



Curriculum and Syllabus

for

M.Tech

RENEWABLE ENERGY

(Two Year Full Time)

Regulation 2018

BOS Date	05.06.2018
29 th ACM Date	09.06.2018



VISION

To be recognized globally for outstanding education and research in all fields of mechanical engineering leading to well qualified engineers, who are innovative, entrepreneurial and successful in studies.

- ❖ Purpose
- ❖ Value
- ❖ Business

MISSION

- ❖ **DM 1:** To inculcate basic mechanical engineering knowledge to students through Effective teaching– learning practices with state of art facilities.
- ❖ **DM2:** To impart quality education to enable the students for higher studies, research and Entrepreneurship.
- ❖ **DM3:** To carry out research activities to satisfy the societal and industrial needs towards sustainability.
- ❖ **DM4:** To provide our students with educational experiences that gives them a sound basis for global requirements, team work and lifelong learning.
- ❖ **DM5 :** To cater the needs of society in context of mechanical engineering with human Ethics values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Mechanical Engineering graduate shall have successful career with good leadership & team work abilities.
PEO2	Graduate pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.



PEO3	Graduate shall have ability to apply core technical competency to various engineering problems along with sense of social awareness.
PEO4	Graduate shall engage in lifelong learning by applying contextual technological knowledge for research and value education.

MAPPING OF MISSION (MS) WITH PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

	PEO1	PEO2	PEO3	PEO4
MS1	2	1	2	2
MS2	2	2	1	1
MS3	1	2	2	2
MS4	1	2	1	1
MS5	2	1	2	2

1 - Slightly

2 - Supportive

3 - Highly related

GRADUATE ATTRIBUTES:

The Graduate Attributes are the knowledge skills and attitudes which the students have at the time of graduation. These attributes are generic and are common to all engineering programs. These Graduate Attributes are identified by National Board of Accreditation.

- 1. Knowledge base for Engineering:** Demonstrate competence in mathematics, natural sciences, engineering fundamentals and specialized engineering knowledge appropriate to the programme.
- 2. Analytical Skills:** Identify, formulate, analyse and solve diverse engineering problems.
- 3. Design:** Solution for complicated open-ended engineering problems and design the components with appropriate standards to meet specified needs with proper attention to public health, safety, environment and society.
- 4. Experimental Investigation:** Technical skills to conduct investigation, interpretation of observed data and provide solution for multifaceted problems.



- 5. Modern Engineering tools usage:** Acquire, select, manipulate relevant techniques, resources and advanced engineering ICT tools to operate simple to complex engineering activities.
- 6. Impact of engineering on society:** Provide a product / project for use by the public towards their health, welfare, safety and legal issues to serve the society effectively.
- 7. Environment and Sustainability:** Design eco-friendly and sustainable products in demonstrating the technology development to meet present and future needs.
- 8. High Ethical Standards:** Practice ethical codes and standards endorsed by professional engineers.
- 9. Leadership and team work:** Perform as an individual and as a leader in diverse teams and in multi-disciplinary scenarios.
- 10. Communication Skills:** Professional communication with the society to comprehend and formulate reports, documentation, effective delivery of presentation and responsible to clear instructions.
- 11. Project management and Finance:** Appropriate in incorporating finance and business practices including project, risk and change management in the practice of engineering by understanding their limitations.
- 12. Life-long learners:** Update the technical needs in a challenging world in equipping themselves to maintain their competence.

Mapping of Program Educational Objectives (PEOs) with Graduate Attributes (GAs)

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA 12
PEO1	3	3	3	2	3	2	2	1	2	1	3	3
PEO2	1	1	2	2	3	2	2	1	1	-	-	3
PEO3	-	-	-	-	-	1	-	-	3	3	2	2
PEO4	2	3	3	3	3	3	2	1	-	-	-	3

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PROGRAMME OUTCOMES (POs)

Graduates shall have

DEPARTMENT OF MECHANICAL ENGINEERING

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 Phone: + 91 - 4362 - 264600 Fax: + 91- 4362 - 264660
 Email: headmech@pmu.edu Web: www. pmu.edu



**PERIYAR
MANIAMMAI**
 INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
 Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited

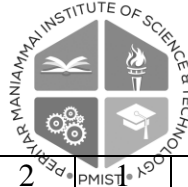
1. an ability to apply principles of engineering, basic science, and mathematics to model and analyze components or processes
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability
4. an ability to function on multi-disciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
12. an ability to imbibe principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes
13. an ability to work professionally in *design and manufacturing* systems (PSO1)
14. an ability to work professionally in *energy* systems (PSO2)

