

# 1.3.1: Courses relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum

### **List of Courses**

S.No	Course Code	Course Title
1	19AT001	Communication Etiquette in Workplaces
2	19AT004	Ethics and Integrity
3	19AT005	Indian Heritage and Culture
4	19AT007	Intellectual Property Rights and Patents
5	19AT011	Social Responsibility
6	19AT013	Trans/Forming Gender
7	19AT014	Women in Leadership
8	19BEA01	Environmental Studies
9	19CE002	Air Pollution and Environmental Impact Assessment
10	19CH303	Introduction to Chemical Engineering
11	16CH801	Industrial Pollution Control Engineering
12	16CH017	Integrated Solid waste Management
13	16CE603	Environmental Engineering
14	16CE607	Environmental Engineering Lab
15	16CE802	Professional Ethics in Civil Engineering
16	16CE009	Environmental Pollution and Solid Waste Management
17	16CE021	Green Buildings
18	16ME014	Alternative Sources of Energy
19	16EE004	Renewable Energy Sources
20	16EE014	Energy Audit, Conservation & Management
21	16EE801	Ethics for Electrical Engineers



# **Description of Courses**

S.No.	Course Code	Course Title	Description
1	19AT001	Communication Etiquette in Workplaces	This course aims to equip the students with all the communication etiquette and protocol knowledge that are needed to conduct business efficiently. The course will address appropriate communication etiquette to be followed through e-mail, mobile phone, social media, etc. in the work places.
2	19AT004	Ethics and Integrity	This course is aimed to provide a common understanding of best ethical practices and standards of integrity that are appropriate for work places. The course deals with importance of ethical decision making that employees can adopt when faced with an ethical dilemma. The intent is to demonstrate the breadth of responsibility of the individual manager, organization, and corporation in making "ethical" decisions.
3	19AT005	Indian Heritage and Culture	India is one of the ancient civilizations of the world. The ability to accommodate and assimilate external influences and weave them into its own cultural fabric makes Indian culture unique among other ancient civilizations. This course includes pluralistic & rich cultural heritage, Indian art, architecture, music, language, philosophy and religion.
4	19AT007	Intellectual Property Rights and Patents	The course gives a brief overview of the Intellectual Property (IP) landscape in India and the role of IP in the modern intangible economy. This course will help the students to understand the types of patents, trademarks & copy rights, enforcement of IP and IP for business.
5	19AT011	Social Responsibility	Business makes up a significant portion of society. Hence, companies should have a responsibility towards society. For a business



			to operate efficiently, it must balance pursuing profit with a responsibility towards society. The objective of this course is to introduce the concepts of ethics and moral development and examine the application of these concepts as they relate to business and social responsibility.
6	19AT013	Trans/Forming Gender	This course deals with how globalization impacts the construction of gender and sexuality and how gendered positions are reproduced, negotiated & deployed against the backdrop of transborder flows of media, people and cultural products. The issues of global mobility, citizenship, global labor flows and how they impact gender and gender politics will be included.
7	19AT014	Women in Leadership	The objective of this course is to inspire and empower women across the world to engage in purposeful career development and take on leadership for important causes. The opportunities, challenges, trade-offs, and organizational dynamics experienced by women in work organizations, as well as reflect on and practice effective individual behaviors will be addressed.
8	19BEA01	Environmental Studies	The need for sustainable development is a key to the future of mankind. This course provides an understanding about continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity.
9	19CE002	Air Pollution and Environmental Impact Assessment	Air Pollution and Environmental Impact Assessment helps to overcome the problems of environmental degradation and to plan the development process in a sustainable manner so that control and mitigation measures can be undertaken prior to occurrence of degradation. This course addresses the need and concept of environmental impact assessments.
10	16CH303	Introduction to Chemical	This course introduces today's environment



		Engineering	of conflicts and stress in the profession, with obligations to be met by one person in many directions and a formal study to improve one's ability and judgment and refine one's behaviour, decisions, and actions in performing the duty to the family, organization, and to the society formation.
11	16CH801	Industrial Pollution Control Engineering	This course has been designed to provide an overview on types of pollution, their origin and effects on environment. It also deals with a variety of physico-chemical& biological processes with regard to water pollution, air pollution and solid waste treatment and management in selected industries.
12	16CH017	Integrated Solid waste Management	Solid wastes are the all the wastes arising from human and animal activities that are normally solid and are discarded as useless or unwanted. Because of their intrinsic properties, discarded material; are often reusable and may be considered a resource in another setting. Solid waste management is the term applied to all the activities associated with the management of society's waste. The basic goal of the waste management is to manage societal waste in a manner that meets public health and environmental concerns and the public's desire to reuse and recycle waste material.
13	16CE603	Environmental Engineering	This course is a subfield of engineering that is concerned with the protection and preservation of the environment and environmental resources as well as the protection of populations from environmental threats. The course deals with population growth and scientific solutions for environmental problems like air pollution, water pollution and finding renewable energy sources.
14	16CE607	Environmental Engineering Lab	This course provides a scientific and engineering basis for understanding environmental issues and problems. The Environmental Engineering laboratory practical provides good insight into different



			experimental methods relevant to Environmental Engineering. In this laboratory various test on potable water and sewage samples to check pH value, total dissolved solids, BOD and COD, total suspended particles etc. will be performed
15	16CE802	Professional Ethics in Civil Engineering	The course is intended to introduce the basic concepts of Human Values, Professional Ethics, Engineering Ethics, Risk Management and Gloabal Issues on Professional Services. The Course content details the attributes of professionals and professionalism, and the social of impact of professions.
16	16CE009	Environmental Pollution and Solid Waste Management	Ever increase in industrialization activities and increase in population resulted in many types of pollutants that are affecting our environment. It is becoming mandatory to treat these emerging pollutants before they are getting mixed within the environment. The main pollution that is harming the environment or air pollution, water pollution, and solid waste management is the emerging challenge in many countries. This course gives basic information about air pollution, noise pollution, solid waste management, handling of hazardous waste, and preparation of EIA report.
17	16CE021	Green Buildings	This course deals with green building concept with effective usage of use of natural resources to the minimal at the time of construction as well as operation. Green buildings emphasize on the resource usage efficiency and also press upon the three R's – Reduce, Reuse and Recycle. The objectives of this course is to expose the students to the concepts of sustainability in the context of building and conventional engineered building materials, such as concrete, bricks, and achieving the same through lower carbon cements, superior brick kilns and recycled aggregate minimizing consumption of natural resources
18	16ME014	Alternative Sources of Energy	This course aims to Demonstrate the



