



(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near VIRUDHUNAGAR).

**B.E. CIVIL ENGINEERING
REGULATIONS – 2021
AUTONOMOUS SYLLABUS
CHOICE BASED CREDIT SYSTEM
VII TO VIII SEMESTER CURRICULUM AND SYLLABI**

VISION:

To make the Department of Civil Engineering, unique of its kind to promote education and research in the various fields of construction industry.

MISSION:

To impart highly innovative and technical knowledge in the field of Civil Engineering to the urban and rural student folks through “Total Quality Education”.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

- PEO 1:** Graduates of the program will be creative, able to apply scientific knowledge and computer aided design tools for technical problems in the field of Civil Engineering.
- PEO 2:** Graduates of the program will be a professional Civil Engineer and/or will pursue higher education in various domains of Civil Engineering by taking competitive examinations.
- PEO 3:** Graduates of the program will passionately perform as a competent team member, team leader and/or entrepreneur in the development of a sustainable environment.

PROGRAM OUTCOMES:

After going through the four years of study, the Civil Engineering graduates will have the ability to

POs	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/Development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 : Graduating students will be able to deal complex problems in the field of Civil Engineering to achieve design solutions with modern technological approach and application software.

PSO2 : Graduating students will be able to understand the professional Civil Engineering practice and apply contextual knowledge with the appropriate consideration of the society and environment.

REGULATIONS - 2021
CHOICE BASED CREDIT SYSTEM
B.E. CIVIL ENGINEERING
CURRICULUM AND SYLLABI FOR SEMESTER VII TO VIII
SEMESTER – VII

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CE2401	Irrigation Engineering	PC	3	3	0	0	3
2.	GE2401	Universal Human Values and Ethics	HS	2	2	0	0	2
3.		Management Electives	HS	3	3	0	0	3
4.		Open Elective II	OE	3	3	0	0	3
5.		Open Elective III	OE	3	3	0	0	3
6.		Open Elective IV	OE	3	3	0	0	3
PRACTICAL								
7.	CE2402	Estimation Costing and Quantity Surveying Laboratory	PC	3	0	0	3	1
8.	CE2403	Structural Design and Detailing Laboratory	PC	4	0	0	4	2
TOTAL				23	17	0	6	20

SEMESTER VIII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1.	CE2451	Project Work	EEC	20	0	0	20	10
TOTAL				20	0	0	20	10

OPEN ELECTIVES

OPEN ELECTIVES II (Offered to AI&DS, CSE, ECE, IT)

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	OCE701	Environmental and Social Impact Assessment	OE	3	3	0	0	3
2	OCE702	Fundamentals of Remote Sensing and GIS	OE	3	3	0	0	3
3	OCE703	Urban Agriculture	OE	3	3	0	0	3

OPEN ELECTIVES III (Offered to AI&DS, BT, CSE, ECE, EEE, IT, MECH, MTR)

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	OCE704	Air Pollution and Control Engineering	OE	3	3	0	0	3
2	OCE705	Green Building Concepts	OE	3	3	0	0	3
3	OCE706	Road Safety and Management	OE	3	3	0	0	3

OPEN ELECTIVES IV (Offered to AI&DS, BT, CSE, ECE, EEE, IT, MECH, MTR)

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	OCE707	Climate Change and its Impact	OE	3	3	0	0	3
2	OCE708	Drinking Water Supply, Treatment and Distribution	OE	3	3	0	0	3
3	OCE709	Environment and Agriculture	OE	3	3	0	0	3

MANAGEMENT ELECTIVES

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	GE2491	Principles of Management	HS	3	3	0	0	3
2	GE2492	Total Quality Management	HS	3	3	0	0	3

Course Code	Course Name	L	T	P	C
CE2401	IRRIGATION ENGINEERING	3	0	0	3

Category: Profession Core

a. Preamble

The student is exposed to different phases in irrigation practices and Planning and management of irrigation. Further they will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Outline the crop water requirements.	K2
CO2	Summarize the methods and management of irrigation.	K2
CO3	Organize the types of Impounding structures.	K3
CO4	Understand canal irrigation and drainage works.	K2
CO5	Explain optimization of water use and water management	K2

c. Course Syllabus

Total : 45 Periods

CROP WATER REQUIREMENT

9

Historical development of irrigation - merits and demerits - Need and classification of irrigation types of crops-crop season-duty, delta and base period-Problems-consumptive use of crops estimation of Evapo-transpiration using experimental and theoretical methods.

IRRIGATION METHODS AND EFFICIENCY

9

Lift irrigation -Tank irrigation - Well irrigation - Irrigation methods: Surface and Sub-surface and Micro-Irrigation - Merits and demerits - ridge and furrow irrigation - Irrigation scheduling - Water distribution system - Irrigation efficiencies.

DIVERSION AND IMPOUNDING STRUCTURES

9

Types of Impounding structures - Gravity dam - Forces on a dam - Design of Gravity dams; Earth dams, Arch dams- Diversion Head works - Weirs and Barrages

CANAL IRRIGATION

9

Canal regulations - direct sluice - Canal drop – Cross drainage works-Canal outlets - Design of prismatic canal - canal alignments – Diversion Head works - Canal drop - Cross drainage

works - Canal regulations - Canal outlets - Canal lining - Kennedy's and Lacey's Regime theory

WATER MANAGEMENT IN IRRIGATION

9

Modernization techniques- Rehabilitation - Optimization of water use-Minimizing water losses - On farm development works - Participatory irrigation management with a case study - Water resources associations - Changing paradigms in water management-Performance evaluation - Economic aspects of irrigation.

d. Activities

Students shall get the practical exposure through field visit.

e. Learning Resources

Text Books

1. Sharma R.K., *Irrigation Engineering*, S.Chand & Co. 2007.
2. Dilip Kumar Majumdar, *Irrigation Water Management*, Prentice-Hall of India, New Delhi, 2008.
3. Punmia B.C., et. al., *Irrigation and water power Engineering*, Laxmi Publications, 16th Edition, New Delhi, 2009.