Mapping of Program Educational Objectives (PEOs) with Program Outcomes (POs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	Tot al
PEO 1	1	0	2	3	1	1	3	1	2	1	1	1	1	1	19
PEO 2	3	2	1	1	2	1	1	1	1	1	2	1	2	1	20

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PEO 3	2	2	3	0	2	3	0	2	0	2	1	1	1	1	20
PEO 4	0	2	1	1	1	1	2	1	3	1	2	2	1	1	19

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Mapping of Program Outcomes (POs) with Graduate Attributes (GAs)

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	3	2	2	1	1	2	1	1	1	2	2	1
PO2	2	3	3	2	1	2	1	1	2	1	1	2
PO3	2	2	2	3	3	1	2	1	1	2	1	2
PO4	2	2	3	3	1	2	1	1	2	2	1	2
PO5	2	1	3	2	3	3	3	2	2	3	1	2
PO6	3	2	2	1	1	2	1	1	1	2	2	1
PO7	2	2	1	1	2	3	2	3	2	1	2	2
PO8	2	1	1	2	1	3	2	2	2	3	1	2
PO9	2	1	1	2	3	3	2	2	3	3	1	3
PO10	2	1	1	2	3	3	2	2	3	3	1	3
PO11	2	1	1	2	3	3	2	2	3	3	1	3
PO12	2	1	1	2	3	3	2	2	3	3	1	3

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CURRICULUM 2018
SEMESTER I

Code No.	Course Title	L	T	P	C	HRS
YRE101	Solar Energy Engineering	3	0	0	3	3
YRE102	Wind energy, Tidal energy and OTEC	3	0	0	3	3
YRE103	Process Modelling and Simulation in energy systems	3	0	0	3	3
YRE104****	Elective – I	3	0	0	3	3
YRE105****	Elective – II	3	0	0	3	3
YRE106	Solar energy lab	0	0	1	1	2
YRE107	MAT and SCI lab	0	0	1	1	2
YRE108*-(MC)	Research Methodology and IPR	2	0	0	0	2
YRE109**-(MC-Audit)	Audit courses (Student's Choice)	2	0	0	0	2
Total		19	0	2	17	23

SEMESTER II

Code No.	Course Title	L	T	P	C	HRS
YRE201	Bio Energy Engineering	3	0	0	3	3
YRE202	Computational Fluid Dynamics	3	0	0	3	3
YRE203	Electrical Energy Technology	3	0	0	3	3
YRE204****	Elective – III	3	0	0	3	3
YRE205****	Elective – IV	3	0	0	3	3
YRE206	Bio Energy and CFD lab	0	0	1	1	2
YRE207	Mini Project	0	0	2	2	4
YRE208**-(MC-Audit)	Audit courses (Student's Choice)	2	0	0	0	2
Total		17	0	3	18	23

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SEMESTER III

Code No.	Course Title	L	T	P	C	HRS
YRE301	Dissertation Phase – I	0	0	10	10	20
YRE302***	Elective - V	3	0	0	3	3
YREOE****	Open Elective Course(Student's Choice)	3	0	0	3	3
Total		6	0	10	16	26

SEMESTER IV

Code No.	Course Title	L	T	P	C	HRS
YRE401	Dissertation Phase – II	0	0	16	16	32
Total		0	0	16	16	32

Total Credits - 67

* - Mandatory Course

** - Mandatory Course - Audit

*** - Elective Course

**** - Open Elective Course

Mandatory Courses – Audit (**)

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.



List of Electives (*)**

ELECTIVE GROUP - I:

Code No.	Course Title	L	T	P	C	HRS
YRE104A	Fluid Dynamics and Heat Transfer	3	0	0	3	3
YRE104B	Energy Conservation in HVAC	3	0	0	3	3
YRE104C	Fuels and combustion technology	3	0	0	3	3

ELECTIVE GROUP - II:

Code No.	Course Title	L	T	P	C	HRS
YRE105A	Environmental Engineering	3	0	0	3	3
YRE105B	Carbon Sequestration And Trading	3	0	0	3	3
YRE105C	Waste Management and Energy Recovery	3	0	0	3	3

ELECTIVE GROUP - III:

Code No.	Course Title	L	T	P	C	HRS
YRE204A	Optimum Utilization of heat and power	3	0	0	3	3
YRE204B	Statistical tools for a data analysis	3	0	0	3	3
YRE204C	Sustainable Development	3	0	0	3	3

ELECTIVE GROUP - IV:

Code No.	Course Title	L	T	P	C	HRS
YRE205A	Instrumentation Technology for Energy Systems	3	0	0	3	3
YRE205B	Hydrogen and Nuclear energy	3	0	0	3	3
YRE205C	Energy Modeling, Economics and Project Management	3	0	0	3	3

ELECTIVE GROUP - V:

Code No.	Course Title	L	T	P	C	HRS
YRE302A	Energy audit and management	3	0	0	3	3
YRE302B	Unit Operations in Industries	3	0	0	3	3
YRE302C	CAD/CAM and Simulation of Renewable Energy systems	3	0	0	3	3

**List of Open Elective Courses (****)**

Code No.	Course Title	L	T	P	C	HRS
YREOE1	Hydro power technology	3	0	0	3	3
YREOE2	Energy Efficient building	3	0	0	3	3

Note:

1. The credit distribution is followed as per the guidelines given by AICTE/UGC.

Course type	Credits				Contact Hours			
	L	T	P	Total	L	T	P	Total
Lecture course	3	0	0	3	3	0	0	3
Lecture + Practical course	3	0	1	4	3	0	2	5
Lecture + Tutorial course	3	1	0	4	3	2	0	5
	2	1	0	3	2	2	0	4
Lecture + Tutorial + Practical course	3	1	1	5	3	2	2	7

**YRE101- SOLAR ENERGY ENGINEERING**
(Use of approved data book permitted in the examination)**3 0 0 3****UNIT - I SOLAR RADIATION****9**

Source of radiation – Sun earth relationship- extra terrestrial radiation.– Atmospheric attenuation – terrestrial radiation-radiation on a horizontal surfaces and inclined planes- relations between horizontal radiation and inclined surfaces – relations between monthly, daily and hourly radiation and components of the radiations– solar charts – Critical radiation-Measurement of global, direct and diffuse solar radiation- pyroheliometer, pyranometer, pyrogeometer, net pyradiometer-sunshine recorder – an overview of solar radiation data in India.

UNIT – II SOLAR COLLECTORS – FLAT PLATE COLLECTORS**9**

Design considerations – classification- Flat plate collectors- air heating collectors liquid heating –Temperature distributions- Heat removal rate- Useful energy gain – Losses in the collectors-for efficiency of flat plate collectors – selective surfaces – tubular solar energy collectors analysis of concentric tube collector – testing of flat plate collectors. Solar green house. Solar tracking. solar kilns

UNIT- III CONCENTRIC SOLAR COLLECTORS AND THERMAL APPLICATION**9**

Concentric collectors-Limits to concentration – concentrator mounting – tracking mechanism - performance analysis focusing solar concentrators: Heliostats. Solar powered absorption A/C system (Ammonia/water) solar water pump, solar chimney, solar drier, solar dehumidifier, solar still, solar cooker.

UNIT – IV SIMULATION AND ENERGY STORAGE**9**

Simulation in Solar Process Design- TRANSYS- Design of active systems- f chart methods for liquid and air heaters- phi bar, of chart method - sensible, latent heat and thermo-chemical storage-pebble bed etc. materials for phase change- Glauber's salt-organic compounds -solar ponds.

UNIT- V SOLAR PV SYSTEM**9**

Photovoltaic cell – characteristics -maximum power- tracking-cell arrays-power electric circuits for output of solar panels--inverters-batteries-charge regulators, Construction concepts. Latest trends in PV systems, Life cycle analysis of solar energy system time value of money, evaluation of carbon credit of solar energy system.

A compulsory seminar / assignment on design / case study/analysis /application in any one of the solar thermal energy system

L:45; T:15; Total:60

**TEXT BOOKS:**

1. Duffie J.A and Beckman, W.A., “Solar Engineering of Thermal Processes”, 2nd Edition, John Wiley & Sons Inc., New York, 1991
2. G.N. Tiwari.”Solar Energy ; Fundamentals ,design,modeling and applications “ Third RePrint , Narosa Publishing House, New Delhi,2006

REFERENCES:

1. Edward E.Anderson, “Fundamentals for Solar Energy Conversion”, Addison Wesley pubCO.,1983.
2. Frank Kreith,,Jan F.Kreider,:Principles of solar Engg”, 1978.
3. Koushika M.D,” Solar Energy Principles and Applications”, IBT publications and distributors, 1988.
4. Kaushik S.C, Tiwari G.N and Nayak J.K, “Thermal control in passive solar buildings” .IBT Publishers & Distributors, 1988.

YRE 102 - WIND ENERGY, TIDAL ENERGY AND OTEC 3 0 0 3**UNIT - I MEASUREMENT TECHNIQUES 12**
(Use of approved data book permitted in the examination)

Introduction-measurement and instrumentation-Beaufort number Guest parameters-wind type-power law index betz constant Terrain value.Wind speed characterization-site survey and site analysis -Energy in wind-Highest, lowest wind speeds-wind speed for return periods-study of wind applicable Indian standards-steel Tables, Structural Engineering.