			concept of different forms of alternative sources of renewable energy, find the calculations on energy storage and thermal analysis, develop the design parameters of wind energy and solar energy. It also explains the environmental issues and economics to interpret the direct energy conversion methods and different aspects of fuel cells
19	16EE004	Renewable Energy Sources	Renewable energy is dependable and abundant, and it has the potential to be very inexpensive once technology and infrastructure improve. It includes solar, wind, geothermal, hydropower, and tidal energy, as well as biofuels grown and harvested without the use of fossil fuels. Renewable energy emits very little carbon dioxide and thus contributes to the fight against climate change caused by the use of fossil fuels.
20	16EE014	Energy Audit, Conservation &Management	The primary goal of an Energy Audit is to identify ways to reduce energy consumption per unit of product output or to reduce operating costs. The energy audit serves as a "benchmark" (reference point) for managing energy in the organisation, as well as the foundation for planning a more efficient use of energy throughout the organisation.
21	16EE801	Ethics for Electrical Engineers	Ethics for Electrical Engineers introduces today's environment of conflicts and stress in the profession, with obligations to be met by one person in many directions and a formal study to improve one's ability and judgment and refine one's behaviour, decisions, and actions in performing the duty to the family, organization, and to the society formation. It deals with codes of ethics of Indian professional societies, detailed risk analysis, crisp case studies. It also deal with the operational issues of electrical apparatus and grid.

# **19AT001** Communication Etiquette in Workplaces

# Unit- I

### Introduction to Professional Ethics:

Ethics In Engineering Profession, Roles of Engineers, Professional Ethics of Engineers and Other Roles Played.

# **Ethical Codes**

Need for Ethical Codes, Prominence of ethical codes and benchmarking, Codes From Other Profession, Advertising Standards of India, Corporate Codes, Knowledge of ethical codes.

# Unit- II

### Workplace Ethics:

Introduction, Needs, Principles, Development of Personal Ethics, Workplace Ethics for Employees-Ethical behavior in workplace- Professionalism, Ethical violations by employees, Employee Attitude and Ethics, Employee Etiquettes. Benefits of ethics in Workplaceemployee commitment, investor loyalty, customer satisfaction, profits

### Professionalism at Workplace:

Unethical Conduct for employees and employers. Factors leading to Unethical Behaviors. Different unethical behaviors. Measures to control unethical behaviors. Rewarding ethical behavior.

### Unit- III

### **Business Ethics:**

Overview of Business Ethics, Corporate Governance, Ethical issues in human resource management- The principal of ethical hiring, Firing, worker safety, whistle blowing, Equality of opportunity, Discrimination, Ethics and remuneration, Ethics in retrenchment. Ethical Dilemmas at workplace, Ethical issues in global business, corporate responsibility of employers.

### Workplace Privacy & Ethics:

Privacy at workplace, Hardware, Software and Spyware, Plagiarism and Computer Crimes, Convenience and Death of Privacy, Defence of employee privacy rights.

### Unit- IV

### Teamwork at Workplace:

Teams, Elements of team, Stages of team development, team meetings, team rules, and teams work and professional responsibility, rules of professional responsibility, ASME code of ethics. Discrimination, sexual harassment, creating awareness about workplace harassment, Vishaka Dutta vs. State of Rajasthan –Supreme Court directions, Compulsory workplace guidelines.

**Managing Change in Workplace through Ethics:** Introduction to Change Management, Models of change, the Ethics of Managing Change, the role of ethics and responsibilities in leading innovation and change, ethics based model for change management, ethics and risks of change management

### Textbook(s)

- 1. R.S. Naagarazan, A Text book on Professional Ethics and Human Values, New Age International (P) Limited, Publishers, 5<sup>th</sup> Edition, 2019
- 2. Kurt Stanberry and Stephen M. Byars, Business Ethics Book, Tata MacGraw Hill Publisher, 6<sup>th</sup> Edition 2020
- 3. Satish Babu Bachu, A Guide to Corporate Business Etiquette: How to Maintain Effective Communication at Work Paperback, 4<sup>th</sup> Edition, 17 July 2014.

4. Barbara Pachter, The Essentials of Business Etiquette and workplace through ethics, 5<sup>th</sup> Edition, 2018.

- The Etiquette Advantage in Business, Third Edition: Personal Skills for Professional Success, Daniel Post Senning, Peter Post, Anna Post, Lizzie Post, Peggy Post, 3<sup>rd</sup> Edition, 2010
- 2. Engineering Ethics & Human Values by: M.Govindarajan , S. Natarajan & V.S.Senthilkumar PHI Learning Pvt. Ltd.
- 3. Professional Ethics by- R. Subramanian
- 4. Business Etiquette: 101 Ways to Conduct Business with Charm & Savvy Book by Ann Sabath, 2011
- 5. The Unwritten Rules of Professional Etiquette Book by Ryan Sharma, 4<sup>th</sup> Edition, 2017
- 6. The Unwritten Rules of Professional Etiquette By: Ryan Sharma, 2017

### **19AT004 ETHICS AND INTEGRITY**

### Unit I

### **Ethics and Interface**

Ethics, Determinants and Consequences of Ethics in - Human Actions; Dimensions of Ethics; Ethics - in Private and Public Relationships. Human Values - Lessons from the Lives and Teachings of Great Leaders, Reformers and Administrators; Role of Family Society and Educational Institutions in Inculcating Values, Human interface.

### Unit II

### Human values

Morals, values and Integrity, Service learning, Civic virtue Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Self-confidence, Character, Spirituality

### Unit III

### **Emotional Intelligence**

Concepts, and their Utilities and Application in Administration and Governance. Contributions of Emotional Thinkers and Philosophers from India and World.

### Unit IV

### **Risk Management and Issues**

Engineering as Experimentation, Codes of Ethics, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Intellectual Property Rights (IPR), Discrimination, Multinational Corporations, Moral Leadership, Code of Conduct, Corporate Social Responsibility.

### **Reference Book(s)**

- 1. R.Subramanian, "Professional Ethics", Oxford University Press, New Delhi, 2013.
- 2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering" Tata McGraw Hill, New Delhi, 2003.
- 3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001

### **19AT004 INDIAN HERITAGE AND CULTURE**

### Unit I

Fundamental Unity of Indian Harappan and Vedic Culture – Evolution of Caste System – Jainism andBuddhism – Gandhara Art.; Political unification of India under Mauryas and Guptas–Cultural achievements

# Unit II

Cultural conditions under the Satavahanas; Contribution of Pallavas and Cholas to Art and letters – Chola Administrative Systems

# Unit III

**On the nature of Culture**: Meaning, Definition and various interpretations of Culture. & Culture and its salient features.

**The Vedic–Upanishadic culture and society**: Human aspirations in those societies – Values – Chaturvidha Purusharthas, Chaturvarna theory Chaturasramsa theory.