Reference Books

1. Asawa, G.L., *Irrigation Engineering*, New Age International Publishers, New Delhi, 2000.
2. Basak, N.N., *Irrigation Engineering*, Tata McGraw Hill Publishing Co. New Delhi, 1999.
3. Chaturvedi M.C., *Water Resources Systems Planning and Management*, Tata McGraw- Hill Inc., New Delhi, 1997.
4. Michael A.M., *Irrigation Theory and Practice*, 2nd Edition, Vikas Publishing, 2008.

Course Code	Course Name	L	T	P	C
GE2401	UNIVERSAL HUMAN VALUES AND ETHICS	2	0	0	2

Category: Science and Humanities

Preamble

This course is intended to provide much-needed orientational input in value education to the young, enquiring minds.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Define the essential complementarity between 'VALUES' and 'SKILLS' for ensuring happiness and prosperity.	K2
CO2	Explore Human being as the Co-existence of the Self and the Body.	K3
CO3	Develop holistic perspective towards value-based living in a natural way.	K3
CO4	Explain the interconnectedness of the four orders of Nature and existence.	K2
CO5	Comprehend the ethics of human values, Humanistic education and constitution, strategies of value-based life and profession.	K2

c. Course Syllabus

Total : 30 Periods

INTRODUCTION TO VALUE EDUCATION 6

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations.

HARMONY IN THE HUMAN BEING 6

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

HARMONY IN THE FAMILY AND SOCIETY **6**

Harmony in the Family - the Basic Unit of Human Interaction, 'Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

HARMONY IN THE NATURE/EXISTENCE **6**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

IMPLICATIONS OF THE HOLISTIC UNDERSTANDING - A LOOK AT PROFESSIONAL ETHICS **6**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

d. Activities

Practice Sessions - Introduction to Value Education

- 1 Sharing about Oneself
- 2 Exploring Human Consciousness
- 3 Exploring Natural Acceptance

Practice Sessions– Harmony in the Human Being

- 4 Exploring the difference of Needs of Self and Body
- 5 Exploring Sources of Imagination in the Self
- 6 Exploring Harmony of Self with the Body

Practice Sessions– Harmony in the Family and Society

- 7 Exploring the Feeling of Trust
- 8 Exploring the Feeling of Respect
- 9 Exploring Systems to fulfil Human Goal

Practice Sessions– Harmony in the Nature (Existence)

- 10 Exploring the Four Orders of Nature
- 11 Exploring Co-existence in Existence

Practice Sessions– Implications of the Holistic Understanding – a Look at Professional Ethics

12 Exploring Ethical Human Conduct

13 Exploring Humanistic Models in Education

14 Exploring Steps of Transition towards Universal Human Order

e. Learning Resources

[https://fdp-si.aicte-india.org/UHV-II Lectures PPTs.php](https://fdp-si.aicte-india.org/UHV-II_Lectures_PPTs.php)

<https://fdp-si.aicte-india.org/UHV-II%20Practice%20Sessions.php>

Text Books

1. R R Gaur, R Asthana, G P Bagaria., *The Textbook A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019.
2. R R Gaur, R Asthana, G P Bagaria., *The Teacher's Manual A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019.

Reference Books

1. EkParichaya, A Nagaraj., *JeevanVidya*, JeevanVidyaPrakashan, Amarkantak, 1999.
2. A.N. Tripathi ., *Human Values*, New Age Intl. Publishers, New Delhi, 2004.
3. Mohandas Karamchand Gandhi ., *The Story of My Experiments with Truth*. 2009.
4. J C Kumarappa., *Economy of Permanence*. 2017.
5. Maulana Abdul Kalam Azad., *India Wins Freedom*. 1988.

Course Code	Course Name	L	T	P	C
CE2402	ESTIMATION COSTING AND QUANTITY SURVEYING LABORATORY	0	0	3	1

Category: Professional Core

a. Preamble

This subject covers the various aspects of estimating of quantities of items of works involved in buildings, water supply and sanitary works, road works and irrigation works. This also covers the rate analysis of different types of work. At the end of this course the student shall be able to estimate the material quantities, prepare a bill of quantities, make specifications.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the general and detailed specifications of different types of construction works	K2
CO2	Estimate quantities of items of works for buildings using conventional method and spread sheet.	K3
CO3	Estimate quantities of items of works for roads.	K3
CO4	Conduct rate analysis for different types of works.	K3
CO5	Demonstrate Bar bending schedule and qE Pro Software.	K2

c. Course Syllabus

**Total : 45
Periods**

1. Writing general specifications for different types of construction works
2. Writing details specifications for different types of construction works.
3. Arriving at quantities of items of buildings with similar foundation throughout with flat/sloped roofs using Individual wall method and Centre line method.
4. Arriving at quantities of items of buildings with differential foundation details with flat/sloped roofs using Individual wall method and Centre line method using spread sheets.
5. Estimation of quantities of items of road works.
6. Rate analysis – concept and terminologies, CPWD/ PWD Schedule of rates.
7. Arriving at rate per unit of items of plain concrete in different types of foundation, floor and weathering course work.
8. Arriving at rate per unit of items of different types of RCC works in structural elements – Beams, Columns, slabs etc.

9. Arriving at rate per unit of items of different types of Masonry works (Stone, Brick etc.), reinforced brick work.
10. Arriving at rate per unit of items of different types of finishing works – plastering, flooring, DPC, pointing, painting etc.
11. Bar bending schedule – concept and terminologies.
12. Demonstration on qE Pro Software.

d. Activities

Students shall be exposed to prepare estimation of their own buildings using spread sheets.

e. Learning Resources

Text Books

1. Dutta, B.N., *Estimating and Costing in Civil Engineering*, UBS Publishers & Distributors Pvt. Ltd., 2003.
2. Chakraborti. M, *Estimating, Costing, Specification & Valuation In Civil Engineering*, Vikas Book House, Pune, 2006.