UNIT - II WINDMILL AND WIND TURBINE 10

Wind mill characteristics – types of wind mills- performance analysis -Merits and limitation-variables in wind energy conversion system-wind power density-power in a wind stream-wind turbine efficiency-power of a wind turbine for given in-coming wind velocity - forces on the blades of a propeller-examples of wind farm site-mean wind velocity-wind velocity duration curve-energy pattern factor-wind power duration characteristics - Tip speed ratios - Solidity curves.

Terms-study of all types of turbines (HAWT, VAWT)-typical large capacity wind turbines-sizing-tower design-power duration curves-wind rows diagrams –study of characteristics-actuator theory –analysis of Hourly, daily, monthly, annual, wind behavior-control and instrumentations. synch & power stabilization synchronization & power stabilization.

UNIT - III POWER GENERATION AND HYBRIDISATION 10

Types of wind energy system-alternators -Grid-combination of diesel generator, Battery storage-wind turbine circuits-wind map of India-Wind farm-indefinitely developed wind



turbine-study of various wind turbines manufactured indigenously – kilowatt rating-retrofits
R&M-OP & FC-speed limitation-fatigue stress.

UNIT - IV WAVE AND TIDAL ENERGY

7

Wave energy -Tidal changes – Ecological changes – Types Tidal Power – Energy from Sea – Tidal Turbines – Tidal Power Generation – Recent Trends and Developments – Problems and solutions – Case Studies.

UNIT - V OTEC

6

The concepts- construction and operational problems – history of OTEC development Alternative energy technology – Ocean thermal energy conversion – Techniques – Problems and solutions – Case Studies-ecological and environmental aspects.

A compulsory seminar / assignment on design / case study/analysis /application in any one of the Wid energy,Tidal and OTEC

L:45; Total:45

TEXT BOOKS:

1. E.L Wakil "Power plant technology", McGrawGill Publishers,New York
2. G. D Rai "Non Conventional Energy sources" Khanna publishers. New Delhi

REFERENCES:

1. S.Rao & B.B.Parulekar,"Energy Technology", 3rd edition,Khanna publishers,1995.
2. Anna Mani & Dr.Nooley,"wind Energy Data for India", 1983.
3. IS 875 part IV and IS 1893 material STDS IS 226 (IS 2862, ASTM A-36, BS. 4360 Gr 43 D)
4. Logan (EARL),"Turbo Machinery Basic theory and applications", 1981.

YRE 103- PROCESS MODELLING AND SIMULATION IN ENERGY SYSTEMS

3 0 0 3

UNIT – I

6

Introduction to modeling, a systematic approach to model building, classification of models. Modeling Techniques-Response function and Numerical methods- Conservation principles, thermodynamic principles of process systems

**UNIT-II****9**

Introduction to development of steady state and dynamic lumped and distributed parameters models based on first principles, Analysis of ill-conditioned systems, Block diagrams and computer simulation, Modeling of process elements consisting of Mechanical (translational and rotational) electro- Mechanical ,fluid flow, thermal and chemical reaction system elements

UNIT-III**9**

Development of grey box models. Empirical model building. Statistical model calibration and validation. Population balance models. Examples.

UNIT-IV**12**

Solution strategies for lumped parameter models. Stiff differential equations. Solution methods for initial value and boundary value problems. Euler's method. R-K method. shooting method, finite difference methods. Solving problems using MATLAB/ SCILAB

UNIT- V**9**

Solution strategies for distributed parameter models. Solving parabolic, elliptic and hyperbolic partial differential equations. Finite element and finite volume methods.

TEXT BOOKS

1. K.M. Hangos and I.T Cameron, " Process Modelling and Model analysis".academic Press 2001.
2. W. L Luyben, " Process Modelling, Simulation and control for chemical Engineers" 2nd Edn, McGraw Hill Book Co, New York,1990
3. W.F Ramirez " Computational Methods for Process Simulation" Butterworths,1995

REFERENCES

1. Mark E. Davis, " Numerical Methods and Modelling for Chemical Engineers" JohnWiley & Sons,1984.
2. Singiresu S. Rao "Applied Numerical Methods for Engineers and Scientists" Prentice hall, Upper saddle River , NJ 2001
3. Francis vanek, Louis D. Albright, " Energy systems Engineering" McGraw- Hill book Company, N.Y 2008
4. "Power System Engineering" 2nd Ed.D.P Kothari, I.J. Nagrath, Tata MaGraw- Hill Co 2008.