# Unit IV

**The Culture in Artha Sastra** : Kautilyan conception of the function of philosophy, State, Religion and King.

**Culture in Ramayana and Mahabharatha:** a. The Ideal Man and Woman b. Concepts Maitri, Karuna, Seela, Vinaya, Kshama, Santi, Anuraga as exemplified in the stories and anecdotes of the Epics.

# **Reference Book(s)**

- 1. Majumdar, A.L. : Advanced History India (Macmillan, 1983)
- 2. Basham, A.L. : Cultural heritage of India Vols.I to IV(Published by Ramakrishna Mission, Calcutta during different years)
- 3. Luniya, B.A. : Evolution of Indian Culture (From the earliest times to the present day)(L.N.Agarwal, Book sellers & Publishers, Agra 1980)
- 4. Bipan Chandra et.al.: Freedom struggle (New Delhi,1972)
- 5. K.Satchidananda Murthy (Ed.): Reading in Indian History, Politics and Philosophy, Part– C "The Culture of India" (AlliedPublishers, Bombay1967)
- 6. Nirmal Kumar Bose : Culture and Society in India(Manimala, Calcutta, 1967)
- 7. B.S.Sanyal : Culture: An Introduction (Macmillan, Madras, 1927)
- 8. S.Radhakrishnan : Hindu View of Life, (Asia Publishing House, Bombay, 1962)
- 9. S.Radhakrishnan : Idealistic View of Life, (Allen & Unwin, London, 1964)
- 10. Sri Aurobindo : Foundations of Indian Culture, (Sri Aurobindo Library, New York, 1953)

### **19AT007 Intellectual Property Rights and Patents**

### Unit I

### **Intellectual Property**

Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para - Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law - Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right

### Unit II

### Trademark

Introduction to Trade mark – Trade mark Registration Process – Post registration procedures – Trade mark maintenance - Transfer of Rights - Inter parties Proceeding – Infringement - Dilution Ownership of Trade mark – Likelihood of confusion - Trademarks claims – Trademarks Litigations – International Trade mark Law

### Unit III

### Copyrights

Introduction to Copyrights – Principles of Copyright Principles -The subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership, Transfer and duration – Right to prepare Derivative works – Rights of Distribution – Rights of Perform the work Publicity Copyright Formalities and Registrations – Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act

### Unit IV

### Trade Secret

Introduction to Trade Secret – Maintaining Trade Secret – Physical Security – Employee Limitation - Employee confidentiality agreement - Trade Secret Law - Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law

### Textbook (s)

- 1. Deborah E.Bouchoux: "Intellectual Property". Cengage learning , New Delhi
- 2. Prabhuddha Ganguli: 'Intellectual Property Rights" Tata Mc-Graw Hill, New Delhi

- 1. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
- 2. R.Radha Krishnan, S.Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi

### **19AT011 SOCIAL RESPONSIBILITY**

### Unit I

### **Introduction to Social Responsibility**

Meaning and Definition, History of Social Responsibility, Concepts of Charity, Social philanthropy, Citizenship, Sustainability and Stakeholder Management. Environmental aspect of Social Responsibility.

### Unit II

### International framework for Social Responsibility

Millennium Development Goals, Sustainable Development Goals, Relationship between Corporate Social Responsibility and Millennium Development Goals. OECD corporate social responsibility policy tool.

### Unit III

### Drivers of Social Responsibility in India

Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in social responsibility, Review of successful corporate initiatives and challenges of social responsibility.

### Unit IV

### Identifying key stakeholders of Social Responsibility

Role of Public Sector in Corporate, government programs, Non-profit and Local Self Governance in implementing Social Responsibility, Global Compact Self-Assessment Tool, National Voluntary Guidelines by Govt. of India, Roles and responsibilities of corporate foundations.

### Reference Book(s)

- 1. William B. Werther Jr. and David Chandler, Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, Second Edition, Sage Publications, 2011
- 2. Sanjay K Agarwal, Corporate Social Responsibility in India, Sage Publications, 2008
- 3. Mark S. Schwartz, Corporate Social Responsibility: An Ethical Approach, Broadview Press, 2011

### **19AT013 TRANS/FORMING GENDER**

### Unit –I

### **Gender Concepts**

Sex & Gender, Social construction of Gender, Gender Socialization, Gender discrimination, gender stereotyping, Androgyny, Gender Roles.

### Unit –II

### **Structures of Gender Inequality**

Patterns of Gender inequality in terms of caste, class and religion patterns of violence against women (with special reference to Karnataka) Female foeticide, Female Infanticide, child marriage. Dowry, Widowhood, Female commercial sex workers, Domestic violence, problems of Elderly and single women

### Unit –III

### **Gender and Institutions**

Kinship and Family: Patriarchy: Concept, origin, Matriliny, Matrilocality (case study of Nayars in Kerala and Khasis of Meghalaya) Joint and Nuclear family Marriage- Concept and Definition, Monogamy, Polygamy Polyandry, Multiple Roles, Role conflict Gender and Education: Gender bias in enrollment, curriculum, content, drop out, recent trends in Women's education

### Unit –IV

### **Issues Related To Marginalized Women And Third Gender**

Status of Dalit women, Tribal women, Minority women, physically challenged women, victims of violence, devdasis, Issues of the rights of sexual minorities and transgender, Artcle 377 and beyond.

### **Reference Book(s)**

1. Rege, Sharmila (ed), Sociology of Gender: The Challenge of Feminist Sociological Knowledge, Sage, New Delhi, 2003.

2. Singh, Indu Prakash, Indian Women: The Power Trapped, Galaxy Pub, New Delhi, 1991.

3. Mohanty, Manoranjan, (eds), Class, Caste, Gender, Sage, New Delhi, 2004

4. Census DocumentKarve, Irawati 1961 : Hindu Society: An Interpretation Poona : Deccan College

5. Ahuja, Ram (1993/2002) Indian Social System, Rawat, Jaipur

6. Kamal K. Misra, Janet Huber Lowry, (Ed)., Recent Studies on Indian Women, Rawat Pub. Jaipur, 2007

7. Malini Bhattacharya (Ed)., Women and Globalization, Tulika Books in Association of School of Women's Studies, Jadapur University, New Delhi, 2005

8. Thomas Sebastian, Globalization and Uneven Development – Neocolonialism, Multi National Corporations, Space and Society, Rawat Publishers, Jaipur, 2007

### **19AT014** Women in Leadership

### UINT-I

### **Education, Employment and Empowerment**

Higher education for women, strategies to implement women's education in rural areas -Women's reservation in education sector, Formal and non-formal ways to education, National Literacy Mission, Traditions, maintaining family honour as strategies to curb financial independence

### Unit-II

### **Roles of Women in Family and Society**

Archaeology of the evolution of women's role - Gender roles in the domestic sphere - Kitchen space feminism - Gender roles in the social sphere - Matriarchy and Matrilineal societies

### Unit-III

### Women in Sports

Physical and Psychological effects of Sports on women - Socio-cultural and economic factors that deter Women's talent in Sports - Against all the odds- Narratives of Women athletes and Sport Stars – Serena Williams, Saina Nehwal, Sania Mirza, Deepika Palikal, Mary Kom - Gender testing, Drug tests and other issues related to sex determination process in sports

### UNIT-IV

### Women Entrepreneurship

Significance of women entrepreneurship, Challenges faced by Women Entrepreneurs, -Relationship between Entrepreneurship and empowerment, Evolution of women entrepreneur development programme, Trends and Patterns of Women Entrepreneurship

### **Text Books:**

- 1. Haque, T. 2015. Empowerment of Rural Women in Developing Countries: Challenges and Pathways. New Delhi: Concept Publishing Company. Sen, Amartya. Development and Freedom. New Delhi: Oxford University Press, 2000
- 2. Agarwal, Suresh. 2015. Social Problems in India. New Delhi: Rajat Publications. Daly, Mary. Beyond God the Father.