Reference Books

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD.
2. Standard Data Book for Analysis and Rates, 2003, IRC, New Delhi.
3. Robert Peurifoy and Gerold Oberlender, *Estimating Construction Costs*, Kindle Edition, 2011.
4. Govt of Tamil Nadu PWD – *Standard Schedule of Rates*, 2016-17.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No.	Description of Equipment	Quantity Required
1.	Models of Structures	1 each
2.	Computers Pentium IV	30 Nos.

Course Code	Course Name	L	T	P	C
CE2403	STRUCTURAL DESIGN AND DETAILING LABORATORY	0	0	4	2

Category: Professional Course

a. Preamble

The course introduces provide students with a solid background on the principles of structural engineering design. To acquire the knowledge of liquid retaining structures, bridges components, retaining wall and industrial structures.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Design and draw reinforced concrete footings.	K3
CO2	Design and draw R.C.C one way slab, two way slab and flat slab as per code provisions.	K3
CO3	Design and draw Cantilever and Counterfort Retaining Walls.	K3
CO4	Design and draw reinforced concrete and steel water tanks.	K3
CO5	Design and detail various steel structures, trusses, connections and Gantry girders.	K3

c. Course Syllabus

Total : 60 Periods

Part A - RCC Structures

1. One way and Two way Slab
2. Simply Supported, Continuous and Cantilever beam
3. Dog legged staircase
4. Rectangular Column and Footing
5. Combined footing with Two columns
6. Cantilever and Counter Fort Retaining wall

Part B- Steel Structures

1. Built up column, column base and Foundation
2. Purlin design
3. Plate Girder (welded)
4. Framed Connections and Detailing
5. Gantry Girder

d. Activities

Students shall be exposed to the field visit to study various R.C.C and Steel Structures.

e. Learning Resources

Text Books

1. Krishnaraju N, *Structural Design and Drawing*, Universities Press, 2022.
2. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, *Comprehensive Design of Steel Structures*, Laxmi Publications Pvt. Ltd., 2012.

Reference Books

1. Krishnamurthy D, *Structural Design and Drawing Voll, II and III*, CBS Publishers, 2010.
2. Shah V L and Veena Gore, *Limit State Design of Steel Structures*
3. *IS800-2007*, Structures Publications, 2009.
4. *IS 456(2000) reaffirmed in 2021, Indian Standard Plain and Reinforced Concrete-Code of Practice*, Bureau of Indian Standards, New Delhi.
5. *SP34 Handbook on Concrete Reinforcement and Detailing*, Bureau of Indian Standards, New Delhi
6. *IS 800 (2007) Indian Standard General Construction In Steel-Code of Practice*, Bureau of Indian Standards, New Delhi.
7. *IS 875 Part 1 (2008) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures*, Code of Practice-Dead Load, Bureau of Indian Standards, New Delhi.
8. *IS 875 Part 2 (2008) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures*, Code of Practice-Imposed Load, Bureau of Indian Standards, New Delhi.
9. *IS 875 Part 3 (2015) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures*, Code of Practice-Wind Load, Bureau of Indian Standards, New Delhi.
10. *IS 3370 Part 1 (2021) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice-General Requirements*, Code of Practice, Bureau of Indian Standards, New Delhi.

11. *IS 3370 Part 2 (2021) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice-Reinforced Concrete Structures*, Code of Practice, Bureau of Indian Standards, New Delhi.
12. *IS 3370–Part 4 (2008) Indian Standard Code of Practice for Concrete Structures for The Storage of Liquids-Design Tables*, Code of Practice, Bureau of Indian Standards, New Delhi.
13. *IS 804 (2008) Indian Standard Specification for Rectangular Pressed Steel Tanks, Code of Practice*, Bureau of Indian Standards, New Delhi.
14. *IS 805 (2006) Indian Standard Code of Practice for Use of Steel in Gravity Water Tanks*, Code of Practice, Bureau of Indian Standards, New Delhi.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No.	Description of Equipment	Quantity Required
1.	Models of Structures	1 each
2.	Computers Pentium IV	30 Nos.
3.	Analysis and Design Software - Minimum 5 use License	1 No.

Course Code	Course Name	L	T	P	C
GE2491	PRINCIPLES OF MANAGEMENT	3	0	0	3

Category: Management Elective

a. Preamble

This course introduces fundamental principles of management, emphasizing their universal applicability in diverse organizations. It covers core managerial functions, explores organizational structures, and provides insights into effective global leadership qualities and skills.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Discuss the trends and challenges of management in global scenario, the different types of organization and its effectiveness.	K2
CO2	Describe the strategies and policies which are involved in process planning and decision making.	K2
CO3	Illustrate the structure, purpose, selection and recruitment process in organizations.	K2
CO4	Elucidate the various motivational theories and processes of management including its functions.	K2
CO5	Explain the process and control techniques for budgeting and inventory management.	K2

c. Course Syllabus

Total : 45 Periods

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management - Nature, Scope and Functions of Management - Evolution of Management - Contributions of FW Taylor (14 principles of Management), Henri Fayol, Elton Mayo, Roethlisberger, H.A.Simon and P.F Drucker - Management theories - Science or Art - Manager Vs Entrepreneur - types of managers managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Current trends and issues in Management.

