1.3.1

Institution integrates cross-cutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability and other value framework enshrined in Sustainable Development Goals and National Education Policy – 2020 into the Curriculum

Introduction:

In today's dynamic world, it is crucial for educational institutions to adapt their curricula to address the emerging challenges of sustainable development and promote a holistic approach to education. Pragati Engineering College recognizes the importance of integrating cross-cutting issues such as professional ethics, gender equality, human values, environment, and sustainability into its curriculum. By aligning with the Sustainable Development Goals (SDGs) and the National Education Policy (NEP) of 2020, Pragati Engineering College aims to foster responsible and ethical professionals who are conscious of their societal and environmental responsibilities.

Professional Ethics:

Pragati Engineering College believes that instilling professional ethics in students is vital to their personal and professional growth. The institution integrates ethical principles throughout the curriculum to guide students in their decision-making processes, promote integrity, and ensure responsible conduct in their chosen fields. The curriculum includes modules that emphasize the importance of honesty, transparency, accountability, and respect for diversity, thus preparing students to become ethically conscious professionals.

Gender Equality:

Promoting gender equality is not only a fundamental human right but also essential for achieving sustainable development. Pragati Engineering College recognizes the need to eliminate gender disparities and biases. The institution ensures gender sensitivity by conducting gender-related topics, discussions, and case studies across disciplines. Through these initiatives, students develop a broader understanding of gender issues, challenge stereotypes, and contribute to building an inclusive and equitable society.

Human Values:

In addition to technical skills, Pragati Engineering College understands the significance of imparting human values to its students. The curriculum includes courses and activities that emphasize empathy, compassion, integrity, and social responsibility. These initiatives cultivate well-rounded individuals who not only excel in their professional pursuits but also contribute positively to their communities. By promoting human values, the institution aims to nurture ethical leaders who prioritize the welfare of others.

Environment and Sustainability:

Recognizing the urgent need to address environmental challenges, Pragati Engineering College integrates environmental education and sustainability practices into its curriculum. The institution emphasizes the importance of sustainable development, resource conservation, and environmental stewardship. Students are exposed to topics such as climate change, renewable energy, waste management, and sustainable engineering solutions. Through hands-on projects and experiential learning opportunities, students develop the knowledge and skills necessary to contribute to a greener and more sustainable future.

Alignment with Sustainable Development Goals:

Pragati Engineering College's integration of cross-cutting issues into the curriculum is closely aligned with the United Nations' Sustainable Development Goals. The institution recognizes that the SDGs provide a comprehensive framework for addressing global challenges and creating a more sustainable and equitable world. By incorporating SDG-related themes and activities into various courses, Pragati Engineering College ensures that students understand the interconnectedness of social, economic, and environmental issues. This holistic approach prepares them to contribute meaningfully to the achievement of the SDGs in their future careers.

National Education Policy – 2020:

Pragati Engineering College fully embraces the vision of the National Education Policy (NEP) of 2020, which emphasizes multidisciplinary and holistic education. The institution aligns its curriculum with the NEP's objectives of promoting critical thinking, creativity, and ethical reasoning. By integrating cross-cutting issues into the curriculum, Pragati Engineering College fosters a student-centered and inclusive learning environment that encourages innovation, problem-solving, and a deep understanding of societal challenges. The institution also ensures that faculty members are well-equipped with the necessary pedagogical training to effectively deliver the revised curriculum.

1.3.1: Institution Integrates Cross cutting Issues Relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability, and Human Values into the curriculum

R20 COURSE STRUCTURE		
Category	**Courses**	**Related Brach**
Professional Ethics	Professional Ethics and Human Values	Common to EEE,ME
Human Values	Constitution of India	Common to CE,EEE,ME, ECE, CSE, CSE-DS, CSE-AIML, IT
	Essence of Indian Traditional Knowledge	Common to CE ,ME, ECE, CSE, CSE-DS, CSE-AIML
	Universal Human Values-II: Understanding Harmony	IT,EEE, ME, ECE, CSE-AIML
	IPR & Patents	Civil
Environment and Sustainability	Environmental Science	Common to CE,EEE,ME, ECE, CSE, CSE-DS, IT
	Renewable Energy Engineering	Civil, ECE, CSE,IT,ME,CSE-AIML, CSE-DS
	Geotechnical Engineering	Civil
	Geotechnical Engineering Laboratory	Civil
	Solid Hazardous and waste Management	Civil
	Environmental Engineering	Civil
	Environmental Engineering Lab	Civil
	Water Resource Engineering	IT,EEE, ME, ECE,CE,CSE-AIML, CSE-DS
	Disaster Management	EEE, ME,ECE,CSE,CSE-AIML, CSE-DS
	Industrial Waste Management	Civil
	Urban Hydrology Storm Drainage and Management	Civil
	Earthquake Resistance Design	Civil
	Ground Improvement Techniques	Civil
	River Management	Civil
	Water Resource System Planning	Civil
	Irrigation Engineering	Civil
	Environmental Impact Assessment & Management Assessment & Management	Civil
	Power Plant Engineering	ME
	Air Pollution And Control	Civil

III Year I Semester
PROFESSIONAL ETHICS AND HUMAN VALUES

Course Category	Mandatory	**Course Code**	20HM5T07
Course Type	Theory	**L-T-P-C**	2-0-0-0
Prerequisites	NIL	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand different concepts in Professional Ethics and Human Values.	K2
CO2	Apply ethical principles to resolve the problems that arise in work place.	K3
CO3	Make use of Engineers rights to fulfill their responsibilities.	K3
CO4	Understand the responsibility of an engineer in designing safety.	K2
CO5	Analyze the social media accounts in order to create and maintain a positive digital footprint.	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	2	-	-	3	2	3	-	2	-	2	-	-
CO2	-	-	2	-	-	3	2	3	-	1	-	2	-	-
CO3	-	-	2	-	-	3	2	3	-	2	-	2	-	-
CO4	-	-	2	-	-	3	2	3	-	2	-	2	-	-
CO5	-	-	2	-	-	3	2	3	-	1	-	2	-	-

COURSE CONTENT

UNIT I
Professional Ethics and Human values:
Ethics -History of Ethics-Types of Ethics, Professional Ethics and its forms - Morals, Values – Integrity – Civic Virtue –Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time –Co-operation – Loyalty- Collegiality-Commitment – Empathy – Self-confidence – Spirituality-Character.

UNIT II
Engineering & Organization Ethics:
Engineering Ethics-Meaning & Purpose of Engineering Ethics- Consensus and Controversy –Work Place Ethics and Business Ethics –Ethics in HRM, Finance & Marketing – Ethical Theories-Meaning & Uses of Ethical Theories-Theories of moral Development-Kohlberg's Theory – Gilligan's Argument –Heinz's Dilemma.

UNIT III
Engineers Responsibilities and Rights:
Key Characteristics of Engineering Professionals – Professional Roles to be played by an Engineer - Ethical egoism-Collective bargaining-Confidentiality- Acceptance of Bribes/Gifts when is a Gift and a Bribe-examples of Gifts v/s Bribes-Whistle Blowing and its types-when should it be attempted-preventing whistle blowing.

UNIT IV

Engineers' Responsibility for Safety and Risk:

Concept of Safety-Types of Safety, Risk-Types of Risks, Voluntary v/s Involuntary Risk- Short term v/s Long term Consequences- Expected Probability- Reversible Effects- Threshold Levels for Risk- Delayed v/s Immediate Risk- Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT V

Ethical issues in Social Media:

Social Media- Various Social Media Platforms: Google, Facebook, YouTube, Instagram -Social Media set-up and Uses-Ethical use of Social media-Effects of Social Media on Public- Social Media (vs) News-Social Media Fame and Reputation-Trolling, Harassing, and Hating on Social Media-Legal Aspects of Social Media.

REFERENCE BOOKS

1. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
2. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana- Maruthi Publications.
3. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran-Laxmi Publications
4. "Professional Ethics and Human Values" by Prof.D.R.Kiran-
5. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication
6. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger -Tata McGraw- Hill -2003
7. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.

WEB RESOURCES

1. https://study.com/academy/lesson/ethical-issues-in-internet-social-media-marketing.html
2. https://www.tutorialspoint.com/engineering_ethics/engineering_ethics_rights_of_engineers
3. https://link.springer.com/article/10.1007/s11948-997-0039-x

CONSTITUTION OF INDIA

Course Category	Humanities including Management	**Course Code**	20CE4T06
Course Type	Theory	**L-T-P-C**	2-0-0-0
Prerequisites	------	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the evolution of Constitution of India	K2
CO2	Make use of one's Fundamental rights.	K3
CO3	Understand the functioning of the Union Government	K2
CO4	Understand the functioning of the State and local self Government.	K2
CO5	Understand the value of Indian Constitution in functioning of the country.	K2

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	0	0	0	3	0	3	0	1	0	2	-	-
CO2	0	0	0	0	0	1	0	2	1	1	0	1	-	-
CO3	0	0	0	0	0	1	0	1	1	1	0	0	-	-
CO4	0	0	0	0	0	1	0	1	1	1	0	0	-	-
CO5	0	0	0	0	0	1	1	1	1	1	0	2	-	-

COURSE CONTENT

Unit – I

Introduction to Indian constitution: Meaning of the term constitution - History and development – Preamble of the Constitution – Constituent Assembly – The salient features of Indian Constitution.

Unit –II

Fundamental Rights: Individual and Collective Rights – Limitations of the fundamental Rights – Fundamental Rights Vs Duties.