L:45; T:15; Total:60



YRE106 - SOLAR ENERGY AND MAT LAB

0 0 1 1

Solar Energy

1. Performance evaluation of solar flat plate collector
2. Performance evaluation of concentrating solar collector
3. Performance evaluation of solar cooker
4. Performance evaluation air dryer
5. Performance evaluation of a solar PV panel in series and parallel combination
6. Charging characteristics of a battery using PV panel
7. Effect of tilt angle and Effect of shadow on solar PV panel

YRE107 – MAT and SCI LAB

0 0 1 1

1. Integration Techniques: Trapezoidal method, Simpson's $1/3^{\text{rd}}$ rule, Simpson's $3/8$ rule
2. Finding root of Arithmetic Equation
3. Optimization Techniques
4. LPP methods
5. Transportation problems.
6. Image process of Bio gasification process

YRE108 (*) – Research Methodology and IPR (MC)

2 0 0 0

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee



Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2 nd Edition, “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007. Mayall , “Industrial Design”, McGraw Hill, 1992.
5. Niebel , “Product Design”, McGraw Hill, 1974.
6. Model Curriculum of Engineering & Technology PG Courses [Volume -II] 125 Asimov, “Introduction to Design”, Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
8. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

YRE 201 - BIO ENERGY ENGINEERING**3 0 0 3****UNIT- I BIO FUELS****9**

Bio fuels: types, Properties and sources- Bio fuels first, second and third generation production processes and technologies- Bio diesel comparison with diesel - Biofuel applications – Bio diesel and Ethanol as a fuel for I.C. engines - Relevance with Indian Economy - Bio-based Chemicals and Materials - Commercial and Industrial Products - Govt. Policy and Status of Bio-fuel technologies in India.

UNIT - II CHARACTERISATION OF BIOMASS**9**

Biomass: Sources and Classification. – Properties - Energy plantation - Preparation of biomass. Size reduction- Briquetting of loose biomass - Drying, storage and handling of biomass. Conversion of biomass. Biomass processing for liquid and gaseous fuel production. Effect of



particle size, temperature, on products obtained – Processing of various biomass for gas production for Thermal and Electrical application.

UNIT- III BIOGAS TECHNOLOGY 10

Feed stock for biogas production, animal residues, Aqueous wastes containing biodegradable organic matter- Microbial and biochemical aspects- factors and operating parameters for biogas production- Kinetics and mechanism-Dry and wet fermentation. Digesters-types-digesters for rural application – High rate digesters for industrial waste water treatment

UNIT- IV GASIFICATION OF BIOMASS 10

Thermo chemical Principles: Effect of pressure, temperature and introducing, steam and oxygen. Design and operation of fixed and fluidized bed Gasifier, circulating fluidized bed gasifiers, Safety aspects, operating characteristics of moving bed and fluidized bed gasifier-different types- advantages and disadvantages- performance analysis of gasifiers.

UNIT – V COMBUSTION OF BIOMASS & COGENERATION SYSTEMS 7

Combustion of woody biomass – theory, calculations and design of equipments, Cogeneration in biomass processing industries. – Economic Case studies: Combustion of rice husk. Use of bagasse for cogeneration.

A compulsory seminar / assignment on design / case study/analysis /application in any one of the Bio Energy systems

L:45; Total:45

TEXT BOOKS;

1. Chakraverthy A, “Biotechnology and Alternative Technologies for Utilisation of Biomass or Agricultural Wastes”, Oxford & IBH publishing Co, 1989.
2. Mittal K.M “ Biogas Systems : “Principles and Applications” New age international publishers (P) Ltd 1996, Nijaguna, B.T Biogas Technology, New age International publishers (P) Ltd

REFERENCES:

- 1 Venkata Ramana P and Srinivas S.N, “Biomass Energy Systems”, ISBN 81-85419-25-6, Tata Energy Research Institute, 1996.
3. Klass D.L and Emert G.M, “Fuels from Biomass and Wastes”, Ann Arbor Since Publ. Inc. Michigan, 1985.
4. O.P.Chawla, “Advances in Bio-gas Technology” I.C.A.R., New Delhi, 1970.

YRE 202 - COMPUTATIONAL FLUID DYNAMICS 3 0 0 3

UNIT - I GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD 10

Classification, Initial and Boundary conditions, Initial and Boundary value problems. Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT - II CONDUCTION HEAT TRANSFER 8



Steady one-dimensional conduction, Two and Three-dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT - III INCOMPRESSIBLE FLUID FLOW**7**

Governing Equations, Stream Function - Vorticity method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar and Spalding, Computation of Boundary layer flow, Finite difference approach.

