 Imprest Cash
- 4.1.5 Indent
- 4.1.6 Invoice, Bill
- 4.1.7 Vouchers
- 4.1.8 Hand receipt Cash Book
- 4.1.9 Temporary Advance.
- 4.1.10 Heads of Accounts

4.2 Mode of Payment to the contractor and its necessity
- 4.2.1 Interim Payment, Advance Payment Secured Advance, Petty advance, Mobilization advance, Running account bill, Final bill, Retention money, E - payment.

5. Introduction to Valuation

5.1 Definition and purpose of Valuation, role of value
- 5.1.1 Definition –
  - 5.1.1.1 Cost
  - 5.1.1.2 Price and Value
  - 5.1.1.3 Characteristics of Value
  - 5.1.1.4 Factors Affecting Value

5.2 Types of Value –
- 5.2.1 Book Value
- 5.2.2 Scrap Value
- 5.2.3 Salvage Value
- 5.2.4 Speculative Value
- 5.2.5 Distress Value
- 5.2.6 Market Value
- 5.2.7 monopoly Value
- 5.2.8 Sentimental Value. Factors affecting value

5.3 Depreciation, Obsolescence, Sinking Fund,
- 5.3.1 Methods of Calculation of Depreciation –
  - 5.3.1.1 Straight Line Method
  - 5.3.1.2 Sinking Fund Method
  - 5.3.1.3 Constant Percentage Method

5.4 Fixation of rent
- 5.4.1 Lease –
  - 5.4.1.1 Types Of Lease
  - 5.4.1.2 Lease Hold Property
  - 5.4.1.3 Free Hold Property
- 5.4.2 Mortgage –
  - 5.4.2.1 Mortgage deed
  - 5.4.2.2 Precautions to be taken while making mortgage

SUGGESTED LEARNING RESOURCES

1. Datta, B. N., Estimating and Costing in Civil engineering, UBS Publishers Pvt. Ltd., New Delhi
2. Raina, V. K., Construction Management and Contract Practices, Shroff Publishers & Distributers Pvt. Ltd.
3. Rangawala, S. C., Estimating and Costing, Charotar Publishing House PVT. LTD., Gujrat
4. Birdie, G. S., Estimating and Costing, Dhanpat Rai Publishing Company(P) Ltd., New Delhi
5. Patil, B. S., Civil Engineering Contracts and Estimates, Orient Longman, Mumbai
6. Chakraborti, M., Estimating and Costing, Specification and Valuation in Civil Engineering, MonojitChakraborti, Kolkata.

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PUBLIC HEALTH ENGINEERING LAB

Course Code	CE 6003 (Same as CC 6003)
Course Title	Public Health Engineering Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	PC

COURSE OBJECTIVES

Following are the objectives of this course:

- To learn the tests for measuring quality of drinking water.
- To learn determination of BOD and COD requirement in sewage.
- To understand the plotting of water supply scheme highlighting different features.

COURSE OUTCOMES

After completing this course, student will be able to:

- Perform various tests to assess quality of water.
- Estimate dissolved solids as per BIS codes.
- Measure BOD and COD of sewage sample.
- Draw line diagram of water pipeline system for a locality.

LIST OF PRACTICAL TO BE PERFORMED

1	Determine pH value of given sample of water.
2	Determine the turbidity of the given sample of water.
3	Determine residual chlorine in a given sample of water.
4	Determine suspended, dissolved solids and total solids of given sample of water.
5	Determine the dissolved oxygen in a sample of water.
6	Undertake a field visit to water treatment plant and prepare a report.
7	Determine the optimum dose of coagulant in a given raw water sample by jar test.
8	Draw sketches of various valves used in water supply pipe line
9	Draw a sketch of one pipe and two pipe system of plumbing
10	Determine B.O.D. of given sample of sewage.
11	Determine pH value of given sample of sewage.
12	Determine suspended solids dissolved and total solids for sample of sewage.
13	Determine the dissolved oxygen in the given sample of sewage.
14	Determine C.O.D. of given sample of sewage.
15	Prepare a report of a field visit to sewage treatment plant

SUGGESTED LEARNING RESOURCES

1. Sharma S.C, Environmental Engineering, Khanna Publishing House, New Delhi
2. Garg, S.K., Environmental Engineering Vol. I and Vol. II, *Khanna Publishers*
3. Birdie, G. S. and Birdie, J. S.Water Supply and Sanitary Engineering, Dhanpat Rai
4. Gupta, O.P., Elements of Environmental Pollution Control, Khanna Publishing House, Delhi
5. Rao, C.S., Environmental Pollution Control Engineering, New Age International
6. Punmia, B C, Environmental Engineering, vol. I and II, Laxmi Publishers
7. Peavy H S, Rowe D R, and Tchobanoglous G, Environmental Engineering, McGraw
8. Basak N N, Environmental Engineering, McGraw Hill Publishers.

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