Unit –III

Union Government: Union Legislature – Lok Sabha and Rajya Sabha (powers and functions) – President of India (powers and functions) – Prime minister of India (powers and functions) – Union Judiciary (supreme court powers and functions).

Unit – IV State and Local self Government:

State Government: State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) – Powers and functions of state legislature – The Chief Minister of the state (powers and functions)

Local Self Government: Election commission of India (Powers and Functions)- The Union Public Service Commission (Powers and Functions)

Unit – V Working of the Indian Constitution

The values of the Indian Constitution and Ushering of Social Revolution in India – Nature and Role of Higher Judiciary in India – Amendments (Recent)

REFERENCE BOOKS

1. 'Indian Polity' by Laxmikanth
2. 'Indian Administration' by Subhash Kashyap
3. 'Indian Constitution' by D.D. Basu

4. ‘Indian Administration’ by Avasti and Avasti

.

WEB RESOURCES

1. https://www.clearias.com/historical-background-of-indian-constitution/
2. https://www.civilserviceindia.com/subject/General-Studies/notes/functions-and-responsibilities-of-the-union-and-the-states.html

Essence of Indian Traditional Knowledge
(Common to all branches)

Course Category	Humanities including Management	**COURSE CODE**	19HM3T06
Course Type	Theory	**Lecture-Tutorial-Practice**	2 -0 -0
Prerequisites		Total Marks (Internal Assessment)	100

Course Outcomes		**Blooms Taxonomy Level**
On successful completion of the course, the student will be able to		
CO 1	Understand the significance of Indian Traditional Knowledge.	Understanding
CO 2	Classify the Indian Traditional Knowledge	Analysis
CO 3	Compare Modern Science with Indian Traditional Knowledge system.	Evaluating
CO 4	Analyze the role of Government in protecting the Traditional Knowledge	Analysis
CO 5	Understand the impact of Philosophical tradition on Indian Knowledge System.	Understanding

Contribution of Course Outcomes towards achievement of Program											
Outcomes: 1 – Low, 2 - Medium, 3 – High											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO11**	**P O**
CO1	0	1	2	0	0	3	0	1	0	2	0	0
CO2	0	0	2	0	0	2	0	2	0	0	0	0
CO3	0	0	2	0	0	3	0	1	1	2	2	1
CO4	0	0	2	0	0	2	0	2	0	0	0	0
CO5	0	0	1	0	0	3	0	1	0	3	0	1

Course Content :

Unit I

Introduction to Traditional Knowledge: Define Traditional Knowledge- Nature and Characteristics- Scope and Importance- kinds of Traditional Knowledge- The historical impact of social change on Traditional Knowledge Systems- Value of Traditional knowledge in global economy.

Unit II

Basic structure of Indian Knowledge System: Astadash Vidya- 4 Ved - 4 Upaved (Ayurved,Dhanurved,GandharvaVed&SthapthyaAdi),6vedanga(Shisha,Kalppa,Nirukha,Vykaran,Jyothisha &Chand),4upanga(Dharmashastra,Meemamsa,purana&Tharka Shastra).

Unit III

Modern Science and Indian Knowledge System-Indigenous Knowledge, Characteristics- Yoga andHolistic Health care-cases studies.

Unit IV

Protection of Traditional Knowledge: The need for protecting traditional knowledge - Significance ofTraditional knowledge Protection-Role of government to harness Traditional Knowledge.

Unit V

Impact of Traditions: Philosophical Tradition (Sarvadarshan) Nyaya, Vyshepec, Sankhya, Yog, Meemamsa, Vedantha, Chavanka, Jain &Boudh - Indian Artistic Tradition - Chitra kala, Moorthi kala,Vasthu kala , Sthapthya, Sangeetha, NruthyaYevamSahithya

Reference Books :

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta andVipin Kumar Singh, Pratibha Prakashan 2012.
3. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya
4. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Pramod Chandra, India Arts, Howard Univ. Press, 1983.
7. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.

Web Resources:

1. https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html
2. http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf
3. https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

Universal Human Values-2: Understanding Harmony

CourseCategory	Humanities including Management	**Credits**	3
CourseType	Theory	**Lecture-Tutorial-Practice**	3 -0 -0
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes		**Blooms Taxonomy Level**
On successful completion of the course, the student will be able to		
CO 1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	K2
CO 2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	K1
CO 3	Understand the role of a human being in ensuring harmony in society and nature.	K2
CO 4	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	K1
CO 5	Understand the current scenario in Technology with respect to the Professional Ethics	K2

Contribution of Course Outcomes towards achievement of Program

Outcomes: 1 – Low, 2 - Medium, 3 – High

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	0	0	0	0	0	3	0	3	0	0	0	3
CO2	0	0	0	0	0	3	0	3	3	0	0	0
CO3	0	0	0	0	0	3	2	3	3	0	0	0
CO4	0	0	0	0	0	3	0	3	3	0	0	0
CO5	0	0	0	0	0	3	0	3	3	0	0	0

Course Content :

Unit – I

Introduction to Value Education:

Value Education, Definition, Concept and Need for Value Education, Content and Process of Value Education, Basic Guidelines for Value Education, Self exploration as a means of Value Education, Happiness and Prosperity as parts of Value Education.

Unit – II

Harmony in the Human Being:

Human Being is more than just the Body, Harmony of the Self ('I') with the Body, Understanding Myself as Co-existence of the Self and the Body, Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body.

Unit – III

Harmony in the Family and Society and Harmony in the Nature:

Family as a basic unit of Human Interaction and Values in Relationships, The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love. Comprehensive Human Goal: The Five Dimensions of Human Endeavour, Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence.

Unit – IV

Social Ethics:

The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct, Holistic Alternative and Universal Order, Universal Human Order and Ethical Conduct, Human Rights violation and Social Disparities.

Unit – V

Professional Ethics:

Value based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current Scenario, Vision for Holistic Technologies, Production System and Management Models.

Textbooks:

1. A.N Tripathy, New Age International Publishers, 2003.
2.Bajpai. B. L , , New Royal Book Co, Lucknow, Reprinted, 2004
3.Bertrand Russell Human Society in Ethics & Politics

Reference Books :

1.Corliss Lamont, Philosophy of Humanism
2.Gaur. R.R. , Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
3.Gaur. R.R. , Sangal. R , Bagaria. G.P, Teachers Manual Excel Books, 2009.
4.I.C. Sharma . Ethical Philosophy of India Nagin & co Julundhar
5.Mortimer. J. Adler, – Whatman has made of man
6.William Lilly Introduction to Ethic Allied Publisher

Web Resources:

1. https://www.tandfonline.com/doi/abs/10.2753/RSP1061-1967330482?journalCode=mrsp20
2. https://www.thefbcg.com/resource/building-family-harmony-starts-with-living-our-values/#:~:text=What%20does%20family%20harmony%20mean,family%20as%20a%20larger%20unit

Intellectual Property Rights and Patents (Common to all branches)

Course Category	Humanities including Management	**Credits**	0
Course Type	Theory	**Lecture-Tutorial-Practice**	2 -0 -0
Prerequisites		**Total Marks (Internal Assessment)**	100

Course Outcomes		**Blooms Taxonomy Level**
On successful completion of the course, the student will be able to		
CO 1	Classify Intellectual Property Rights and explain basic concepts of Intellectual Property Rights.	Understanding
CO 2	Appraise the role of Copyright Registration process and evaluate legal requirements for Semi Conductor Chip Protection	Evaluation
CO 3	Identify relationship between Product Patent and Process Patent and how patent will apply for new situations (Inventions).	Application
CO 4	Analyze trade mark registration process and distinguished between different Trademarks.	Analysis
CO 5	Explain Employee Confidentiality Agreement and summarize Trade Secret Litigation Process.	Understanding

Contribution of Course Outcomes towards achievement of Program											
Outcomes: 1 – Low, 2 - Medium, 3 – High											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	2	2	2	2	1	2	1	1	1	1	1
CO2	0	1	0	0	0	0	2	3	0	0	2	2
CO3	0	0	0	0	0	0	2	2	0	0	3	2
CO4	0	0	0	0	0	0	0	3	0	0	2	1
CO5	0	0	0	0	0	0	0	3	0	0	2	1

Course Content :

Unit I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration –Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

Unit II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration– Copyright Formalities and Registration – Limitations – Infringement of Copyright – Semiconductor Chip Protection Act.

Unit III

Introduction to Patent Law – Rights under Patent Law – Patent Requirements – Product Patent and Process Patent- Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting.

Unit IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion.

Unit V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

Reference Books :

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi.
2. Kompal Bansal & Parishit Bansal “Fundamentals of IPR for Engineers”, BS Publications (Press).
3. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw – Hill, New Delhi.
4. Richard Stim: “Intellectual Property”, Cengage Learning, New Delhi.
5. R. Radha Krishnan, S. Balasubramanian: “Intellectual Property Rights”, Excel Books. New Delhi.
6. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.