UNIT - IV CONVECTION HEAT TRANSFER AND FEM**10**

Steady One-Dimensional and Two-Dimensional Convection - Diffusion, Unsteady one-dimensional convection - Diffusion, Unsteady two-dimensional convection - Diffusion - Introduction to finite element method - Solution of steady heat conduction by FEM - Incompressible flow - Simulation by FEM.

UNIT - V TURBULENCE MODELS**10**

Algebraic Models - One equation model, K-E Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes.

L:45; T:15; Total :60**TEXT BOOK**

1. Anderson ,D.A Tannehill, I I and Pletcher , R,H “Computational Fluid Mechanics and Heat transfer” Narosa Publication House, NewYork, USA,1984

REFERENCES:

1. Muralidhar, K.,and Sundararajan,T., "Computational Fluid Flow and Heat Transfer", Narosa PublishingHouse ,New Delhi1995.
2. Ghoshdasdar, P.S.,"Computer Simulation of flow and heat transfer" Tata McGraw-Hill PublishingCompany Ltd., 1998.
3. Anderson, D.A.,Tannehill, I.I., and Pletcher, R.H., “Computational Fluid Mechanics and Heat Transfer”,Hemishpere Publishing Corporation, New York, USA, 1984.
4. Flectcher, C.A.J., "Computational Techniques for Different Flow Categories, Springer-Verlage 1987.

YRE 203 - ELECTRICAL ENERGY TECHNOLOGY**3 0 0 3****UNIT - I POWER SYSTEM FUNDAMENTALS****7**

Single line representation – power flow study – power factor improvement, Protection, types of relays, symmetrical components, asymmetrical components, Introduction: Hybrid power system. HVDC - introduction, various coupling methods.

**UNIT - II ELECTRIC ENERGY CONVERSION DEVICES****9**

Transformers – Parallel operation, auto transformers, DC machines, Applications of DC machines – performance equation - generator characteristics - motor characteristics – applications of Synchronous machines - alternators – Induction machines.

UNIT - III SOLID-STATE POWER CONVERTERS AND DRIVES**9**

Controlled rectifiers, choppers, inverters, voltage regulators and cyclo -converters.
 Speed control of dc motors and ac motors – converter fed chopper –fed control Inverter – ac voltage regulators, VFD.

UNIT - IV HYBRID POWER GENERATION**9**

Types of hybrid systems, Integration issues - Steady state performance of Wind-driven induction generators. Grid connected solar photo voltaic system - line commutated converters - Boost converters- selection of inverter. Three phase AC voltage controllers for wind power plants - uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

Micro Grids, Intelligent Grids, Smart grids, Phase Monitoring Unit (PMU), Case studies.

UNIT - V POWER QUALITY IMPROVEMENT**11**

Introduction – Characterisation of Power Quality, impacts, Types of Harmonic filters: passive, Active and hybrid filters. Custom power devices: Load compensation using STATCOM / DSTATCOM, Voltage regulation.

FACT controlled devices, DVR. UPQC control strategies, UPFC, P-Q theory, Status of application of custom power devices.

L:45; Total:45**TEXT BOOKS:**

1. John J Grainger and W.D Stevenson “Power system analysis” McGrawHill publishing company, 1994.
2. T.JE. Miller “FACT controlled device” Johan willey Publications.
3. M.H.Rasheed “Power Electronics” Tata Mc Graw Hill.
4. Arindam Ghosh “Power Quality Enhancement Using Custom Power Devices”, kluwer Academic Publishers, 2002

YRE206- BIO ENERGY AND CFD LAB**0 0 1 1****Bio Energy:**

1. Flue gas analysis – IC engine and gasifier

DEPARTMENT OF MECHANICAL ENGINEERING

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think • innovate • transform

2. Proximate and Ultimate analysis of fuels
3. Analysis of chemical oxygen demand (COD)
4. Analysis of biological oxygen demand (BOD)
5. Determining the Flash point, Fire point and Calorific value of Biofuel
6. Effect of P_H on total dissolved solids (TDS)
7. Heat pipes demonstration

Computational Fluid Dynamics:

1. Experiments on flow patterns.
2. Velocity profile in an air pipe.
3. Wind tunnel calibration.
4. Draining of a tank..
5. Pipe friction..
6. Boundary layer studies.
7. Falling ball experiments.
8. Viscosity measurement.

YRE207 MINI PROJECT

0 0 1 2

Syllabus contents:-

Students can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

YRE301 DISSERTATION PHASE – I

0 0 10 10

Guidelines:

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review.