### **Reference Text Books:**

- 1. Drinkwater, Barabara, Ed. 2000. Women in Sport. Oxford: Blackwell Science.
- 2. 1 Hisrich, Robert D., Michael Peters and Dean Shepherded-" Entrepreneurship " 9th Tata McGraw Hill 2012
- 3. Peter F.Drucker "Innovation and Entrepreneurship" Reprint Heinemann 2006

### **19BEA01 Environmental Studies**

### Unit I Multidisciplinary Nature of Environmental Studies & Natural Resources

Definition, Scope and Importance, Multidisciplinary nature of Environmental Studies, Value of Nature-Productive, Aesthetic/Recreation, Option, Need for Public Awareness, Institutions (BNHS, BVIEER, ZSI, BSI) and People in Environment (MedhaPatkar, Sundarlal Bahuguna, Indira Gandhi, Rachael Carson)

Natural Resources: Renewable and Non-renewable resources–Importance, uses, overexploitation/threats, and conservation of (i) forest (ii) water (iii) mineral (iv) food and (v) energy resources, role of an individual in conservation of natural resources Biotic and abiotic components–Case studies of forest-water-mineral-food-energy resources

### Unit II

### **Ecosystem & Biodiversity**

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Biogeological cycles (Energy flow, Carbon and Nitrogen Cycles), Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structures and functions of the following ecosystems: a. Forest Ecosystem b. Aquatic Ecosystem Biodiversity and its Conservation: Definition and levels of biodiversity, Bio-geographical classification of India, hot spots of biodiversity–India as a mega diversity nation, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity: In–situ and Ex–situ conservation, Phosphorus cycle–Desert ecosystems–Grassland ecosystem–Case studies on conservation of biodiversity

### Unit III

### **Environmental Pollution & Social Issues**

Environmental Pollution: Definition, Cause, effects, control measures and case studies of: Air pollution b. Water pollution c. Soil pollution Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Disaster management (floods and cyclones) Social Issues and the Environment: Sustainability, Urban problems related to energy, Water conservation and watershed management, Resettlement and rehabilitation of people; Environmental ethics: Issues and possible solutions, global warming, ozone layer depletion, Consumerism and waste products Noise pollution–Case studies on pollution–Wasteland reclamation

### Unit IV

### Human Population and the Environmental Acts

Human Population and the Environment: Population growth, Affluence, Technology and Environmental Impact (Master Equation), Population explosion and Family Welfare Programme, Value Education, HIV/AIDS, Women and Child Welfare, Role of information Technology in Environment and human health, Environment Protection Acts: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act and Forest Conservation Act. Issues involved in enforcement of environmental legislation

Human Rights-The environment (Protection) Act, 1986

### Textbook (s)

1. E. Bharucha, Textbook of Environmental Studies, 1<sup>st</sup> Ed., University Press (India) Pvt. Ltd., 2005

- 1. W. P. Cunningham, M. A. Cunningham, Principles of Environmental Science, 6th Ed., Tata McGraw Hill, 2008
- 2. A. Kaushik, C. P. Kaushik, Perspectives in Environmental Studies, 4<sup>th</sup> Ed., New Age International Publishers, 2008
- 3. H. S. Peavy, D. R. Rowe, G. Tchobanoglous, Environmental Engineering, 1st Ed., McGraw Hill, 1984
- 4. T. E. Graedel, B. R. Allenby, Industrial Ecology and Sustainable Engineering, 1<sup>st</sup> Ed., Pearson Publications, 2009

### **19CE002 AIR POLLUTION AND ENVIRONMENTAL IMPACT ASSESSMENT**

### Unit I

### **Sources and Effects of Air Pollution**

Classification of Air pollutants, Particulates and gaseous pollutants, effects of air pollution on human being, materials, animals and vegetation; global warming- ozone layer depletion, sampling and analysis, basic principle of sampling, source of ambient sampling, analysis of pollutants, principles

Sampling of air Pollutants; Ambient air quality standards.

### Unit II

### **Air Pollution Control and Noise Pollution**

Air Pollution Control: Particulate control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation- selection criteria for equipment- gaseous pollutant control by adsorption, absorption, condensation, combustion.

Noise Pollution: Sources, Effects, Assessments, Standards and Control Methods, Prevention Methods.

Plume rise behavior ; Measurement of Noise level.

### Unit III

### **Environmental Impact Assessment**

Impacts of Development on Environment, Environmental Impact Assessment (EIA): Objectives, Historical development, EIA Types, EIA Notification and Legal Framework, Stakeholders and their Role in EIA.

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

*Rio Principles of Sustainable Development; Mathematical models for Impact prediction.* 

### Unit IV

### **Environmental Management Plan**

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

Case Studies: EIA case studies pertaining to Infrastructure Projects, Roads and Bridges, Ports and Harbor, Airports, Dams and Irrigation projects, Power plants, CETPs.

Public Hearing; Post Project Monitoring.

# Text book (s)

- 1. M. N. Rao and H. V. N. Rao, Air pollution, Tata McGraw-Hill, New Delhi, 1993 2. N
- 2. D. Nevers, Air Pollution Control Engineering, McGraw-Hill International Ed., 1993
- 3. Canter, R.L, "Environmental impact Assessment ", 2nd Edition, McGraw Hill Inc, New Delhi,1995.
- Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank, 1997.
- 5. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers,1909

- 1. K. Wark, C. F. Warner, Air Pollution, Its Origin and Control, Harper and Row, New York, 1981
- 2. C. S. Rao, Environmental Pollution Control Engineering, New Age International, 1905
- 3. Becker H. A., Frank Vanclay, "The International handbook of social impact assessment" conceptual and methodological advances, Edward Elgar Publishing, 1903.
- 4. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 1902.
- 5. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.
- 6. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 1910.