Web Resources:

1.https://www.jakemp.com/en/knowledge-centre/briefings/introduction-to-patents
2. https://www.legalzoom.com/knowledge/trademark/topic/trademark-service-mark-definition
3.http://www.copyrighthub.org/copyright-resources/introduction-to-copyright/

Members of BoS

Dr. B. MuraliManohar Senior Professor, VIT Business School, VIT, Vellore	Dr. B. Kuberudu Professor, Andhra University, Vizag	Mr. Arjun Hoskote, Head HR - Technology Business Unit, Tata Consultancy Services, Hyd	Mr. Vamsi Kiran Somayajula Chairman-BoS

Environmental Sciences

(Common to CE, ME, ECE, CSE, CSEDS&AI, IT)

Course Category	Basic Sciences	**Course Code**	**20BE1MC01**
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 0
Prerequisites	Basic Knowledge in Environment and protection.	**Internal Assessment** **Semester End Examination** **Total Marks**	0 0 0

COURSE OBJECTIVE:	
1	To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century
CO4	Recognize the interconnectedness of human dependence on the earth's ecosystems
CO5	Influence their society in proper utilization of goods and services.
CO6	Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	0	1	0	0	1	2	0	0	0	1	0	0	0
CO2	0	1	0	0	0	0	1	0	0	0	0	0	0	0
CO3	0	0	0	0	2	0	1	0	0	0	0	0	0	0
CO4	0	0	0	0	1	1	3	0	0	0	0	0	0	0
CO5	0	0	0	0	0	0	3	1	0	0	0	0	0	0

Course contents:

UNIT – I

Multidisciplinary nature of Environmental Studies

Definition, Scope and Importance-*International Efforts & Indian Environmentalists*

Natural Resources

Forest resources : deforestation – Mining, dams and other effects on forest and tribal people.
Water resources :Use and over utilization of surface and groundwater.
Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems.
Energy resources: renewable and nonrenewable energy sources.
Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles.

LEARNING OUTCOMES:

Students will be able to

Articulate the basic structure, functions, and processes of key social systems affecting the environment
Explain why renewable and non-renewable energy resources are important.
Explain how water resources should be used.

UNIT- II

Ecosystems, Biodiversity and its conservation

Definition of Ecosystem and its structure, Functions
Biodiversity Definition-Value of biodiversity, India as a mega-diversity nation, Threats to biodiversity, Conservation of biodiversity, *Endangered and endemic species of India*.

LEARNING OUTCOMES:

Students will be able to

Get a clear picture of structure and functions of ecosystems.
Demonstrate knowledge and understanding of theories in the field of Biodiversity and Systematic in the broad sense.
Explain endangered and endemic species of India.

UNIT III

Environmental Pollution and Solid Waste Management

Definition, Cause, Effects of Air pollution, Water pollution, Noise pollution, Radioactive pollution, Role of an individual in prevention of pollution.
Solid Waste Management: Sources, effects and control measures of urban and industrial waste,
e-waste management

LEARNING OUTCOMES

Students will be able to

Understand Cause, effects and control measures of air pollution.
Understand solid waste management.

UNIT IV

Social Issues and the Environment

Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act-Issues involved in enforcement of environmental legislation, Rain water harvesting, Global Environmental challenges-*case studies*

LEARNING OUTCOMES:

Students will be able to

Explain the enforcement of Environmental legislations

Acquire knowledge on various environmental challenges induced due to unplanned anthropogenic activities.

Explain the reasons for global warming

UNIT-V

Human population and the Environment

Population growth, Women and child welfare, Role of Information technology in environment and human health. *Impact Assessment and its significances, stages of EIA*

Field work:

A mini project related to Environmental issues / to visit a local polluted site (Submission of project by every student)

LEARNING OUTCOMES

Students will have

Explain various types of information technologies

Explain the theories of population explosion

Acquire knowledge on various environmental challenges induced due to unplanned anthropogenic activities

DEPARTMENT OF ENVIRONMENTAL SCIENCES

TEXT BOOKS	
1.	Environmental Studies for undergraduate courses by ErachBharucha,UGC.
2.	A Textbook of Environmental Studies by Dr.S.AzeemUnnisa,Acadamic publishing company.
3.	Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai
REFERENCE BOOKS	
1.	Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage learning.
2.	Glimpses of Environment by K.V.S.G. Murali Krishna Published by Environmental Protection Society, Kakinada, A.P.
3.	Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi
4.	Environmental Studies by PiyushMalaviya, Pratibha Singh, Anoopsingh: Acme Learning, New Delhi.
5.	An Introduction to Environmental Pollution by Dr.B.k.Sharma AND Dr.(Miss)H.kaur,Goel publishing House ,a unit of Krishna Prakasham Media (p) LH,Meerut –India
WEB RESOURCES	
1.	**UNIT-1: MULTI DISPLINARY NATURE OF ENVIRONMENT and NATURAL RESOURCES** http://www.defra.gov.uk/environment/climatechange https://www.climatesolutions.org

	https://en.wikibooks.org/wiki/Ecology/Ecosystems
2.	**UNIT-2:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION** http://conbio.net/vl/ and www.biodiversitya-z.org/content/biodiversity
3.	**UNIT-3: ENVIRONMENTAL POLLUTION** https://www.omicsonline.org/environment-pollution-climate-change.php and https://www.britannica.com/technology/solid-waste-management
4.	**UNIT-4: SOCIAL ISSUES ANDTHE ENVIRONMENT** http://www.publichealthnotes.com/solid-waste-management/
5.	**UNIT-5: HUMANPOPULATION AND THE NVIRONMENT**http://www.ecoindia.com/education/water-conservation.html https://thewaterproject.org/water_conservation\ https://legalcareerpath.com/what-is-environmental-law/

RENEWABLE ENERGY ENGINEERING

(Open Elective – I offered by other departments)

Course Category	Professional Core Courses	**Course Code**	20EE5T13
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NIL**	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics
2	To understand the concept of Wind Energy Conversion & its applications
3	To study the principles of biomass and geothermal energy
4	To understand the principles of Ocean Thermal Energy Conversion (OTEC), motion of waves and power associated with it
5	To study the various chemical energy sources such as fuell cell and hydrogen energy along with their operation and equivalent circuit

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage	K4
CO2	Illustrate the components of wind energy systems	K3
CO3	Illustrate the working of biomass, digesters and Geothermal plants	K3
CO4	Demonstrate the principle of Energy production from OTEC, Tidal and Waves	K3
CO5	Evaluate the concept and working of Fuel cells & MHD power generation	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	1	-	-	1	-	-	-	-	1	2	2
CO2	3	2	1	1	-	-	1	-	-	-	-	1	2	2
CO3	3	1	1	1	-	-	1	-	-	-	-	1	2	2
CO4	3	1	1	1	-	-	1	-	-	-	-	1	2	2
CO5	3	1	1	1	-	-	1	-	-	-	-	1	2	2

COURSE CONTENT	
UNIT 1	**Solar Energy:** Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating

	collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.
UNIT 2	**Wind Energy**: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.
UNIT 3	**Biomass and Geothermal Energy:** **Biomass:** Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant **Geothermal Energy**: Introduction, Geothermal Sources – Applications - operational and Environmental problems.
UNIT 4	**Energy From oceans, Waves & Tides:** **Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India. **Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy -Components of Tidal Energy.
UNIT 5	**Chemical Energy Sources:** **Fuel Cells**: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications. **Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications **Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types.

TEXT BOOKS	
1	G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011
2	John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013
REFERENCE BOOKS	
1	S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011
2	John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013
3	Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/103/107/103107157/

GEOTECHNICAL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Core	**Course Code**	20CE5T10
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	-----	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE LEARNING OBJECTIVES	
1	To Enable the Knowledge of availability,types, index Properties of soils and classify it.
2	To impart the concept of permeability and seepage of water through soils for better understanding the discharge of water through different types of soils.
3	To interpolate the student to understand the concept of stress induced and to determine various parameters.
4	To make the students understand the principles of compaction & consolidation and determine the magnitude and the rate of consolidation settlement.
5	To Impart the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Demonstrate the various quantities related to soil mechanics, establish their inter-relationships and their classification.	K2
CO2	Apply the concept of seepage through soil to construct the flow net for water flow calculations	K3
CO3	Examine the stress distribution under the loads.	K4
CO4	Know the importance of the different engineering properties of the soil such as compaction, permeability, consolidation and determine them in laboratory	K3
CO5	Measure shear strength parameters for field conditions	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	2	3	2	1	1	1	1	2	3	3	3	2
CO2	2	3	3	2	2	1	1	1	1	1	2	3	2	2	3
CO3	3	3	2	2	2	1	1	1	1	1	1	3	2	3	2
CO4	3	3	2	2	2	2	1	2	1	1	2	3	2	3	2
CO5	2	3	3	3	1	1	1	2	1	2	1	3	2	3	2

COURSE CONTENT	
UNIT I	**Introduction:** Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass-volume relationship –Relative density **Index Properties of Soils:** Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.
UNIT II	**Permeability:** Soil water – capillary rise – One dimensional flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability – Permeability of layered systems. **Geo static Stresses:** Total, neutral and effective stresses –quick sand condition **Seepage:**2-D flow and Laplace's equation - Seepage through soils –Flow nets: Characteristics and Uses.
UNIT III	**Stress Distribution In Soils:** Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method.
UNIT IV	**Compaction:** Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control. **Consolidation:** Compressibility of soils – e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (C_v) - Over consolidated and normally consolidated clays.
UNIT V	**Shear Strength of Soils:** Basic mechanism of shear strength -Mohr – Coulomb Failure theories – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions.

TEXT BOOKS	
1.	B.M Das, "Principles of Geotechnical Engineering", 7th edition 2013, Cengage Publications.
2.	" An introduction to Geotechnical Engineering" by Holtz and Kovacs; Prentice Hal,lPearson Education India; 2nd edition (2013)
3.	"Soil Mechanics and Foundation Engineering" by V.N.S.Murthy, CBS Publishers.
REFERENCE BOOKS	
1.	"Soil Mechanics and Foundation Engineering" by B.C.Punmia; Laxmi Publications, Delhi,17 th edition 2017.