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The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

YRE401

DISSERTATION PHASE – II

0 0 16 16

Guidelines:

It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. . The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

LIST OF ELECTIVES (*)**

YRE104A - FLUID DYNAMICS AND HEAT TRANSFER

3 0 0 3

UNIT – I

8

Basic equations and flow of non viscous fluids – Fluid and Fluid Properties – The differential equation of fluid flow – Flow of Non viscous fluids.

UNIT - II

12

The flow of viscous fluids – Laminar flow in closed conduits – turbulence – Dimensional analysis and its application to fluid dynamics – Turbulent flow in closed conduits – the laminar sub layer - Flow in the entrance section of closed conduits – Flow of incompressible fluids past immersed bodies – Flow in the shell side of multitude heat exchangers.

UNIT - III

10



The convection-heat – transfer coefficient – Dimensional Analysis in convection heat transfer
Heat transfer during laminar flow in closed conduits – turbulent flow heat transfer in closed
conduits – Empirical correlation for high – Prandtl – Number fluids.

UNIT - IV

8

The analogy between momentum and heat transfer – Heat transfer with liquid metals – Heat
transfer during incompressible flow past immersed bodies.

UNIT – V

7

Recent development in the designing of heat exchanger – Plate heat exchanger – run around
coils – heat pipes – regenerators - effectiveness of heat exchanger.

L:45; Total:45

TEXT BOOKS;

1. James G. Knudsen, Donald L. Katz., “Fluid Dynamics and Heat Transfer”, 1958, Mc
Graw Hill Publishers

REFERENCES:

1. Kern D.C., “Process Heat Transfer”, Mc Graw Hill Publishers.

YRE104B - ENERGY CONSERVATION IN HVAC

3 0 0 3

UNIT - I DESIGN OF HVAC SYSTEM COMPONENTS

9

Vapour compression Systems-Refrigerant properties- Energy Efficient compressor-
Condensers-Evaporators-expansion devices- Cooling Systems other auxiliaries-Design and
Analysis for Energy conservation- Case Studies- VAR Systems- Utilization of Waste heat and
other sources- Analysis for Energy Efficiency Ratio.

UNIT – II AIR CONDITIONING SYSTEMS

9

Psychrometry – Comfort conditions -Types of A/c Systems- Energy conservation of
Humidifiers, Air Washers- Air distribution and handling systems-Controls for AHU-Passive
and Active A/c Systems-Thermal Properties and Energy content of Building materials.

UNIT - III ESTIMATION OF BUILDING LOADS

9

Steady state method – Network method-Numerical method – correlations – computer packages
for carrying out thermal design of buildings and predicting performance- Thermal comfort –



Ventilation and air quality – Air conditioning requirement – Visual perception – Illumination Requirement – Auditory requirement – Energy Management Options – Energy Audit and Energy Targeting – Technological Options for Energy Management-standards on indoor parameters.

UNIT - IV FACTORS AFFECTING THE ENERGY USE

9

Factors that affect energy use in building- functional factors, environmental factors-Envelope factors-Air conditioning system factors- Energy source factors and Electrical systems factors-Fenestration design for optimal day lighting- Lighting and Visual ability – Light sources and Luminaries – Lighting System- Design-Day lighting-Day light factors- Luminance Efficacies-CRI for Lighting source and Usage- Economics and Aesthetics.

UNIT-V MODELING AND SIMULATION

9

Evaluation of natural ventilation in buildings, determination of probable indoor wind speed and direction- Ventilation heat transfer - Solar-air temperature-Introduction to Natural and artificial ventilation simulation systems- Energy Calculations- Degree Days procedure- BIN methods-Comprehensive simulation methods
L:45; Total: 45

TEXT BOOKS:

1. Faye C. McQuiston and Jerald D. Parker “ Heating, Ventilating and Air Conditioning –Analysis and Design”, 4th Edition, John-Wiley & Sons, Inc, NewYork.1994.
2. C.P.Arora “ Refrigeration and Air-conditioning”, Tata-McCraw Hill Publishers, New Delhi

REFERENCES:

1. J.Krieder and A.Rabi “Heating and Cooling of Buildings. Design for Efficiency McGraw Hill (1994).
2. J.R.Williams, Passive Solar Heating, Ann Arbor Science(1983).
3. R.W.Jones, J.D.Balcomb, C.E.Kosiewiez, G.S.Lazarus, R.D.Mc Farland and W.O.Waray, Passive Solar Design Handbook, Vol.3 Report of U.S. Department of Energy (DOE/CS-0127/3) (1982).