# **19CH303 Introduction to Chemical Engineering**

# Unit I

# **Introduction & Fundamentals of Chemical Engineering**

Origin and development of the chemical process industry, Impact of chemical engineering, Functions of a chemical engineer, Professional activities in chemical engineering, Scope of chemical engineering, Unit operations and processes, Process categories, Representing chemical processes using process diagrams, Material Balance: conservation of total mass, material balance for multiple species, material balance with and without formation/consumption

Career opportunities for chemical engineer-Flow diagram for nitric acid

# Unit II

# **Unit Operations**

Fluid Flow: Concept of pressure, Non-flowing fluids, Principles of fluid flow Heat & Mass Transfer: Fundamentals of heat transfer (Conduction, Convection & Radiation), Heat exchange devices (Double pipe and Shell & tube heat exchangers) fundamentals of mass transfer operations – Distilation, extraction, absorption, adsorbtion, leaching, and drying **Reaction Engineering** : Reaction rates, Types of reactions (elementary and non-elementary reactions), Types of reactors

Humidification, crystalisation

# Unit III

# **Human Values& Engineering Ethics**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time –Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality –– Variety of moral issues – Types of inquiry – Moral–dilemmas – Moral Autonomy– Consensus and Controversy –Models of professional roles

Introduction to Yoga and meditation for professional excellence and stress management.

# Unit IV

### **Professional Engineering Ethics**

Theories about right action Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.– Industrial standards – Intellectual property rights

Global Issues: related to integration of countries through commerce, transfer of technology, and exchange of information and culture –Ethics and codes of business conduct in MNC – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Kohlberg's theory – Gilligan's

# Textbook (s)

- 1. K. A.Solen, J.N. Harb, Introduction to Chemical Engineering, 5<sup>th</sup>ed., Willey, 2015
- 2. S.K.Ghosal, S. K. Sanyal, S. Datta, Introduction to Chemical Engineering,1<sup>st</sup>ed., Tata McGraw Hill, 1993

3. Naagarazan, R. S. Textbook on professional ethics and human values. New Age International, 2006

# Reference(s)

- 1. W. L. Badger, J.T. Banchero, Introduction to Chemical Engineering, 1<sup>st</sup> ed., McGraw Hill, 1955
- 2. W. L. McCabe, J.C. Smith, P. Harriot, Unit Operations in Chemical Engineering, 5thed., McGraw Hill, 1993

D. M. Himmelblau, Basic Principles and Calculations in Chemical Engineering,  $6^{th}ed.$ , Prentice Hall, 1996

# **16CH801 Industrial Pollution Control Engineering**

# Unit I

# **Industrial Pollution Emissions and Indian Standards**

Types of emissions from chemical industries and effects on environment, Type of pollution and their sources, Effluent guide lines and standards, Solid waste management: Sources and classification, Methods of collection (HCS and SCS), Disposal methods, Characterization of effluent streams, Oxygen demands and their determination (BOD, COD, and TOC), Oxygen sag curve, BOD curve interpretation, Controlling of BOD curve, Self-purification of running streams

Determination of Inorganic Substances-Nitrogen-Phosphorous-Trace Elements

# Unit II

# **Wastewater Treatment Processes**

Wastewater treatment Process-Methods of primary treatment; Screening, sedimentation, flotation, neutralization, secondary treatment: Biological treatment of wastewater and bacterial growth curve, suspended growth processes (activated sludge, aerated lagoon and stabilization pond), attached growth processes (trickling filter and rotating biological contactor); tertiary treatment methods (carbon adsorption, membrane separation, chlorination, and ozonation)

Anaerobic treatment, UV radiation for disinfection

### Unit III

# Air Pollution Sampling, Control Methods and Equipments

Criteria and toxic air pollutants, Air pollution sampling and measurement: Ambient air sampling: collection of gaseous air pollutants, Collection of particulate air pollutants, Stack sampling: Sampling system, particulate and gaseous sampling. Air pollution control methods and equipments: Source correction methods: raw material changes, process changes and equipment modification, Particulate emission control: collection efficiency, Control equipments like gravity settling chambers, Cyclone separators, Fabric filters, Electrostatic precipitator, Scrubbers (spray towers andventuri scrubbers), Gaseous emission control ( $SO_x$ ,  $NO_x$  and organic vapor): absorption by liquids and adsorption by solids

Analysis of air pollutants(SO<sub>x</sub>, NO<sub>x</sub>, CO, Particulates)

# Unit IV

### Introduction to safety

Introduction: Safety Programs - Accident and Loss Statistics- Acceptable Risk-Public Perceptions- The nature of the Accident Process-Inherent Safety. Industrial Hygiene: Government of India regulations and OSHA – Industrial Hygiene - Identification – Evaluation - Control. The fire triangle, Distinction between fire and explosions; Definitions, Flammability characteristics of liquids and vapors, ignition energy, Auto ignition, Auto oxidation, Adiabatic compression, Explosions.

*MSDS, cold and hot work permit, types of fire extinguishers* 

# Textbook(s)

- 1. C.S. Rao, Environmental Pollution and Control Engineering, 2<sup>nd</sup> Ed., Wiley, India, 2006
- 2. S.P.Mahajan, Pollution Control in Processes Industries, TMH, 1985

- 1. M.NarayanaRao and A.K.Datta, Waste water treatment, 3<sup>rd</sup> Ed., Oxford and IBH, 2005
- 2. M.N.Rao, H. V.N.Rao, Air Polution, Tata McGraw Hill Education Private Limited, India,2010
- 3. H.S.Peavy, P.R. Rowe, G. Tchobanoglous, Environmental Engineering, McGraw Hill, 1985
- 4. Metcalf and Eddy, Wastewater engineering treatment and reuse, 4<sup>th</sup>Ed., Tata McGraw Hill, 2003

# 16CH017 Integrated Solid Waste Management

# Unit I

# Prospective and Sources, composition & Properties of Solid wastes and Legislation

Evolution of Solid waste management, legislative trends and impacts, Sources, Types and composition of Municipal &solid and hazardous wastes–Physical, Chemical & Biological properties of Municipal &solid and hazardous wastes *Biomedical wastes* 

Unit II

# **Solid Waste Generation & Collection Rates**

Solid Waste generation and Collection rates-Collection of Solid wastes-transfer & transport

Waste handling & Separation, Storage, and processing at the source

# Unit III

# Separation, Transformation and Recycling of Waste materials

Material Separation & processing Technology–Thermal Conversion Technologies– Biological & Chemical Conversion Technologies–Solidification and stabilization of hazardous wastes, Solidwaste management in different industries like – Papermils-Sugar mills

Recycling of Materials found in Municipal Solid Waste

# Unit IV

# Closure, Restoration and Rehabilitation of Landfills

Disposal in landfills-site selection-design and operation of sanitary landfills-secure landfills and landfill bioreactors-Leachate and landfill gas management-Landfill closure and environmental monitoring-Landfill remediation-Elements of integrated waste management

Case Studies

# Textbook (s)

- 1. George TchobanoglousKreith, Frank. Handbook of solid waste management. 1999.
- 2. McDougall, Forbes R., et al. Integrated solid waste management: a life cycle inventory. John Wiley & Sons, 2008
- 3. Nag, Ahindra. Environmental education and solid waste management. New Age International, 2005.