GEOTECHNICAL ENGINEERING LAB

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Core lab	**Course Code**	20CE5L07
Course Type	LAB	**L-T-P-C**	0-0-3-1.5
Prerequisites	------	**Internal Assessment**	15
		Semester End Examination	35
		Total Marks	50

COURSE LEARNING OBJECTIVES	
1	To impart knowledge of determination of index properties required for classification of soils.
2	To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
3	To teach how to determine shear parameters of soil through different laboratory tests.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Determine the dry density of field and OMC.	K3
CO2	Examining the rate of Permeability of soil.	K3
CO3	Identify the type of soil existing in field.	K3
CO4	Evaluate the shear strength parameters from field and laboratory.	K5
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	--	3	--	--	--	--	--	--	--	2	--	3	--	2
CO2	2	--	3	--	--	--	--	--	--	--	2	--	3	--	2
CO3	2	3	3	--	--	--	--	--	--	--	2	--	3	--	2
CO4	2	--	3	--	--	--	--	--	--	--	2	--	3	--	2

LIST OF EXPERIMENTS	
1	Determination of Specific gravity of soil solids, Gs. (IS-2720-Part 3-1980)
2	Determination of soil Atterberg's Limits. (IS-2720-Part 5-1985)
3	Determination of Field density by Core cutter and Sand replacement methods. (IS-2720-Part 28- 1974)
4	Determination of soil Grain size analysis by sieving. (IS-2720-Part 4-1985)
5	Determination of soil Grain size analysis by hydrometer analysis. (IS-2720-Part 4-1985)
6	Determination of Permeability of soil - Constant head test & Variable head test. (IS-2720-Part 17-1986).
7	Determination of dry density and OMC by using Compaction test. (IS-2720-Part 8-1983)
8	Determination of coefficient of consolidation. (IS-8009-Part 1-1976)

9	Determination of Shear strength parameters by using box shear test. (IS-2720-Part 13-1986)
10	Determination of Shear strength parameters by using tri-axial (UU test). (IS-2720-Part11-1993)
11	Determination of Shear strength parameters by using Vane Shear test. (IS-4434-Part 3-1978)
12	Determination of CBR Value. (IS-2720-Part 16-1979)

*Note: At least 10 Experiments has to be completed

S NO.	LIST OF EQUIPMENTS
1	Casagrande's liquid limit apparatus.
2	Apparatus for plastic and shrinkage limits
3	Field density apparatus for Core cutter method
4	Sand replacement testing setup.
5	Set of sieves: 4.75 mm, 2 mm, 1 mm, 0.6 mm, 0.425 mm, 0.3 mm, 0.15 mm, and 0.075 mm.
6	Hydrometer apparatus.
7	Permeability apparatus for Constant head test and Variable head test
8	Apparatus for Compaction test.
9	Apparatus for Consolidation test.
10	Apparatus for Tri-axial test.
11	Apparatus for Vane shear test.
12	Apparatus for CBR test.
13	Apparatus for Box shear test
14	Air-dry oven, Weighing Machine

TEXT BOOKS	
1.	Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006.
2.	"Soil Mechanics - Laboratory manual" by Braja M. Das 6th Edition
REFERENCE BOOKS	
1.	Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015
2.	IS Code 2720 – relevant parts
WEB RESOURCES	
1.	https://archive.nptel.ac.in/courses/105101160/

SOLID HAZARDOUS AND WASTE MANAGEMENT

DEPARTMENT OF DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Elective	**Course Code**	20CE5T15
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	----	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE LEARNING OBJECTIVES	
1	To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Knowledge on characteristics of municipal solid wastes.	K2
CO2	Planning on Reduction, reuse and recycling of waste.	K4
CO3	Ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.	K5
CO4	Knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.	K2
CO5	Design and operation of sanitary landfill.	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of program Outcomes (1 - Low, 2- Medium, 3-High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	2	-	2	-	1	2	-	-	-
CO2	3	-	2	-	1	-	2	2	1	-	-	2	2	-	-
CO3	2	1	2	2	-	2	3	-	2	-	1	2	1	2	-
CO4	3	-	2	-	1	-	2	2	1	-	1	2	-	-	1
CO5	2	1	-	-	-	-	3	-	2	-	1	2	1	2	1

COURSE CONTENT	
UNIT-I	**Introduction to Solid Waste Management:** Goals and objectives of solid waste management, Classification of Solid Waste – Factors Influencing generation of solid waste – sampling and characterization –Future changes in waste composition, major legislation, monitoring responsibilities.
UNIT-II	**Basic Elements In Solid Waste Management:** Elements and their inter relationship principles of solid waste management- onsite handling, storage and processing of solid waste Collection of Solid Waste: Type and methods of waste collection systems, analysis of collection system – optimization of collection routes– alternative techniques for collection system.
UNIT-III	**Transfer and Transport:** Need for transfer operation, compaction of solid waste – transport means and methods, transfer station types and design requirements.
UNIT-IV	**Separation and Transformation of Solid Waste**: unit operations used for separation and transformation: shredding – materials separation and recovery, source reduction and waste minimization.
UNIT-V	**Processing and Treatment:** Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators. **Disposal of Solid Waste:** Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

TEXT BOOKS	
1.	Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, 1993.
2.	Vesilind, P.A. and Rimer, A.E., “Unit Operations in Resource Recovery Engineering”, Prentice Hall, Inc., 1981
REFERENCE BOOKS	
1.	Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000
2.	Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
3.	Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2000
WEB RESOURCES	
1.	https://nptel.ac.in/courses/105103205

ENVIRONMENTAL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Core Courses	**Course Code**	20CE6T19
Course Type	Theory	**L-T-P-C**	3-1-0-3
Prerequisites	----	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE LEARNING OBJECTIVES	
1	Outline planning and the design of water supply systems for a community/town/city.
2	Impart understanding of importance of protection of water source quality and enlightens the efforts involved in converting raw water into clean potable
3	Outline planning and the design of wastewater collection, conveyance and treatment systems for a community/town/city.
4	Impart understanding of treatment of sewage and the need for its treatment.
5	Teach planning, and design of septic tank and imhoff tank and the disposal of the effluent from these low cost treatment systems and effluent disposal method

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Classify sources of water and their characteristics	K4
CO2	Identify various water treatment methods and know about their functions	K2
CO3	Examine the effects and primary treatment of sewage	K4
CO4	Know the different types of sewerage systems and storm drains	K2
CO5	Analyse the available disposal options and their practical implications	K2
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	2	3	-	-	1	3	-	3	3	-	-	3	2
CO2	3	-	3	2	2	2	-	3	-	3	-	-	3	3	2
CO3	3	-	3	2	-	2	-	-	-	3	-	-	3	2	2
CO4	2	-	3	2	3	-	-	-	-	3	2	3	3	2	2
CO5	2	2	3	2	2	-	-	3	3	3	2	3	3	3	2

COURSE CONTENT	
UNIT I	**Introduction**: Importance and Necessity of Protected Water Supply systems, Water borne diseases, Flow chart of public water supply system, Role of Environmental Engineer. **Water Demand and Quantity Estimation:** Estimation of water demand for a town or city, Per capita Demand and factors influencing it-Types of water demands and its variations-factors affecting water demand, Design Period, Factors affecting the Design period, Population forecasting.
UNIT II	**Quality of Water:** Characteristics of water– Physical, Chemical and Biological.Comparison of sources with reference to quality- IS 10500 2012 and WHO guidelines for drinking water - Water quality standards for Agriculture, Industries and Construction **Analysis of Water:**Analysis of Water – Physical, Chemical and Biological characteristics-Biological Examination-Measurement of BOD and COD -BOD equations.
UNIT III	**Treatment of Water:** Treatment methods: Theory and Design of Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration **Disinfection:** Theory of disinfection-Chlorination and other Disinfection methods, Softening of Water, Removal of color and odors- Removal of Iron and Manganese - Adsorption-Fluoridation and deflouridation– Aeration–Reverse Osmosis- Ion exchange– Ultrafiltration **Treatment of sewage:** Primary treatment-Screens-grit chambers-grease traps–floatation–sedimentation – design of preliminary and primary treatment units-Aerobic and anaerobic treatment process-comparison.
UNIT IV	**Introduction to Sanitation** – Systems of sanitation – relative merits & demerits – collection and conveyance of wastewater – sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations– types of sewers - Hydraulics of sewers and storm drains– design of sewers. **Suspended growth process:** Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, Oxidation ponds, Aerated Lagoons. **Attached Growth Process:** Trickling Filters–mechanism & design,RBCs, Fluidized bed reactors
UNIT V	**Miscellaneous Treatment Methods:** Nitrification and Denitrification – Removal of Phosphates –UASB–Membrane reactors-Integrated fixed film reactors. Anaerobic Processes: Septic Tanks and Imhoff tanks- working Principles and Design–disposal of septic tank effluent. **Disposal of sewage:** methods of disposal – disposal into water bodies-Oxygen Sag Curve-disposal on land- sewage sickness

TEXT BOOKS	
1.	Wastewater Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill 4th Edition 2017.
2.	Elements of Environmental Engineering by K.N. Duggal, S. Chand & Company Ltd. New Delhi, 3rd Edition 1996
3.	Environmental Engineering by Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.