PLANNING **9**

Nature and purpose of planning - Planning process - Types of planning - Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

ORGANISING **9**

Nature and purpose - Formal and informal organization - Organization chart - Organization structure - Types - Line and staff authority - Departmentalization - delegation of authority - Centralization and decentralization - Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

DIRECTING **9**

Directing meaning - importance - principles of directing - Motivation - Motivation theories - Motivational techniques - Job satisfaction - Job enrichment - Leadership - 14 types and theories of leadership - Communication - Process of communication, types of communication and its uses - Barrier in communication - Effective Communication - Communication and IT.

CONTROLLING **9**

System and process of controlling - Budgetary and non - Budgetary control techniques - Use of computers and IT in Management control - Productivity problems and management - Inventory Management - PERT, CPM - Application - Control and performance – Direct and preventive control.

d. Activities

Students shall be given exposure to various concepts of delegation of authority, centralization, and decentralization within the college premises.

e. Learning Resources

Text Books

1. Harold Koontz and Heinz Weihrich, *Essentials of Management*, Tata McGraw Hill, 2020.
2. Stephen P. Robbins and Mary Coulter, *Management*, Pearson , 2019.

Reference Books

1. Robert Kreitner and Mamata Mohapatra, *Management*, Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, *Fundamentals of Management*, Pearson Education, 9th Edition, 2016.

3. Tripathy PC and Reddy PN, *Principles of Management*, Tata McGraw Hill, 2021.

Course Code	Course Name	L	T	P	C
GE2492	TOTAL QUALITY MANAGEMENT	3	0	0	3

Category: Management Elective

a. Preamble

Quality is the mantra for success or even for the survival of any organization in this competitive global market. Total Quality Management (TQM) is an enhancement to the traditional way of doing business. It is a proven technique to guarantee survival in world class competition. It integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach. At the end of the course the students are expected to recognize the quality issues in an organization and analyze the ways to solve those using TQM techniques, and demonstrate skills in using modern TQM tools.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Describe the concepts of TQM for an enterprise.	K2
CO2	Comprehend the TQM principles and its implementation.	K2
CO3	Discuss the various traditional and new TQM tools.	K2
CO4	Examine the fundamental concepts of QFD and TPM with applications.	K3
CO5	Apply QMS and EMS in business organization.	K3

c. Course Syllabus

Total : 45 Periods

INTRODUCTION

9

Concept of Quality and Quality Management - Determinants of quality of a product & Service - Reliability - Definition of TQM - Basic concepts of TQM - TQM Framework - Barriers to TQM - Benefits of TQM - Gurus of TQM (Brief Introduction) - Quality statements - vision, mission, and policy.

TQM PRINCIPLES

9

Continuous Improvement Process - Deming Philosophy - Juran Trilogy - PDSA cycle - Kaizen - Concepts of Quality circle - Japanese 5S principles and 8D methodology.

TQM TOOLS & TECHNIQUES I

9

The seven traditional tools of quality - New management tools - Six-sigma Process Capability - Bench marking: Reasons for benchmarking , Benchmarking process, Understanding Current Performance, Planning, Pitfalls and Criticisms of Benchmarking - FMEA: Intent, Documentation, Stages: Design FMEA and Process FMEA.

TQM TOOLS & TECHNIQUES II

9

Quality circles - Quality Function Deployment: QFD Team - Benefits of QFD - Voice of the customers - Organization of Information - House of Quality - QFD Process - Taguchi quality loss function - TPM: Concepts, improvement needs - Performance measures - Cost of Quality - Applications.

QUALITY AND ENVIRONMENTAL MANAGEMENT SYSTEM

9

Introduction - Benefits of ISO Registration - ISO 9000 Series of Standards - Sector Specific Standards: AS 9100, TS16949 and TL 9000 - ISO 9001 Requirements - Implementation - Documentation - Internal Audits - Registration - ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction - ISO 14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001 – Benefits and applications of EMS.

d. Activities

Students shall be exposed to learn the knowledge and skills necessary to drive organizational excellence through the implementation of effective quality management strategies.

e. Learning Resources

Text Books

1. Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield, Mary B.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe., *Total Quality Management*, Revised 3rd Edition, Pearson Education Asia, 2013.
2. Suganthi L & Anand Samuel., *Total Quality Management*, Prentice Hall Publications, 2004.

Reference Books

1. Kiran. D.R., *Total Quality Management: Key concepts and case studies*, Butterworth – Heinemann Limited, 2016.
2. Shridhara Bhat K., *Total Quality Management: Text and Cases*, Himalaya Publishing House India, 2nd Edition, 2016.

Course Code	Course Name	L	T	P	C
CE2451	PROJECT WORK	0	0	20	8

Category: Professional Core

a. Preamble

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.

To train the students in preparing project reports and to face reviews and viva voce examination

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Choose any challenging practical problems and understand the background	K3
CO2	Make literature review to classify project characteristics	K3
CO3	Develop solution by formulating proper methodology	K4
CO4	Analyze and apply relevant tools for evolving the solution	K4
CO5	Function as a team in multidisciplinary approach.	K4

c. Course Syllabus

Total : 300 Periods

The students will be working in single or group of 3 to 4 on a scientific problem approved by the Head of the Department under the guidance of the faculty member and prepare a comprehensive report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on project evaluation process as recommended in the respective regulation

The student can also be permitted to work on the project in Industry/Research organization with the due permission from Head of the Department. The Engineer/Scientist from Industry/Research Organization can jointly act as supervisor in addition to the Project Supervisor. The student should undergo project evaluation process as recommended in the respective regulations.

Course Code	Course Name	L	T	P	C
OCE701	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	3	0	0	3

Category: Open Elective

a. Preamble

To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	carry out scoping and screening of developmental projects for environmental and social assessments	K2
CO2	explain different methodologies for environmental impact prediction and assessment	K2
CO3	plan environmental impact assessments and environmental management plans	K2
CO4	evaluate environmental impact assessment reports	K2
CO5	apply all the concepts in real time case study	K3

c. Course Syllabus

Total : 45 Periods

INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle – EIA Notification and Legal Framework.

ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA - Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices - Networks - Checklist Methods - Mathematical models for Impact prediction.

ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna - Environmental Monitoring Plan - EIA Report Preparation - Public Hearing-Environmental Clearance.

SOCIO ECONOMIC ASSESSMENT

9

Baseline monitoring of Socio economic environment - Identification of Project Affected Personal - Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts - Cost benefit Analysis.

CASE STUDIES

9

EIA case studies pertaining to Infrastructure Projects - Roads and Bridges - Mass Rapid Transport Systems - Airports - Dams and Irrigation projects - Power plants.

d. Activities

Students shall be exposed to prepare the draft report of EIA.

e. Learning Resources

Text Books

1. Canter, R.L., *Environmental impact Assessment*, 2nd Edition, McGraw Hill Inc, New Delhi, 1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu., *Environmental Impact Assessment for Developing Countries in Asia*, Volume 1 – Overview, Asian Development Bank, 1997.

Reference Books

1. Becker H. A., Frank Vanclay., *The International handbook of social impact assessment conceptual and methodological advances*, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe., *Environmental Impact Assessment Training Resource Manual*, United Nations Environment Programme, 2002.

Course Code	Course Name	L	T	P	C
OCE702	FUNDAMENTALS OF REMOTE SENSING AND GIS	3	0	0	3

Category: Open Elective

a. Preamble

- This course introduces the students to the basic concepts and principles of various components of remote sensing and its application.
- It will also provide an exposure to GIS and its practical applications

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Demonstrate the concepts of Electro Magnetic energy, spectrum and spectral signature curves.	K2
CO2	Apply the concepts of satellite and sensor parameters and characteristics of different platforms.	K3
CO3	Apply the concepts of DBMS in GIS.	K3
CO4	Make use of raster and vector data analysis and modeling in GIS.	K3
CO5	Apply GIS in land use, disaster management, ITS and resource information system.	K3

c. Course Syllabus

Total : 45 Periods

EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL 9

Remote Sensing - Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere - Atmospheric Windows and its Significance – EMR interaction with Earth Surface Materials - Spectral Signature and Spectral Signature curves for water, soil and Earth Surface.

PLATFORMS AND SENSORS 9

Satellites - Classification - Satellite Sensors - satellite and sensor parameters - Resolution - Types of Remote Sensing - Visual Interpretation of Satellite Images - Digital Image processing - Characteristics of different platforms: Landsat, SPOT, IRS series, IKONOS,

QUICKBIRD - Radar, LIDAR, SAR, MODIS, AMSRE, Sonar remote sensing systems
introduction of GPS- data receiving mode- DTM generation-View shed analysis.

GEOGRAPHIC INFORMATION SYSTEM 9

GIS - History of Development - Components of GIS - Hardware, Software and Organizational Context - Data - Spatial and Non-Spatial - Data Input Sources - DBMS - Data Output - Data models - Raster and Vector data structures - Data compression - Raster vs. vector comparison.

DATA ANALYSIS AND MODELLING 9

Analysis using Raster and Vector data - Operations - Overlaying - Buffering - Modelling in GIS - Digital Terrain Modelling, Analysis and application - Products of DEMs and their uses - Sources of errors in GIS and their elimination.

APPLICATIONS OF REMOTE SENSING AND GIS 9

Applications of Remote Sensing and GIS - Advanced applications of GIS - Disaster management, Water resource, Landuse - Land cover - Urban planning - Intelligent Transport Systems - Development of Resources Information Systems.

d. Activities

Students shall be exposed to open source GIS software.

e. Learning Resources

Text Books

1. Anji Reddy. M., *Remote Sensing and Geographical Information Systems*, S. Publications, Hyderabad, 2001.
2. Satheesh Gopi, *Advanced Surveying*, Pearson Education, 2017.

Reference Books

1. Burrough P.A. and Rachel A. McDonell, *Principles of Geographical Information Systems*, Oxford Publication, 2004.
2. C.P. Lo and Albert K. W. Yeung, *Concepts and Techniques of Geographical Information Systems*, Prentice- Hall India, 2006.
3. Thomas. M. Lillesand and Ralph. W. Kiefer, *Remote Sensing and Image Interpretation*, John Wiley and Sons, 2003.

Course Code	Course Name	L	T	P	C
OCE703	URBAN AGRICULTURE	3	0	0	3

Category: Open Elective

a. Preamble

To introduce the students the principles of agricultural crop production and the production practices of crops in modern ways. To delineate the role of agricultural engineers in relation to various crop production practices.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Demonstrate the principles behind crop production and various parameters that influences the crop growth on roof tops	K2
CO2	Explain different methods of crop production on roof tops	K2
CO3	Explain nutrient and pest management for crop production on roof tops	K2
CO4	Illustrate crop water requirement and irrigation water management on roof tops	K2
CO5	Explain the concept of waste management on roof tops	K2

c. Course Syllabus

Total : 45 Periods

INTRODUCTION 9

Benefits of urban agriculture- economic benefits, environmental benefits, social and cultural benefits, educational, skill-building and job training benefits, health, nutrition and food accessibility benefits.

VERTICAL FARMING 9

Vertical farming- types, green facade, living/green wall-modular green wall , vegetated mat wall Structures and components for green wall system: plant selection, growing media, irrigation and plant nutrition: Design, light, benefits of vertical gardening. Roof garden and its types. Kitchen garden, hanging baskets: The house plants/ indoor plants

SOIL LESS CULTIVATION 9

Hydroponics, aeroponics, aquaponics: merits and limitations, costs and Challenges, backyard gardens- tactical gardens- street landscaping- forest gardening, greenhouses, urban beekeeping

MODERN CONCEPTS

9

Growth of plants in vertical pipes in terraces and inside buildings, micro irrigation concepts suitable for roof top gardening, rain hose system, Green house, polyhouse and shade net system of crop production on roof tops

WASTE MANAGEMENT

9

Concept, scope and maintenance of waste management- recycle of organic waste, garden wastessolid waste management-scope, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues, waste utilization.

d. Activities

Students shall be exposed to the gardening activities in the college premises.

e. Learning Resources

Text Books

1. Martellozzo F and J S Landry, *Urban Agriculture*. Scitus Academics Llc, 2020.
2. Rob Roggem, *Sustainable Urban Agriculture and Food Planning*. Routledge Taylor and Francis Group, 2016.
3. Akrong M O., *Urban Agriculture*. LAP Lambert Academic Publishing, 2012.