- 1. M. La Grega, P. Buckingham, J. Evans, Hazardous Waste Management, 2<sup>nd</sup> Ed., McGraw Hill, 2001
- 2. McDougall, Forbes R., et al. Integrated solid waste management: a life cycle inventory. John Wiley & Sons, 2008.

- 3. Cheremisinoff, Nicholas P. Handbook of solid waste management and waste minimization technologies. Butterworth-Heinemann, 2003.
- 4. Unnisa, SyedaAzeem, and S. BhupatthiRav, eds. Sustainable solid waste management. CRC press, 2012.
- 5. Rao, M. N., et al. Solid and Hazardous Waste Management: Science and Engineering. Butterworth-Heinemann, 2016.
- 6. Goel, Sudha, ed. Advances in Solid and Hazardous Waste Management. Springer, 2017.

### **16CE603 ENVIRONMENTAL ENGINEERING**

# Unit I

# Water Demand and Quality

Population forecasts, design period – water demand – factors affecting – fluctuations – fire demand – storage capacity Waterborne diseases – protected water supply – water quality and testing – drinking water standards. Comparison from quality and quantity and other considerations– Intakes *Springs- Wells* 

# Unit II

# **Design of Water Treatment Units**

Layout and general outline of water treatment units – sedimentation – principles – design factors – coagulationflocculation, clarifier design – coagulants – feeding arrangements Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation, comparison of filters – disinfection – theory of chlorination, chlorine demand, other disinfection practices- Miscellaneous treatment methods-water softening. *Ultra Filtration- Reverse Osmosis* 

### Unit III

### Sewage Quality and Design of Sewage Treatment Units

Conservancy and water carriage systems–Hardy Cross Method, characteristics of sewage– B.O.D. – C.O.D. equations. Dilution -Self-purification of rivers - Layout and general outline of various units in a waste water treatment plant. Primary treatment design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – biological treatment – trickling filters – standard and high rate *Rotating Biological Reactors- Sewer Apparatus* 

### Unit IV

### **Design of Ponds and Sludge Disposal**

Concept of ponds-Construction and design of anaerobic and oxidation ponds - Sludge digestion – factors effecting – design of Digestion tank Sludge disposal by drying – Other options-septic tanks working principles and design – soak pits. Ultimate disposal of sewage. *Cess Pool- Seepage Pit* 

### Textbook (s)

 B.C. Punmia, Ashok Jain & Arun Jain, Water Supply Engineering, Vol. 1, Wastewater Engineering, Vol. II, 2nd Ed., Laxmi Publications Pvt. Ltd, New Delhi, 2016
G.S. Birdi, Water supply and Sanitary Engineering, Revised Ed., DhanpatRai & Sons Publishers, 2015

3. K.N. Duggal, Elements of Environmental Engineering, 3rd Ed., S. Chand Publishers, 2010

### **Reference (s)**

1. Mark J Hammer and Mark J. Hammer Jr., Water and Waste Water Technology, 7th Ed., Pearson, 2012

2. G.L. Karia and R.A. Christian, Waste water treatment- concepts and design approach, 2nd Ed., Prentice Hall of India, 2013

3. R. Elangovan and M.K. Saseetharan, Unit operations in Environmental Engineering, 5th Ed., Newage India Publishing, 2008

# **16CE607 ENVIRONMENTAL ENGINEERING LAB**

# **List of Experiments**

- 1. Determination of pH and Electrical Conductivity
- 2. Determination and estimation of total Hardness
- 3. Determination of Calcium and Magnesium hardness
- 4. Determination of Alkalinity
- 5. Determination of Acidity
- 6. Determination of chlorides in water and soil.
- 7. Determination and estimation of total solids, dissolved solids
- 8. Determination of Iron
- 9. Determination of dissolved oxygen with D.O Meter & Winkler's Method
- 10. Physical parameters-Temperature, Turbidity
- 11. Determination of B.O.D/COD
- 12. Determination of chlorine demand
- 13. Determination of optimum coagulant dose
- 14. Detrmination of Flourides
- 15. Determination of MPN

# **List of Augmented Experiments**

- 1. pH and Electrical Conductivity value of different samples
- 2. Estimation of total Hardness of bore water
- 3. Determination of Calcium and Magnesium hardness of bore water
- 4. Determination of Alkalinity and Acidity of different samples
- 5. Determination of chlorides in water and soil.
- 6. Estimation of total solids, dissolved solids in Surface water and sub-surface water sample
- 7. Determination of dissolved oxygen of pond water with D.O Meter & Winkler's Method
- 8. Physical parameters-Temperature, Turbidity
- 9. B.O.D/COD of different samples
- 10. Determination of chlorine demand for municipal water

### **Reading Materials (s)**

1. Environmental Engineering Lab Manual-Civil Engineering, GMRIT, Rajam

2. Standard Methods for Analysis of Water and Waste Water - APIIA

3. KVSG Murali Krishna, Chemical Analyses of Water and Soil,3rd Ed., Reem Publications, New Delhi.2013

### **16CE802 PROFESSIONAL ETHICS IN CIVIL ENGINEERING**

# Unit I

### **Introduction to Human values & Ethics**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management. *Ethics, qualities* 

# Unit II

### **Engineering Ethics**

Senses of \_Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories. *Communication, Speaking, Work place* 

### Unit III

### **Risk Management**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. *Laws, Risk* 

### Unit IV

### **Global Issues**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility. *Consultants, leadership, Profession, Responsibilities* 

### Textbook(s)

1. R.Subramanian, —Professional Ethics||, Oxford University Press, New Delhi, 2013.

2. Mike W. Martin and Roland Schinzinger, —Ethics in Engineering||, Tata McGraw Hill, New Delhi, 2003.

3. Govindarajan M, Natarajan S, Senthil Kumar V. S, —Engineering Ethics||, Prentice Hall of India, New Delhi, 2004.

### Reference(s)

1. Charles B. Fleddermann, —Engineering Ethics||, Pearson Prentice Hall, New Jersey, 2004. 2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, —Engineering Ethics – Concepts and Cases||, Cengage Learning, 2009.