REFERENCE BOOKS	
1.	Water Supply Engineering – Dr. P.N. Modi
2.	Water Supply Engineering – B.C. Punmia
WEB RESOURCES	
1.	https://nptel.ac.in/courses/103107084

ENVIRONMENTAL ENGINEERING LAB

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Core courses lab	Course Code	20CE6L09
Course Type	LAB	L-T-P-C	0-0-3-2
Prerequisites	ENGINEERING CHEMISTRY & ENVIRONMENTAL ENGINEERING	Internal Assessment Semester End Examination Total Marks	15 35 50

COURSE LEARNING OBJECTIVES	
1	Estimation of some important characteristics of water and wastewater in the laboratory.
2	It also gives the significance of the characteristics of the water and wastewater.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Perform the different laboratory techniques for examining the water quality parameters	K2
CO2	Perform the different laboratory techniques for examining the wastewater quality parameters	K2
CO3	Analyze the laboratory data and comment with respect to permissible limits and field conditions.	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3	2	1	1	--	1	1	1	--	2	2	2
CO2	2	3	3	2	1	1	1	--	1	1	1	--	1	2	2
CO3	2	3	3	2	1	1	1	--	1	1	1	--	1	2	2

LIST OF EXPERIMENTS	
1	Determination of pH and Electrical Conductivity (Salinity) of Water and Soil
2	Determination and estimation of Total Hardness–Calcium & Magnesium.
3	Determination of Alkalinity/Acidity.
4	Determination of Chlorides in water and soil
5	Determination and Estimation of total solids,organic solids and inorganic solids and settleable solids by Imhoff Cone
6	Determination of Iron.
7	Determination of Dissolved Oxygen with D.O. Meter &Wrinklers Method.
8	Determination of N, P, K values in solid waste
9	Physical parameters – Temperature, Colour, Odour, Turbidity, Taste.

10	Determination of Optimum coagulant dose.
11	Determination of Chlorine demand.
12	. Determination of C.O.D and B.O.D.

*Note: At least 10 Experiments has to be completed

SNO.	LIST OF EQUIPMENTS
1	pH meter
2	Turbidity meter
3	Conductivity meter
4	Hot air oven
5	Muffle furnace
6	Dissolved Oxygen meter
7	U–V visible spectrophotometer
8	COD Reflux Apparatus
9	Jar Test Apparatus
10	BOD incubator
11	Autoclave
12	Laminar flow chamber
13	Hazen's Apparatus

TEXT BOOKS	
1	Standard Methods for Analysis of Water and Waste Water – APHA.
2	Chemical Analysis of Water and Soil by KVSG Murali Krishna, ReemPublications, New Delhi

REFERENCE BOOKS	
1	Relevant IS Codes.
2	Chemistry for Environmental Engineering by Sawyer and Mc. Carty
WEB RESOURCES	
1	http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/index.html

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

Water resource engineering
(Open Elective – IV)

Course Category	Professional Core	**Course Code**	20CE7T18
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Hydraulics and Hydraulic Machinery	**Internal AssessmentSemester End Examination Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To introduce hydrologic cycle and its relevance to Civil engineering.
2	Make the students understand physical processes in hydrology and, components of the hydrologic cycle.
3	Appreciate concepts and theory of physical processes and interactions.
4	Learn measurement and estimation of the components hydrologic cycle.
5	Provide an overview and understanding of Unit Hydrograph theory and its analysis.
6	Understand flood frequency analysis, design flood, flood routing.
7	Appreciate the concepts of groundwater movement and well hydraulics
8	Learn overview of flood routing and its effects.
9	Has to be understood and identify the flood occurring areas nearby.

COURSE OUTCOMES	
Upon successful completion of the course, the student will be able to:	
CO1	Explain the theories and principles governing the hydrologic processes and list out the forms of precipitation in real conditions.
CO2	Apply key concepts to several practical areas of engineering hydrology and related design aspects.
CO3	Design major hydrologic components for a need-based structures.
CO4	Estimate flood magnitude and carry out flood routing.
CO5	Demonstrate the recuperation test process in open wells.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO2	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO3	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO4	3	2	2	2	2	2	--	--	--	--	1	--	1	--	2
CO5	3	2	2	2	1	2	--	--	--	--	1	--	1	--	2

COURSE CONTENT	
UNIT I	INTRODUCTION: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data. Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, Frequency of point rainfall, Rain fall data in India. Intensity-Duration-Frequency (IDF) curves, Depth-Area Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm, problems on average rainfall on towns
UNIT II	ABSTRACTIONS FROM PRECIPITATION: Introduction, Initial abstractions. EVAPORATION: Factors affecting, measurement, reduction, Analytical methods of Evaporation estimation. EVAPOTRANSPIRATION: Factors affecting, measurement, control, INFILTRATION: Factors affecting, Infiltration capacity curve, measurement, Infiltration Indices. Problems on ϕ-Index and W-Index.
UNIT III	RUNOFF: Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve. HYDROGRAPH ANALYSIS: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S- hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph. Problems on unit hydrograph.
UNIT IV	FLOODS: Causes and effects, frequency analysis - Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management, Design flood, Design storm. FLOOD ROUTING: Hydrologic storage routing, channel and reservoir routing-Muskingum and Puls methods of routing, flood control in India. ADVANCED TOPICS IN HYDROLOGY: Rainfall-Runoff Modelling, Instantaneous Unit Hydrograph (IUH) - Conceptual models - Clark and Nash models, general hydrological models- Chow - Kulandaiswamy model.
UNIT V	GROUNDWATER: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, specific capacity, permeability, transitivity and storage coefficient, types of wells, wellloss, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.

TEXT BOOKS	
1.	„Engineering Hydrology" by Subramanya, K, Tata McGraw-Hill Education Pvt. Ltd, (2013), NewDelhi.
2.	„Engineering Hydrology" by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi.
3.	"Irrigation and Water Power Engineering" by Punmia B C, P.B.B Lal, A.K. Jainand A.K. Jain

DISASTER MANAGEMENT

OPEN ELECTIVE (OFFERED TO OTHER BRANCHES)

Course Category	Open Elective	**Course Code**	20CE6T40
Course Type	Theory	**L-T-P-C**	3-1-0-3
Prerequisites	----------	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To provide basic conceptual understanding of disasters.
2	To understand approaches of Disaster Management.
3	To build skills to respond to disaster.
4	To understand to reduce the intensity of future disasters.
5	To understand the Restoration of human life in the region.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Knowledge on characteristics of natural disasters	K1
CO2	Planning on approaches of Disaster Management	K3
CO3	Ability to plan and design the new skills in disaster response	K6
CO4	Role of remote sensing system in disaster area response	K2
CO5	Knowledge on the Restoration of human life in the region.	K1
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO2	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO3	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO4	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1
CO5	2	2	3	--	1	1	--	--	--	--	2	--	3	1	1

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COURSE CONTENT	
UNIT I	**Natural Hazards and Disaster Management**: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT II	**Man Made Disaster and Their Management Along With Case Study Methods Of The Following:** Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.
UNIT III	**Risk and Vulnerability:** Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses
UNIT IV	**Role of Technology in Disaster Managements:** Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations-roads and bridges mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS
UNIT V	**Multi-sectional Issues, Education and Community Preparedness:** Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action

TEXT BOOKS	
1.	"Disaster Management guide lines", GOI-UND Disaster Risk program (2009-2012)
2.	Modh S. (2010) "Managing Natural Disasters", Mac Millan publishers India LTD.
REFERENCE BOOKS	
1.	Murty D.B.N. (2012) "Disaster Management", Deep and Deep Publication PVT.Ltd. New Delhi
WEB RESOURCES	
	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

INDUSTRIAL WASTE MANAGEMENT

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Elective	**Course Code**	20CE6T23
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	-------	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE LEARNING OBJECTIVES	
1	To make the students understand about industrial waste, its characteristics and effects
2	To make students to know various sources of industrial waste and how to recycle and reuse them.
3	To understand what are the various treatment technologies for treating industrial waste
4	To create wariness of hazardous waste and their treatment

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Define the characteristics of industrial waste and environmental regulation for prevention and control of industrial and hazardous waste	K1
CO2	Explain waste management approach and interpret the applications of recycle, reuse and by product recovery.	K2
CO3	Classify various sources of waste and its characteristics	K2
CO4	Interpreting various treatment technologies and its applications	K3
CO5	Defining hazardous waste and their treatment technologies.	K1
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of program															
Outcomes (1 - Low, 2- Medium, 3-High)															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	2	2	2	3	1	2	2	3	2	2	1
CO2	3	3	2	2	2	2	2	3	1	2	2	3	2	1	2
CO3	2	3	3	2	3	1	2	3	1	3	2	3	3	3	3
CO4	3	2	3	3	3	1	1	3	1	2	3	3	3	3	2
CO5	3	3	2	2	3	1	1	3	1	2	2	3	2	2	3

COURSE CONTENT	
UNIT I	**INTRODUCTION** Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislation related to prevention and control of industrial effluents and hazardous wastes

UNIT II	**CLEANER PRODUCTION** Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.
UNIT III	**POLLUTION FROM MAJOR INDUSTRIES** Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Waste water reclamation concepts
UNIT IV	**TREATMENT TECHNOLOGIES** Equalization – Neutralization – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganic – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal
UNIT V	**HAZARDOUS WASTE MANAGEMENT** Hazardous wastes - Physio chemical treatment – solidification – incineration – Secure land fills