Reference Books

1. Agha Rokh A., *Evaluation of ornamental flowers and fishes breeding in Bushehr urban wastewater using a pilot-scale aquaponic system*. *Water and Wastewater*, 19 (65): 47–53, 2008.
2. Agrawal M, Singh B, Rajput M, Marshall F and Bell J. N. B. , *Effect of air pollution on periurban agriculture: A case study*. *Environmental Pollution*, 126 (3): 323–329,2003
<https://www.sciencedirect.com/science/article/pii/S0269749103002458#aep-section-id24>.
3. Jac Smit and Joe Nasr., *Urban agriculture for sustainable cities: using wastes and idle land and water bodies as resources*. *Environment and Urbanization*, 4 (2):141-152, 1992.

Course Code	Course Name	L	T	P	C
OCE704	AIR POLLUTION AND CONTROL ENGINEERING	3	0	0	3

Category: Open Elective

a. Preamble

To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Classify the air pollutants, their effects and to know about the ambient air quality and emission standards.	K2
CO2	Characterize the plume behaviour and dispersions.	K2
CO3	Select the methods of air pollution control for particulate contaminants.	K2
CO4	Select the methods of air pollution control for gaseous pollutants.	K2
CO5	Assess the indoor air quality and to know about the noise pollution, source, effect, control and preventive measures.	K2

c. Course Syllabus

Total : 45 Periods

INTRODUCTION

9

Structure and composition of Atmosphere - Definition, Scope and Scales of Air Pollution - Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility - Ambient Air Quality and Emission standards, Air prevention and Control of Pollution act, 1981.

METEOROLOGY

9

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories - Dispersion models, Plume rise.

CONTROL OF PARTICULATE CONTAMINANTS

9

Factors affecting Selection of Control Equipment - Gas Particle Interaction - Working principle - Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators.

CONTROL OF GASEOUS CONTAMINANTS 9

Factors affecting Selection of Control Equipment - Working principle - absorption, Adsorption, condensation, Incineration, Bio filters - Process control and Monitoring.

INDOOR AIR QUALITY MANAGEMENT 9

Sources, types and control of indoor air pollutants, sick building syndrome and Building related illness - Sources and Effects of Noise Pollution - Measurement - Standards - Control and Preventive measures.

d. Activities

Activities to improve the experimental learning:

- Industrival visit to cement factory might be arranged to know about air quality management.

e. Learning Resources

Text Books

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, *Air Pollution Control Engineering*, Tokyo, springer science + science media LLC, 2004.
2. Noel de Nevers, *Air Pollution Control Engineering*, Waveland press, Inc ,2017.
3. Anjaneyulu. Y, *Air Pollution and Control Technologies*, Allied Publishers (P) Ltd., India, 2002.

Reference Books

1. David H.F. Liu, Bela G. Liptak, *Air Pollution*, Lweis Publishers, 2000.
2. Arthur C. Stern, *Air Pollution (Vol.I – Vol.VIII)*, Academic Press, 2006.
3. Wayne T.Davis, *Air Pollution Engineering Manual*, John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, *Air Pollution*, Tata Mcgraw Hill Publishing Company limited, 2007.
5. C.S.Rao, *Environmental Pollution Control Engineering*, New Age International(P) Limited Publishers, 2006.

Course Code	Course Name	L	T	P	C
OCE705	GREEN BUILDING CONCEPTS	3	0	0	3

Category: Open Elective

a. Preamble

To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Understand the various environmental implications of buildings.	K2
CO2	Explain the implications of building technologies for the embodied energy of buildings.	K2
CO3	Outline the characteristics of building materials and building techniques.	K2
CO4	Explain the concepts solar energy in buildings.	K2
CO5	Illustrate the concepts of green composites for buildings.	K2

c. Course Syllabus

Total : 45 Periods

ENVIRONMENTAL IMPLICATIONS OF BUILDINGS 9

Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings.

IMPLICATIONS OF BUILDING TECHNOLOGIES EMBODIED ENERGY OF BUILDINGS 9

Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

COMFORTS IN BUILDING 9

Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

UTILITY OF SOLAR ENERGY IN BUILDINGS 9

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

GREEN COMPOSITES FOR BUILDINGS **9**

Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

d. Activities

Students shall be exposed to the different machine parts, starters and the drive in the college premises.

e. Learning Resources

Text Books

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. *Alternative Building Materials and Technologies*. New Age International, 2007.
2. Ursula Eicker. *Low Energy Cooling For Sustainable Buildings*. John Wiley and Sons Ltd, 2009.
3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

Reference Books

1. Osman Attmann. *Green Architecture Advanced Technologies and Materials*. McGraw Hill, 2010.
2. Jerry Yudelson. *Green building Through Integrated Design*. McGraw Hill, 2009.
3. Marian Keeler, Bill Burke. *Fundamentals of Integrated Design for Sustainable Buildig*, John Wiley and Sons Ltd, 2009.