3. Edmund G Seebauer and Robert L Barry, —Fundamentals of Ethics for Scientists and Engineers||, Oxford University Press, Oxford, 2001

### **16CE009 ENVIRONMENTAL POLLUTION AND SOLID WASTE MANAGEMENT**

# Unit 1

# Air Pollution and Noise Pollution

Air pollution Control Methods - Particulate control devices - Methods of Controlling Gaseous Emissions – Air quality standards Noise standards, Measurement and control methods -Reducing residential and industrial noise - ISO14000 *Green House Effect - Heat Islands, Traffic Regulations - Zoning* 

# Unit II

# Solid Waste Management

Solid waste characteristics - basics of on-site handling and collection - separation and processing - Incineration, Composting-Solid waste disposal methods - fundamentals of Land filling *Land farming, waste- to-energy combustion* 

### Unit III

### **Hazardous Waste**

Characterization - Nuclear waste - Biomedical wastes - Electronic wastes - Chemical wastes - Treatment and management of hazardous waste - Disposal and Control methods. Non- Bio Medical Waste, Integrated waste management (IWM)

# Unit IV

### **Environmental Impact Assessment**

Impact evaluation and analysis, EIA Methodologies, Assessment of Impacts on surface water, Air and biological Environments - Environmental audit, Preparation of Environmental impact statement - Case studies

Environmental Pollution Act, Mota Act

### Textbook (s)

1. Howard S. Peavy, George Tchobanoglous and Donald R. Rowe's, Environmental Engineering, Tata McGraw-Hill Education Publications, New Delhi, 1985.

2. C. S. Rao, Specifications of Environmental Pollution Control Engineering, Second edition, New Age International Publishers, 2006.

### **Reference (s)**

1. M.N. Rao and H.V.N. Rao, Air Pollution and Control, 29th Reprint, Tata McGraw-Hill, 1988.

2. Gerard Kiley, Environmental Engineering, 1st Ed., Tata McGraw-Hill, 1998.

3. Ruth F. Weiner and Robin Mathews, Environmental Engineering, 4th Ed., Elsevier, 2003.

4. K. Sasi Kumar, S.A. Gopi Krishna, Solid Waste Management, PHI New Delhi, 2013

5. Harry Freeman, Standard handbook of hazardous waste treatment and disposal, Tata McGraw-Hill, 1998.

6. Y. Anjaneyulu, Environmental Impact Assessment, 2nd Ed., BS Publications, 2010

### **16CE021 GREEN BUILDINGS**

# Unit I Green Buildings

Definition of Green Buildings, typical features of green buildings, benefits of Green Buildings, Green building Principles, Sustainable site selection and planning of buildings to maximize comfort, day lighting, ventilation, planning for storm water drainage *Smart Buildings* 

# Unit II

# **Environmentally Friendly Building Materials and Technologies**

Natural Materials like bamboo, timber, rammed earth, stabilized mud blocks, hollow blocks, lime & limepozzolana cements, materials from agro and industrial waste, ferro-cement, alternative roofing systems, various paints reducing the heat gain of the building, etc. *Ferro Concrete* 

### Unit III

### **Energy and Resource Conservation and Use of Renewable Energy Resources**

Need for energy conservation, various forms of energy used in buildings, embodied energy of materials, energy used in transportation and construction processes- water conservation systems in buildings-water harvesting in buildings – waste to energy management in residential complexes or gated communities. Wind and Solar Energy Harvesting, potential of solar energy in India and world, construction and operation of various solar appliances, *Case studies of fully solar energy based buildings in India.* 

### Unit IV

### **Building Resources and Green Building Rating Systems**

Passive energy system design, Building envelope, orientation and components of building fabric and shading, High rise buildings, modular building, Construction of curtain walls, Sourcing and recycling of building materials, alternative calcareous, metallic and non metallic materials. Introduction to Leadership in Energy and Environment Design (LEED), Green Rating systems for Integrated Habitat Assessment – Modular wastewater treatment systems for built environment – Building automation *Building management systems* 

Textbook(s)

1. K.S.Jagadish, B. U. Venkataramareddy, K. S. Nanjundarao, Alternative Building Materials and Technologies, 2nd Ed., New Age International, 2007

2. Osman Attmann, Green Architecture Advanced Technologies and Materials, McGraw Hill, 2010

### Reference(s)

1. Kibert, C. J, Sustainable Construction:Green Building Design and Delivery, 3rd Ed., John Wiley & Sons, Inc., 2012

- 2. G. D. Rai, Non-Conventional Energy Resources,6th Ed., Khanna Publishers.1988
- 3. Greening Building Green Congress, US. (Web).
- 4. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

### 16ME014 ALTERNATIVE SOURCES OF ENERGY

### Unit I

### Introduction

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power.

### **Principles of Solar Radiation**

Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sunshine, solar radiation data.

### **Solar Energy Collection**

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advances collectors.

### **Solar Energy Storage**

Different methods, sensible, latent heat and stratified storage, solar ponds. Solar application, solar heating/cooling techniques, solar distillation and drying, photovoltaic energy conversion *classification of concentrating collectors* 

### Unit II

### Wind energy

Sources and potentials, horizontal and vertical axis windmills, performance characteristics. **Bio-mass** 

Principles of Bio conversion, Anaerobic/aerobic digestion, types of Bio gas digesters, gas yield, combustion characteristics of bio gas utilization for cooking *Biogas disasters* 

### Unit III

### **Geothermal energy**

Resources, types of wells, methods of harnessing the energy, potential in India.

### **O T E C**

Principles, utilization, setting of OTEC plants, thermodynamics cycles.

### Tidal and wave energy

Turbines available for converting tidal wave energy.

Geothermal methods

### Unit IV

### **Direct energy conversion**

Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo electric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects.

### **Fuel cells**

Principle. Faraday's laws, thermodynamics aspects, selection of fuels and operating conditions. *MHD engine* 

### Textbook (s)

- 1. G.D. Rai, Non- conventional Energy Sources, Khanna Publications, 2nd Edition, 2004
- 2. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Limited, 3rd Edition, 2014
- 3. Km Mittal, Non-conventional energy Systems, Wheeler Publishing Co. Limited, 2nd Edition, 2000
- 4. Ramesh & Kumar, Renewable Energy Technologies, Narosa Publishing Company, 4th Edition, 2003

- 1. John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis publishers, 2<sup>nd</sup> Edition, 2003.
- 2. Sukhame & JK Nayak, "Solar Energy", TMH, 3<sup>rd</sup> Edition, 2007
- 3. B.S. Magal Franck Kreith & J.F Kreith , Solar Power Engineering, 8th Edition, 2013
- 4. John A. Duffie William A. Beckman, Solar Engineering of Thermal Processes, Wiley publishers, 4th Edition, 2011