TEXT BOOKS	
1.	Rao M. N. & Dutta A. K. , "Waste water Treatment", Oxford - IBH Publication, 3rd Edition 1995
2.	Eckenfelder W.W. Jr., "Industrial Water Pollution Control", McGraw Hill Book Company, New Delhi,3rd Edition 1999
3.	Stephenson R.L. and Blackburn J.B., Jr., "Industrial Waste water Systems Hand book", Lewis Publisher, New York, 1998
REFERENCE BOOKS	
1.	Freeman H.M., "Industrial Pollution Prevention Hand Book", McGraw Hill Inc., New Delhi, 1995.
2.	Bishop, P.L., "Pollution Prevention: Fundamental & Practice", McGraw Hill, 2000.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/105105160

URBAN HYDROLOGY STORM DRAINAGE & MANAGEMENT

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Elective	**Course Code**	20CE6T22
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	------	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE LEARNING OBJECTIVES	
1	Appreciate the impact of urbanization on catchment hydrology and understand the importance of short duration rainfall runoff data for urban hydrology studies.
2	Learn the techniques for peak flow estimation for storm water drainage system design.
3	Understand the concepts in design of various components of urban drainage systems.
4	Learn some of the best management practices in urban drainage.
5	Understand the concepts of preparation master urban drainage system.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Develop intensity duration frequency curves for urban drainage systems.	K3
CO2	Identify the techniques to estimate peak flow of storm water and design of drainage system.	K3
CO3	Develop design storms to size the various components of drainage system.	K3
CO4	Formulate for best management practices in urban drainage system.	K2
CO5	Prepare master plan of drainage system for urbanized area.	K2
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	2	1	-	-	-	-	1	-	1	-	2
CO2	3	3	3	2	2	1	-	-	-	-	1	-	1	-	2
CO3	3	3	3	2	2	1	-	-	-	-	1	-	1	-	2
CO4	3	3	3	2	2	1	-	-	-	-	1	-	1	-	2
CO5	3	3	3	2	2	1	-	-	-	-	1	-	1	-	2

COURSE CONTENT	
UNIT I	**INTRODUCTION:** Urbanization and its effect on water cycle – Urban Hydrologic cycle – trends in urbanization – Effect of urbanization on hydrology. **PRECIPITATION ANALYSIS:** Importance of Short Duration of Rainfall and Runoff data, Methods of Estimation of time of concentration for design of Urban Drainage Systems, Intensity-Duration - Frequency (IDF) Curves, Design Storms for Urban Drainage Systems
UNIT II	**APPROACHES TO URBAN DRAINAGE:** Time of concentration, Peak Flow Estimation Approaches, Rational Method, NRCS Curve Number Approach, Runoff Quantity and Quality, waste water and Storm Water Reuse, Major and Minor Systems.
UNIT III	**ELEMENTS OF DRAINAGE SYSTEMS:** Open Channel, Underground Drains, Appurtenances, Pumping, and Source Control.
UNIT IV	**ANALYSIS AND MANAGEMENT:** Storm water drainage structures, design of storm waternetwork- Best Management Practices–detention and retention facilities, Swales, constructed wetlands, models available for storm water management.
UNIT V	**MASTER DRAINAGE PLANS:** Issues to be concentrated upon – Typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning, and use of models in planning.

TEXT BOOKS	
1.	"Manual on Drainage in Urbanized area" by Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, (1987 - 2 volumes),UNESCO.
2.	"Urban Hydrology" by Hall M J (1984), Elsevier Applied Science Publisher.
3.	"Storm water Detention for Drainage" by Stahre P and Urbonas B (1990), Water Quality and CSO Management, Prentice Hall.
REFERENCE BOOKS	
1.	"Urban water cycle processes and interactions" by Marsalek et. Al., (2006), Publication No. 78, UNESCO, Paris.
2.	Urban Hydrology, Hydraulics and Storm water Quality: Engineering Applications and Computer Modelling" by Akan A.O and R.L. Houghtalen (2006), Wiley International.
WEB RESOURCES	
1.	http://nptel.ac.in/courses/105105048/M7L7.pdf
2.	http://www.iitg.ac.in/kartha/CE551/Lectures/Lecture16.pdf
3.	http://nptel.ac.in/courses/105105048/8

EARTHQUAKE RESISTANCE DESIGN

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Elective	**Course Code**	20CE7T25
Course Type	Theory	**L-T-P-C**	3-1-0-3
Prerequisites	Structural Analysis	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE LEARNING OBJECTIVES	
1	To know the student with Engineering Seismology.
2	Equip student with concepts of Structural Dynamics and Understand Concepts of Seismic Design
3	To know the students with various IS codal provisions for ductile design and detailing andDesign philosophies for Seismic loading

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	To familiarize with seismic terminology basics; General considerations.	K1
CO2	Students acquire the ability to analyze single and multi-degrees of freedom systems of structures.	K4
CO3	To familiarize with seismic codal and detailing provisions.	K3
CO4	To familiarize with seismic codal philosophy	K3
CO5	To demonstrate the ability to design earthquake-resistant structures at various dynamic conditions.	K2
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	-	-	-	2	-	2	1	-	-	3	1	-
CO2	3	2	1	-	-	-	2	-	1	-	-	-	3	1	-
CO3	3	2	1	-	-	-	-	-	-	1	-	-	3	2	-
CO4	3	2	1	-	-	-	2	-	-	-	-	-	3	1	-
CO5	3	2	1	-	-	-	2	-	-	3	-	-	3	3	-

COURSE CONTENT	
UNIT I	**Seismic-resistant building architecture** Introduction; Lateral load resisting systems- moment resisting frame, building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions; Building characteristics – Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity/redundancy, non-structural elements, foundation soil/ liquefaction. Foundations; Quality of construction and materials – quality of concrete, construction joints, general detailing requirements.
UNIT II	**Design forces for buildings** Introduction; Equivalent static method; Mode superposition technique; Dynamic inelastic-time history analysis; Advantages and disadvantages of these methods; Determination of lateral forces as per IS 1893(Part 1) – Equivalent static method, Model analysis using response spectrum.
UNIT III	**Ductility considerations in earthquake resistant design of RCC buildings** Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility– Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920.
UNIT IV	**Earthquake resistant design of a long two-storey, two-bay RCC building** Determination of lateral forces on an intermediate plane frame using Equivalent static method and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893(Part 1); Identification of design forces and moments in the members; Design and detailing of typical flexural member, typical column, footing and detailing of an exterior joint as per IS13920.
UNIT V	**Base isolation of structures** Introduction; Considerations for seismic isolation; Basic elements of seismic isolation; seismic-isolation design principle; Feasibility of seismic isolation; Seismic-isolation configurations.

TEXT BOOKS	
1.	Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2011.
2.	Seismic design of reinforced concrete and masonry buildings by T. Paulay and M.J.N. Priestley, John Wiley & Sons, 1st Edition 1992.
3.	The seismic design handbook, Edited by F. Naeim, Kluwer Academic publishers, 2001.
REFERENCE BOOKS	
1.	Introduction to the Theory of Seismology‟ by Bullen K.E., Great Britain at the University Printing houses, Cambridge University Press 1996.
2.	Relevant code of practic
WEB RESOURCES	
1.	https://nptel.ac.in/courses/105101004

GROUND IMPROVEMENT TECHNIQUES

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Elective	**Course Code**	20CE7T26
Course Type	Theory	**L-T-P-C**	3-1-0-3
Prerequisites	Geo-Technical Engineering.	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE LEARNING OBJECTIVES	
1	To make the student how to improve the properties of different soils by adopting different ground improvement techniques.
2	To make the student appreciate the need for different ground improvement methods adopted for improving the properties of remoulded and in-situ soils by adopting different techniques such as in situ densification and dewatering methods
3	To make the student understand how to stabilize the different types of poor quality soils, purpose and effects of grouting.
4	To enable the students to know how reinforced soil, geotextiles and geosynthetics can be used to improve the engineering performance of soils

COURSE OUTCOMES		**Cognitive**
Upon successful completion of the course, the student will be able to:		**Level**
CO1	Identify various problems associated with soil deposits, formulate and methods to evaluate them.	K2
CO2	Explain the concept involved for in-situ treatment of cohesive and cohesionless soils and ability required to design an appropriate techniques to implement ground improvement methods.	K2
CO3	Ability to design a dewatering system, component or process as per needs and specifications.	K3
CO4	Know the various functions of Geosynthetics and their applications in civil engineering practice.	K3
CO5	Design a reinforced earth embankment and check its stability, concepts and applications of grouting	K3
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	2	2	2	3	1	2	2	3	2	2	1
CO2	2	3	3	2	3	1	2	3	1	3	2	3	3	3	3
CO3	3	3	2	2	2	2	2	2	3	1	2	2	3	1	2
CO4	3	2	3	3	1	1	3	1	2	3	3	3	2	2	3
CO5	3	2	3	3	3	1	3	1	2	3	3	3	3	2	2

COURSE CONTENT

UNIT I	**PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES** Role of ground improvement in foundation engineering – Methods of ground improvement Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.
UNIT II	**INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS** In-situ densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles- Installation techniques – Simple design - Relative merits of above methods and their limitations. separation, road works and containment application- Introduction to Liquefaction & its effects & applications.
UNIT III	**DEWATERING TECHNIQUES** - Well points – Vacuum and electroosmotic methods – Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.
UNIT IV	**STABILIZATION OF SOILS** – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag. **GROUTING** – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting – hydraulic fracturing in soils and rocks – post grout tests.
UNIT V	**REINFORCE EARTH** – principles – components of reinforced earth – design principles of reinforced earth walls – stability checks – soil nailing. **GEOSYNTHETICS** – geotextiles – types – functions , properties and applications – geogrids , geomembranes and gabions - properties and applications.