Course Code	Course Name	L	T	P	C
OCE706	ROAD SAFETY AND MANAGEMENT	3	0	0	3

Category: Open Elective

a. Preamble

This course introduces the basic concepts of,

- Guidelines, and crash data analysis related to driving safety
- Traffic signs, road markings, and signals for safe driving
- Intersection traffic flow principles
- Methods for improving road safety
- Safe driving for the vulnerable road users

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Explain the principles, concepts, and crash data analysis related to driving safety.	K2
CO2	Outline the knowledge of road markings, traffic signs and signals for safe driving.	K2
CO3	Explain the concepts of traffic flow at intersections.	K2
CO4	Summarize the methods for managing road safety.	K2
CO5	Apply the techniques for driving safely for the most vulnerable road users.	K3

c. Course Syllabus

Total : 45 Periods

OVERVIEW OF ROAD SAFETY 9

Introduction, definition - science based perspectives - Road safety demographics - Road user decisions - Classification of accidents, causes Origin, characteristics and uses - of crash data - Contributing to crash factors, countermeasures.

ROAD MARKINGS 9

Functions, types, general principles - Carriageway marking, pedestrian crossing, cyclist crossing, marking at parking space, object marking, word messages.

SIGNS AND SIGNALS 9

Importance of traffic signs - need for international standardization - general principles of traffic signing Types of traffic signs – purposes Advantages and disadvantages of traffic signals - signal faces, fixed time signals - Vehicle actuated signals, concept of signal coordination.

MANAGEMENT OF ROAD SAFETY 9

Introduction to traffic control aids - Street furniture - types and purposes - Traffic islands and channelization - general principle and purposes, street lighting - At grade intersection - types, conflict points - Grade separated structures - types, advantages and disadvantages, traffic flow concepts - Traffic regulations - basic principles, Roles of Government and NGO's, Motor Vehicle Act - 1988 - Rules of Road Regulations – 1989, National Road Safety Policy, Parking regulations - Road side facilities and amenities - general principles and purposes.

SAFE DRIVING 9

Tips and suggestions for safe driving at urban and rural locations - safety in long journey, driving in night times, hill roads and tunnels - vulnerable road user - regulatory measures for motor cycle and scooter riders - Common rules for pedestrians and cyclists - Case studies.

d. Activities

Students shall be exposed to the different road markings and signs and signals for safe driving.

e. Learning Resources

Text Books

1. Kadiyali L.R, *Traffic Engineering and Transport Planning*, Khanna Publishers, New Delhi, seventh edition, 2011

Reference Books

1. Elvik Rune, *The Handbook of Road Safety Measures*, Emerald Group Publishing Limited, 2nd revised edition 2009
2. Ashwini Bagga and Nisha Bagga, *Essentials of Road Safety*, Mayas Publishers, 2012
3. *Highway Safety Code*, Indian Road Congress, New Delhi, 1996
4. *Code of Practice for Road Markings*, IRC: 35 – 1970, revised edition, 1990
5. *Recommended Practice for Road Delineators*, IRC:79 Indian Road Congress, New Delhi, 1981

Course Code	Course Name	L	T	P	C
OCE707	CLIMATE CHANGE AND ITS IMPACT	3	0	0	3

Category: Open Elective

a. Preamble

To understand the basics of weather and climate To have an insight on Atmospheric dynamics and transport of heat . To develop simple climate models and evaluate climate changes using models

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Outline the concepts of weather and climate	K2
CO2	Explain the principles of Atmospheric dynamics and transport of heat and air mass	K2
CO3	Expalin the components and phenomena in the global climate system	K2
CO4	Outline different process in climate system	K2
CO5	Demonstrate simple climate models and to predict climate change	K2

c. Course Syllabus

Total : 45 Periods

BASICS OF WEATHER AND CLIMATE:

9

Shallow film of Air - stratified & disturbed atmosphere - law - atmosphere Engine. Observation of parameters: Temperature - Humidity - Wind - Pressure - precipitation-surface - networks. Constitution of atmosphere: well stirred atmosphere - process around turbopause - in dry air - ozone - carbon Dioxide - Sulphur Dioxide - Aerosol - water. Evolution of Atmosphere. State of atmosphere: Air temperature - pressure - hydrostatic - Chemistry - Distribution - circulation

ATMOSPHERIC DYNAMICS:

9

Atmosphere dynamics: law - isobaric heating and cooling - adiabatic lapse rates - equation of motion - solving and forecasting. Forces - Relative and absolute acceleration - Earth's rotation coriolis on sphere - full equation of motion - Geostrophy;- Thermal winds - departures - small- scale motion. Radiation, convection and advections: sun & solar radiation

- energy balance - terrestrial radiation and the atmosphere - Green house effect - Global warming - Global budget - radiative fluxes - heat transport. Atmosphere and ocean systems convecting & advecting heat. Surface and boundary layer - smaller scale weather system - larger scale weather system.

GLOBAL CLIMATE

9

Components and phenomena in the climate system: Time and space scales - interaction and parameterization problem. Gradients of Radiative forcing and energy transports by atmosphere and ocean - atmospheric circulation - latitude structure of the circulation - latitude - longitude dependence of climate features. Ocean circulation: latitude - longitude dependence of climate features - ocean vertical structure - ocean thermohaline circulation - land surface processes - carbon cycle.

CLIMATE SYSTEM PROCESSES

9

Conservation of motion: Force - coriolis - pressure gradient - velocity equations - Application - geotropic wind - pressure co-ordinates. Equation of State - atmosphere - ocean. Application: thermal circulation - sea level rise. Temperature equation: Ocean - air - Application - decay of sea surface temperature. Continuity equation: ocean - atmosphere. Application: coastal upwelling - equatorial upwelling - conservation of warm water mass. Moisture and salinity equation: conservation of mass - moisture. Source & sinks - latent heat. Moist processes - saturation - convection - Wave processes in atmosphere and ocean.