### **16EE004 Renewable Energy Sources**

# Unit I

# Introduction & Solar Energy

Introduction to renewable energy, advantages of generating power through renewable energy sources – technical & economical, **Solar Energy**: Physics of sun, the solar constant, extraterrestrial and terrestrial solar radiation, instruments for measuring solar radiation and sun shine. Flat Plate and Concentrating Collectors, classification of concentrating collectors, thermal analysis of flat plate collectors, Photo voltaic energy conversion,PV cell model and characteristics, Maximum power point tracking for photovoltaic power systems. Types of Maximum power point tracking methods (Perturb and Observe (hill climbing), Incremental Conductance, Fractional short circuit current, Fractional open circuit voltage) *Solar applications-solar heating /cooling technique* 

### Unit II

### Wind & Bio-Mass Energy

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, maximum power point tracking for wind, types of Maximum power point tracking methods

Principles of Bio-Conversion, Anaerobic/aerobic digestion, Types of Bio-Gas Digesters, gas yield, Combustion characteristics of bio-gas,

Utilization for cooking, IC.Engine operation

### Unit III

### **Energy Conversion systems**

**Geothermal & Ocean Energy:** Types of Resources (hydrothermal, geo-pressured, hot dry rock), types of wells, and methods of harnessing the energy (vapour dominated, liquid dominated).Ocean thermal energy conversion, principles, Open loop&closed loop OTEC Cycles.Tidal energy- potential, conversion techniques-single basin, two basin system. Wave energy: conversion techniques.

Fuel cells-Principle of working of various types of fuel cells and their working, Magnetohydrodynamics (MHD)-Principle of working of MHD Power plant, Hydrogen generation, battery energy storage system.

Wave, tidal power conversion systems & Small hydro power generation

### Unit IV

### **Distributed generation & Micro-grid**

Define grid, distributed generation(DG) & microgrid, importance of DG & microgrid, typical structure and

configuration of a microgrid, AC and DC microgrids, modes of operation and control of microgrid: grid

connected and islanded mode, anti-islanding schemes: passive, active and communication based techniques.

HVDC microgrid system

### Textbook (s)

- 1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, 1stEdition, 2000.
- 2. B H Khan, Non-conventional energy resources, Tata McGraw Hill Education Private Limited, 2<sup>nd</sup>Edition, 2001.
- 3. <u>Alexis Kwasinski</u>, <u>Wayne Weaver</u>, <u>Robert S. Balog</u>, Micro grids and other local area power and energy systems, Cambridge University Press, 1<sup>st</sup> Edition, 2016

- 1. Tiwari and Ghosal, Renewable energy resources, Narosa Publishing house, 2<sup>nd</sup>Edition, 2001
- 2. <u>Ranjan Rakesh</u>, <u>Kothari D. P.</u> & <u>Singal K. C.</u>, Renewable Energy Sources And Emerging Technologies, PHI, 2<sup>nd</sup>Edition, 2013.
- 3. <u>Nikos Hatziargyriou</u>, Micro grids: Architectures and Control, wiley, 1<sup>st</sup> Edition.
- 4. Electricity Act 2003, Renewable Energy Act 2015.
- 5. Indian Constitution-Articles 51A, 47, 48A.

### 16EE014 Energy Audit, Conservation & Management

### Unit I

### **Energy Scenario and Energy Environment**

**Energy Scenario:** Energy situation – world and India, Commercial and Non-Commercial Energy, Primary Energy Resources, Commercial Energy Production, Final Energy Consumption, Energy Needs of Growing Economy, Energy Sector Reforms in India. Energy Strategy for the Future, Energy Conservation Act-2001 and its Features

**Energy and Environment**: Air Pollution, Climate Change, Energy Security, Energy Conservation and its Importance.

Air Pollution

### Unit II

### **Energy Auditing and Energy Economic Analysis**

**Energy Auditing:** Energy conservation schemes – Short, medium and long term. Elements of energy audits-energy index-cost index-energy cost, Energy use profiles-pie chart-Sankey diagram, Types of energy audits

**Energy Economic Analysis:** Costing techniques-cost factors-breakeven charts-capital sourcesinterests-capital recovery-depreciation methods-budgeting-standard costing-cash flows, Methods of investment appraisal-rate of return method, pay back method, net present value method, internal rate of return method.

Taxes and tax credit

### Unit III

### **Energy Efficiency In Electrical Systems**

Electricity billing, Electrical load management and maximum demand control, Power factor improvement and its benefit, Selection and location of capacitors, Performance assessment of PF capacitors, Distribution and transformer losses. Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls, Energy saving potential of each technology.

Variable speed drives

### Unit – IV

### **Demand Side Management**

Introduction to DSM, concept of DSM, benefits of DSM, different techniques of DSM – time of day pricing, multi-utility power exchange model, time of day models for planning, load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment

Concept of ABT

### Text book(s)

- 1. WR Murphy, G McKay, "*Energy Management*", Elsevier Butterworth Heinemann Publications, India 2013
- 2. A S. Pabla, "Electrical Power distribution", TMH, 8th edition, 2011

- 1. D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai, *"Recent Advances in Control and Management of Energy Systems"*, Interline Publisher, Bangalore, 1993.
- 2. Ashok V. Desai, "Energy Demand Analysis, Management and Conservation", new age international pvt ltd 1998

### **16EE801 Ethics for Electrical Engineers**

# Unit I

### **Human Values and Engineering Ethics**

Morals, Values and Ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Character, Spirituality.

Senses of Engineering Ethics, Variety of moral issues, Types of inquiry, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Models of professional roles, Theories about right action, Self-interest, Customs and Religion, Uses of Ethical Theories.

Moral dilemmas, Moral Autonomy

### Unit II

### Safety, Responsibilities and Rights in Social Experimentation

Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, Balanced Outlook on Law, Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, Employee Rights. Intellectual Property Rights

### Unit III

### **Operational Issues of Electrical Apparatus**

Code of practice for construction, installation, protection, operation and maintenance of electric supply lines and apparatus, Installation and Testing of Generating Units, Meters, maximum demand indicators and other apparatus on consumer's premises, Point of commencement of supply, Test for resistance of insulation, Earth leakage protective device, Use of energy at high and extra-high voltages Maximum stresses; Factors of safety, clearances in overhead lines *Role, qualification and licensing of electrical inspector* 

### Unit IV

### **Operational Issues of Power Grid**

Terminology, Objective, Scope and Structure of Indian Electricity Grid Code (IEGC), Role of various agencies under IEGC, Functioning of interstate transmission, Operating code, Scheduling and dispatch

*Connection code* 

### Text books:

1. R.S.Naagarazan, "Professional Ethics and Human Values", New Age International Ltd Publishers, 2006

### **Reference books:**

- 1. The Indian Electricity Grid Code (IEGC), Central Electricity Regulatory Commission, Section 178 of the Electricity Act, 2003
- 2. Indian Electricity Rules 1956
- 3. Douglas W. Cromey, Sci Eng Ethics. 2010 December; 16(4): 639–667. doi:10.1007/s11948-010-9201