TEXT BOOKS	
1.	„Ground Improvement Techniques‟ by Purushotham Raj, Laxmi Publications, New Delhi. 2nd Edition 2015.
2.	„Ground Improvement Techniques‟ by NiharRanjanPatro ,Vikas Publishing House (p) limited , New Delhi. 1st Edition 2012.
3.	„An introduction to Soil Reinforcement and Geosynthetics‟ by G.L.Siva Kumar Babu, Universities Press. 1st Edition 2005.
REFERENCE BOOKS	
1.	Koerner, R.M., “Designing with Geosynthetics” (Fourth Edition), Prentice Hall, Jersey, 2012.
2.	Moseley, M.P., “Ground Improvement Blockie Academic and Professional”, Chapman and Hall, Glasgow, 2004.
WEB RESOURCES	
	https://archive.nptel.ac.in/courses/105105210/

WATER RESOURCE SYSTEM PLANNING

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Elective	**Course Code**	20CE7T37
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Water Resource Engineering	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE LEARNING OBJECTIVES	
1	Introduce the concepts of system analysis in the planning, design, and operation of water resources.
2	Appreciate mathematical optimization methods and models.
3	Learn and apply basic economic analysis tools to water resources projects.
4	Understand linear, nonlinear and dynamic programming techniques and apply them to various water resources systems planning.
5	Appreciate simulation and management techniques in water resources systems.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Apply optimization methods related to water resource systems.	K3
CO2	Application of linear programming in water resources	K3
CO3	Simulate models for planning and design of Water Resources Systems.	K3
CO4	Understand the Non- Linear Optimization Techniques in water resources.	K2
CO5	Perform basic economic analysis to evaluate the economic feasibility of water resources projects.	K5
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	1	2	3	1	1	--	2	2	1	3	--	3
CO2	3	3	3	3	2	3	1	1	--	2	3	--	3	--	3
CO3	3	3	3	3	2	3	1	1	--	2	3	--	3	--	3
CO4	3	3	3	3	2	3	1	1	--	2	3	--	3	--	3
CO5	2	2	3	3	3	3	2	1	1	2	3	2	3	--	3

COURSE CONTENT	
UNIT I	Introduction: concepts of systems analysis, definition. Systems approach to water resource planning, role of optimization models, objective function and constraints, types of optimization techniques.
UNIT II	Linear programming: Formation of linear programming models, graphical methods, simplex method, application of linear programming in water resources. Revised simplex method, duality in linear programming, sensitivity and past optimality anal
UNIT III	Dynamic Programming: principles of optimality forward and backward recursive dynamic programming, case of dimensionality, application for resource allocation.
UNIT IV	Non- Linear Optimization Techniques: Critical method of optimization, Kuch – Tucleer, gradential based research techniques for simple unconstrained optimization.
UNIT V	Simulation: Application of simulation techniques in water resources. ii) Water Resource Economics: Principles of Economic analysis benefit – cost analysis socio economic intuitional pricing of water resources.

TEXT BOOKS	
1.	Water resource system analysis – Vedula&Mujumdar – Tata Mc. Graw hill company Ltd. 2005.
2.	Water resources Economics – James & Lee. Oxford publi
REFERENCE BOOKS	
1.	Optimal design of water distribution networks P.R.Bhave, Narosi publishing house 2003.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/105108081

IRRIGATION ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Course	**Course Code**	20CE7T32
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Water Resource Engineering	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE LEARNING OBJECTIVES	
1	To introduce the types and design of irrigation systems.
2	Discuss the relationships between soil, water and plant and their significance in planning an irrigation system
3	Understand design methods of erodible and non-erodible canals.
4	Know the principles of design of hydraulic structures on permeable foundations.
5	Know the concepts for analysis and design principles of storage, diversion head works and canal structures.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Demonstrate the irrigation types and methods.	K1
CO2	Design principles of Unlined and Lined canals.	K3
CO3	Estimate the life of reservoir and storage capacity.	K4
CO4	Apply the concepts of Bligh's creep theory and Khosla's theory.	K3
CO5	Apply the design principles of cross drainage works. Design of super passage and canal regulator.	K3
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	2	-	-	-	-	1	-	1	-	3
CO2	3	2	2	2	1	2	-	-	-	-	1	-	1	-	3
CO3	3	3	3	2	2	2	-	--	-	-	1	-	1	-	3
CO4	2	2	2	2	1	2	-	-	-	-	1	-	1	-	3
CO5	2	2	2	2	1	2	-	-	-	-	1	-	1	-	3

COURSE CONTENT	
UNIT I	IRRIGATION: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT II	CANALS: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals – Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting, design of lined canal. SPILLWAYS: Types, design principles of Ogee spillways, types of spillways crest gates. Energy dissipation below spillways-stilling basin and its appurtenances.
UNIT III	RESERVOIR PLANNING: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation. DAMS: Types of dams, selection of type of dam, selection of site for a dam. GRAVITY DAMS: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis, drainage galleries, grouting. EARTH DAMS: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters, stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions.
UNIT IV	DIVERSION HEAD WORKS: Types of diversion head works, weirs and barrages, layout of diversion head works, components. Causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.
UNIT V	CANAL STRUCTURES FALLS: Types and location, design principles of Sarda type fall, trapezoidal notch fall and straight glacis fall. REGULATORS: Head and cross regulators, design principles. CROSS DRAINAGE WORKS: Types, selection, design principles of aqueduct, siphon aqueduct and super passage. OUTLETS: Types, Proportionality, Sensitivity and Flexibility. RIVER TRAINING: Objectives and approaches, interlocking system of rivers.

TEXT BOOKS	
1.	"Irrigation and Water Power Engineering" by Punmia B C, P.B.B Lal, A.K. Jain and A.K. Jain, Laxmi Publications Pvt. Ltd., New Delhi.7th Edition 2021
2.	"Irrigation Water Resources and Water Power Engineering" by Modi P N (2011), Standard Book House, NewDelhi. 7th Edition 2021
REFERENCE BOOKS	
1.	"Water Resources Engineering" by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi.
2.	"Irrigation Engineering" by Sharma R.K. and Sharma, T.K (2012), S.Chand& Co. Publishers.
3.	"Water Resources Engineering" by Satyanarayana Murthy Challa (2008), New Age International Publishers.
WEB RESOURCES	
1.	https://nptel.ac.in/courses/126105010

ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Elective	**Course Code**	20CE7T38
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	-----	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE LEARNING OBJECTIVES	
1	To impart knowledge on different concepts of Environmental Impact Assessment.
2	To know procedures of risk assessment.
3	To learn the EIA methodologies and the criterion for selection of EIA methods.
4	To pre-requisites for ISO 14001certification
5	To know the procedures for environmental clearances and audit.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Prepare EMP, EIS, and EIA report	K3
CO2	Identify the risks and impacts of a project	K2
CO3	Selection of an appropriate EIA methodology	K2
CO4	Evaluate the EIA report	K5
CO5	Estimate the cost benefit ratio of a project	K5
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	1	1	-	2	3	3	2	2	-	3	2	1
CO2	2	-	-	-	-	2	-	-	2	-	1	2	3	2	2
CO3	2	3	3	-	1	-	-	2	1	-	-	-	-	2	2
CO4	2	2	3	-	2	-	-	2	-	-	2	2	2	2	2
CO5	-	-	2	2	-	2	-	-	2	-	2	-	2	2	2

COURSE CONTENT	
UNIT I	**BASIC CONCEPT OF EIA:** Elements of EIA - Factors affecting EIA - Initial Environmental Examination - life cycle analysis, Preparation of Environmental Base map - Classification of environmental parameters – Role of stakeholders in the EIA preparation – Stages in EIA.
UNIT II	**EIA METHODOLOGIES**: Introduction, Criteria for the selection of EIA Methodology, EIA methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, Overlay methods, cost/benefit Analysis - EIS and EMP.
UNIT III	**IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE**: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives - Application of remote sensing and GIS for EIA.
UNIT IV	**PROCUREMENT OF RELEVANT SOIL QUALITY**: Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - EIA with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment.
UNIT V	**ASSESSMENT OF IMPACT OF DEVELOPMENT ACTIVITIES**: Vegetation and wildlife, Environmental Impact of Deforestation, EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Procedure for environmental clearance, evaluation of EIA report. Environmental legislation objectives, Evaluation of Audit data and preparation of Audit report.