CLIMATE CHANGE MODELS

9

Constructing a climate model - climate system modeling - climate simulation and drift - Evaluation of climate model simulation - regional (RCM) - global (GCM) - Global average response to warming - climate change observed to date.

d. Activities

Students shall be exposed to the gardening activities in the college premises.

e. Learning Resources

Text Books

1. Robin Moilveen, *Fundamentals of weather and climate*, Oxford University Press, (2nd Edition), 2010.
2. J. David Neelin, *Climate change and climate modeling*, Cambridge University press, 2011.

Reference Books

1. Tristan Kershaw, *Climate Change Resilience in the Urban Environment*, IOP Publishing Ltd, 2017.

Course Code	Course Name	L	T	P	C
OCE708	DRINKING WATER SUPPLY, TREATMENT AND DISTRIBUTION	3	0	0	3

Category: Open Elective

a. Preamble

This course introduces the principles and working of water treatment units and distribution system.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Understand of water quality criteria and standards, and their relation to public health.	K2
CO2	Develop the water conveyance system	K3
CO3	Outline the various unit operations and processes in water treatment	K2
CO4	Understand the various systems for advanced water treatment	K2
CO5	Explain the structure of drinking water distribution system	K2

c. Course Syllabus

Total : 45 Periods

SOURCES OF WATER 9

Public water supply system - Planning, Objectives, Design period, Population forecasting; Water demand - Sources of water and their characteristics, Surface and Groundwater - Impounding Reservoir - Development and selection of source - Source Water quality - Characterization - Significance - Drinking Water quality standards.

CONVEYANCE FROM THE SOURCE 9

Water supply - intake structures - Functions; Pipes and conduits for water - Pipe materials - Hydraulics of flow in pipes - Transmission main design - Laying, jointing and testing of pipes - appurtenances - Types and capacity of pumps - Selection of pumps and pipe materials.

WATER TREATMENT 9

Objectives - Unit operations and processes - Principles and functions of water treatment plant units, aerators of flash mixers, Coagulation and flocculation - sand filters - Disinfection - Construction, Operation and Maintenance aspects.

ADVANCED WATER TREATMENT

9

Water softening - Desalination- R.O. Plant - demineralization - Adsorption - Ion exchange - Membrane Systems - Iron and Manganese removal - Defluoridation - Construction and Operation and Maintenance aspects

WATER DISTRIBUTION AND SUPPLY

9

Requirements of water distribution - Components - Selection of pipe material - Service reservoirs - Functions - Appurtenances - Leak detection - Principles of design of water supply in buildings - House service connection - Fixtures and fittings, systems of plumbing and types of plumbing.

d. Activities

Students shall be exposed to handson testing of water quality parameters in laboratory.

e. Learning Resources

Text Books

1. Garg. S.K., *Water Supply Engineering*, Khanna Publishers, Delhi, September 2008.
2. Punmia B.C, Arun K.Jain, Ashok K.Jain, *Water supply Engineering* , Lakshmi publication private limited, New Delhi, 2016.
3. Birdie.G.S., *Water Supply and Sanitary Engineering*, Dhanpat Rai and sons, 2018.

Reference Books

1. Fair. G.M., Geyer.J.C., *Water Supply and Wastewater Disposal*, John Wiley and Sons, 1954.
2. Babbitt.H.E, and Donald.J.J, *Water Supply Engineering* , McGraw Hill book Co, 1984
3. Steel. E.W.et al., *Water Supply Engineering* , Mc Graw Hill International book Co, 1984.
4. Duggal. K.N., *Elememts of public Health Engineering*, S.Chand and Company Ltd, New Delhi, 1998.

Course Code	Course Name	L	T	P	C
OCE709	ENVIRONMENT AND AGRICULTURE	3	0	0	3

Category: Open Elective

a. Preamble

To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.

b. Course Outcome

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

CO. No.	Course Outcome	Knowledge Level
CO1	Understand the concepts of environment and its concerns	K2
CO2	Interpret the environmental impacts on agriculture	K2
CO3	Understand the context of climate change	K2
CO4	Illustrate the ecological context of agriculture	K2
CO5	Outline the emerging global issues	K2

c. Course Syllabus

Total : 45 Periods

ENVIRONMENTAL CONCERNS

9

Environmental basis for agriculture and food - Land use and landscape changes - Water quality issues - Changing social structure and economic focus - Globalization and its impacts - Agro ecosystems.

ENVIRONMENTAL IMPACTS

9

Irrigation development and watersheds - mechanized agriculture and soil cover impacts - Erosion and problems of deposition in irrigation systems - Agricultural drainage and downstream impacts - Agriculture versus urban impacts.

CLIMATE CHANGE

9

Global warming and changing environment - Ecosystem changes - Changing blue-green-grey water cycles - Water scarcity and water shortages - Desertification.

ECOLOGICAL DIVERSITY AND AGRICULTURE

9

Ecological diversity, wild life and agriculture - GM crops and their impacts on the environment - Insects and agriculture - Pollination crisis - Ecological farming principles - Forest fragmentation and agriculture - Agricultural biotechnology concerns.

EMERGING ISSUES

9

Global environmental governance - alternate culture systems - Mega farms and vertical farms - Virtual water trade and its impacts on local environment - Agricultural environment policies and its impacts - Sustainable agriculture.

d. Activities

Students shall be exposed to get the knowledge through case studies.

e. Learning Resources

Text Books

1. M.Lakshmi Narasaiah, *Environment and Agriculture*, Discovery Pub. House, 2006.
2. Arvind Kumar, *Environment and Agriculture*, ABH Publications, New Delhi, 2005.

Reference Books

1. T.C. Byerly, *Environment and Agriculture*, United States. Dept. of Agriculture. Economic Research Service, 2006.
2. Robert D. Havener, Steven A. Breth, *Environment and agriculture: rethinking development issues for the 21st century* : proceedings of a symposium, Winrock International Institute for Agricultural Development, 1994.