TEXT BOOKS	
1.	Environmental Impact Assessment, Canter Larry W.,McGraw-Hill education 2nd Edition (1996)
2.	Environmental Impact Assessment Methodologies, by Y.Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad. 2nd Edition, 2011.
3.	Environmental Science and Engineering, by Suresh K.Dhaneja – S.K.Katania&Sons Publication, NewDelhi. 2013.
REFERENCE BOOKS	
1.	Environmental Science and Engineering, by J. Glynn and Gary W.HeinKe – Prentice Hall Publishers.
2.	Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd., NewDelhi.
WEB RESOURCES	
1.	**https://onlinecourses.nptel.ac.in/noc22_ar07/preview**

IV Year I Semester
POWER PLANT ENGINEERING

Course Category	Professional Elective	**Course Code**	20ME7T26
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	IC Engines and Turbo Machinery, Fluid Mechanics and Hydraulic Machines	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Student can learn about power generation through prime movers by using steam.
2	Student can learn about power generation through prime movers by using Diesel and Gas energy.
3	Student can learn about power generation through prime movers by using hydro power and non-conventional energy such as solar, wind and tidal.
4	Student can able to understand the power generation through Nuclear Reactors.
5	Student can able to understood the importance of economic and environmental considerations of power plants.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the functions of the different components of steam power plant.	K2
CO2	Illustrate the working of Diesel and Gas power plant.	K3
CO3	Demonstrate the working of hydel power plant and non-conventional energy generation	K3
CO4	Classify different reactors for power generation and explain the working of nuclear plants	K3
CO5	Estimate various costs related to the economics of power plants.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	1	-	-	-	-	-	-	-	-	2	2	-
CO5	2	2	-	3	3	2	3	3	3	-	2	3	2	3

COURSE CONTENT

UNIT I
STEAM POWER PLANT

Introduction to the Sources of Energy – Resources and Development of Power in India. Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipment's, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

COMBUSTION PROCESS: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT II

INTERNAL COMBUSTION ENGINE PLANT

DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

GAS TURBINE PLANT: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

UNIT III

HYDRO ELECTRIC POWER PLANT

Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

HYDRO PROJECTS AND PLANT: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

POWER FROM NON-CONVENTIONAL SOURCES: Utilization of Solar energy, Fuel cells, Thermo-electric and Thermo-ionic, MHD generation - Collectors Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT IV

NUCLEAR POWER STATION

Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

TYPES OF REACTORS: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT V

POWER PLANT ECONOMICS AND ENVIRONMENTAL CONSIDERATIONS

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor– related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS

1. Power Plant Engineering – P.C.Sharma / S.K.Kataria Publications.
2. A Course in Power Plant Engineering: / Arora and S. Domkundwar.

REFERENCE BOOKS

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications.
2. Power plant Engineering/ Ramalingam/ Scietech Publishers.
3. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
4. An Introduction to Power Plant Technology / G.D. Rai.
5. Power plant Engg - Elanchezhian- I.K. International Publications.

WEB RESOURCES

1. http://nptel.ac.in/courses/112106133/1
2. http://nptel.ac.in/courses/112106133/2
3. http://nptel.ac.in/courses/112106133/3
4. http://nptel.ac.in/courses/112106133/4

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
ELECTRICAL AND ELECTRONICS ENGINEERING

IV Year I semester

Renewable and Distributed Energy Technologies
(Professional Elective – III)

Course Category	Professional Core Courses	**Course Code**	20EE7T20
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	**NIL**	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To understand the basic concepts on wind energy systems with concept on aerodynamics, horizontal and vertical axis wind turbines.
2	To understand the various relations between speed, power and energy in the wind systems.
3	It provides the knowledge in fundamentals of solar energy systems, various components of solar thermal systems, applications in the relevant fields and design of PV systems.
4	To understand the Hydel system components and their design concepts. To get an idea on different other sources like tidal, geothermal and gas based units.
5	To understand the use of various renewable sources as distributed generators.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate basic concepts of renewable and distributed source	K3
CO2	Demonstrate the components of wind energy conversion systems	K3
CO3	Model PV systems and analyze MPPT Techniques.	K4
CO4	Illustrate the concept of Energy Production from Hydro - Tidal and Geothermal.	K3
CO5	Distinguish between standalone and grid connected DG systems and design hybrid renewable energy systems.	K2
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)														
	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	2	1	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	1	-	-	-	-	1	-	-	-	-	1	1	1
CO3	2	1	1	-	-	-	1	-	-	-	-	1	1	1
CO4	2	1	-	-	-	-	1	-	-	-	-	1	1	1
CO5	2	1	1	-	-	-	-	-	-	-	-	1	1	1

COURSE CONTENT	
UNIT 1	**Brief idea on renewable and distributed sources** - their usefulness and advantages; Wind Energy Systems: Estimates of wind energy potential - wind maps - Instrumentation for wind velocity measurements - Aerodynamic and mechanical aspects of wind machine design - Conversion to electrical energy - Aspects of location of wind farms.

UNIT 2	**Wind speed and energy** - Speed and power relations - Power extraction from wind - Tip speed ratio (TSR) - Functional structure of wind energy conversion systems - Pitch and speed control - Power-speed-TSR characteristics - Fixed speed and variable speed wind turbine control - Power optimization - Electrical generators - Self-Excited and Doubly-Fed Induction Generators operation and control.
UNIT 3	**Solar PV Systems:** Present and new technological developments in photovoltaic - estimation of solar irradiance - components of solar energy systems - solar-thermal system applications to power generation - heating - Types of PV systems - Modelling of PV cell - current-voltage and power-voltage characteristics - Effects of temperature - Solar array simulator - Sun tracking - Peak power operations - PV system - MPPT techniques - Effects of partial shading on the characteristic curves and associated MPPT techniques - Solar park design outline.
UNIT 4	**Hydel Power:** Water power estimates - use of hydrographs - hydraulic turbine - characteristics and part load performance - design of wheels - draft tubes and penstocks - plant layouts; Brief idea of other sources viz. - tidal - geothermal - gas-based - etc.
UNIT 5	**Requirements of hybrid/combined use of different renewable and distributed sources -** Need of energy storage; Control of frequency and voltage of distributed generation in Stand-alone and Grid-connected mode - use of energy storage and power electronics interfaces for the connection to grid and loads - Design and optimization of size of renewable sources and storages.

TEXT BOOKS	
1	Math J. Bollen - Fainan Hassan 'Integration of Distributed Generation in the Power System' - IEEE Press - 2011.
2	Loi Lei Lai and Tze Fun Chan 'Distributed Generation: Induction and Permanent Magnet Generators' - Wiley-IEEE Press - 2007.
REFERENCE BOOKS	
1	Studies' Craig Anderson and Rudolf I. Howard 'Wind and Hydropower Integration: Concepts - Considerations and Case - Nova Publisher - 2012.
2	Amanda E. Niemi and Cory M. Fincher 'Hydropower from Small and Low-Head Hydro Technologies' - Nova Publisher - 2011.
3	D. Yogi Goswami - Frank Kreith and Jan F. Kreider 'Principles of Solar Engineering' - Taylor & Francis 2000.
4	G. N. Tiwari 'Solar Energy Technology' - Nova Science Publishers - 2005.
5	Math J. Bollen - Fainan Hassan 'Integration of Distributed Generation in the Power System' - IEEE Press - 2011.
6	S. Heier and R. Waddington 'Grid Intergration of Wind Energy Conversion Systems' – Wiley - 2006.
WEB RESOURCES (Suggested)	
1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/108/107/108107112/

AIR POLLUTION AND CONTROL

DEPARTMENT OF CIVIL ENGINEERING

Course Category	Professional Elective	**Course Code**	20CE7T33
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Environmental Engineering	**Internal Assessment** **Semester End Examination** **Total Marks**	30 60 100

COURSE LEARNING OBJECTIVES	
1	To know the analysis of air pollutants
2	To know the Threshold Limit Values (TLV) of various air pollutants, acquire the design principles of particulate and gaseous control
3	To learn plume behaviour in different environmental conditions

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Decide the ambient air quality based the analysis of air pollutants	K2
CO2	The design principles of particulate and gaseous control measures for an industry.	K4
CO3	Judge the plume behaviour in a prevailing environmental condition	K2
CO4	Estimate carbon credits for various day to day activities.	K4
CO5	Estimate carbon credits for various day to day activities	K4
K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	2	-	2	1	-	-	3	1	-
CO2	3	2	1	-	-	-	2	-	1	-	-	-	3	1	-
CO3	3	2	1	-	-	-	-	-	-	1	-	-	3	2	-
CO4	3	2	1	-	-	-	2	-	-	-	-	-	3	1	-
CO5	3	2	1	-	-	-	2	-	-	3	-	-	3	3	-

COURSE CONTENT	
UNIT I	**Air Pollution:** Sampling and analysis of air pollutants, conversion of ppm into $\mu g/m^3$. Definition of terms related to air pollution and control - secondary pollutants - Indoor air pollution - Climate Change and its impact - Carbon Trade.

UNIT II	**Thermodynamics and Kinetics of Air-pollution**: Applications in the removal of gases like SOx, NOx, CO and HC - Air-fuel ratio- Computation and Control of products of combustion, Automobile pollution. Odour pollution control, Flares. **Meteorology and Air Pollution:** Properties of atmosphere: Heat, Pressure, Wind forces, Moisture and relative Humidity, Lapse Rates - Influence of Terrain and Meteorological phenomena on plume behavior and Air Quality - Wind rose diagrams, Plume Rise Models.
UNIT III	**Ambient Air Quality Management:** Monitoring of SPM, SO2; NOx and CO - Stack Monitoring for flue gases - Micro-meteorological monitoring - Weather Station. Emission Standards- Gaussian Model for Plume Dispersion.
UNIT IV	**Air Pollution Control:** Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control Equipments – Settling Chambers, Cyclone separators –Fabric filters– scrubbers, Electrostatic precipitators.
UNIT V	**Air Pollution Control Methods:** Control of NOx and SOx emissions – Environmental friendly fuels - In-plant Control Measures, process changes, methods of removal and recycling. Environmental criteria for setting industries and green belts.

TEXT BOOKS	
1	Air Pollution by M.N. Rao and H.V.N. Rao – Tata McGraw Hill Company.
2	Air Pollution and Control by KVSG Murali Krishna, Laxmi Publications, New Delhi.
REFERENCE BOOKS	
1	An Introduction to Air pollution by R.K. Trivedy and P.K. Goel, B.S. Publications.
2	Air pollution by Wark and Warner - Harper & Row, New York. 3rd Edition 1998.
WEB RESOURCES	
1	https://onlinecourses.nptel.ac.in/noc22_ce22/preview