YRE104C - FUELS AND COMBUSTION TECHNOLOGY

3 0 0 3

UNIT – I FUELS, FUEL ANALYSIS & COMBUSTION STOICHIOMETRY

8

FUELS & FUEL ANALYSIS: Types of fuel-Physical and chemical characteristics of solid, liquid, and gaseous fuels-Nonconventional fuel-producer gas, hydrogen, biogas etc-



Determination of Calorific values-Ultimate and proximate analysis-problems associated with handlings, storage and combustion

COMBUSTION STOICHIOMETRY

Stoichiometry relations – conservation of mass principles – theoretical & actual combustion processes – calculation of air fuel ratio for a fuel of known combustion – calculation of flue gas composition of fuel and excess air supplied from exhaust gas analysis – combustion calculation with sub- stoichiometry air – calculation of atmospheric air moisture – Dew point temperature of the combustion products – Flue gas analysis- Boiler performance analysis

UNIT - II THERMODYNAMICS OF COMBUSTION PROCESSES 10

COMBUSTION KINETICS: Degree of reactions-reactions equilibrium-Laws of mass action-criteria of equilibrium-heat and temperature-Gibbs free energy – equilibrium constant-Vant hoffs isotherm – rate of reaction-factors affecting rate of reaction-calculation of equilibrium constant and composition of reacting systems .

UNIT- III FLAME, FLAME STRUCTURE, IGNITION AND IGNITORS 10

Flame – flame structure – flame propagation – deflagration – detonations – flame front – Ignition – self & forced ignition – Ignition temperature & ignition limits – Factors influencing ignition – SIT – Ignition lag – limits of inflammability & its determination – factors affecting inflammability limits – calculation of inflammability limits – flame blow off, blow out & flash back – flame quenching, Flame structure – flame stability – premixed & diffused flames – velocity of flame propagation – various methods of flame stabilization – swirl number & its significance – Turndown ratio – Ignitors – various types of ignitors – NFPA class I, II & III ignitors – Eddy plate ignitor – plasma ignitor – High energy Arc ignitor – DIPC ignitor.

UNIT- IV BASICS OF FURNACES 10

Industrial furnaces – process furnaces Steam generating furnaces – Kilns – Batch & continuous furnaces – Advantages of ceramic coating – Heat source – Distributions of head source in furnaces – Blast furnace – open hearth furnace – pot & crucible furnaces – waste heat recovery in furnaces – Recuperator – Regenerators – Furnace atmospheres – Furnace Insulation – Furnace Heat balance calculations, Pipe still Heater.

UNIT - V COAL BURNING EQUIPMENTS 7

Coal burning methods – over feed & underfeed supply of coal – Mechanical Stokers – Travelling grate & spreader stoker – vibrating grate stoker – Advantages & disadvantages of stoker firing over pulverized systems of firing – problems encountered with burning of high ash coal. Pulverized fuel burners – streamlined burner – turbulent burners – Tangential burner – cyclone burner – special type burners.

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A compulsory seminar / Assignment on design /case study / Analysis/ Application in any one of the combustion system and accessories (viz Burner,Draught etc)

L:45; Total:45

Text Books:

1. Dr. SamirSarkar, “Fuels & Combustion”, Orient Longman, Second edition, 1990.
2. Gupta O.P. “Elements of Fuels, Furnaces & Refractories”, 3rd edition, Khanna Publishers, 1996.

REFERENCES:

1. S.P. Sharma & Chander Mohan, “Fuels & Combustion”, Tata McGraw Hill Publishing Co.Ltd., 1984
2. J.D. Gilchrist, “Fuels, Furnaces & Refractories”, Pergamon Press,

ISBN-008-029430-9 ----

3. Blokh A.G. “Heat Transmission in Steam Boiler furnaces”, Hemisphere Publishing Corpn.ISBN-089-116-626-2—

YRE105A - ENVIRONMENTAL ENGINEERING

3 0 0 3

UNIT - I ENVIRONMENTAL POLLUTION

10

Mass and energy transfer – units of measurements, material balance and energy fundamentals – Environmental chemistry stoichiometry, chemical equilibria. Mathematics of growth – exponential growth, resource consumption and population growth, resource consumption and population growth – problems. Atmosphere – Regions of atmosphere – Earth’s natural atmosphere – consequences of population growth – classification of pollution – pollution of Air, Water & Soil – Effect of pollutants on living system – Environmental legislation.

UNIT - II AIR POLLUTION CONTROL METHODS & EQUIPMENT

10

Sources of air pollution –classification & properties of air pollutants – scales of concentration – Effects of air pollution – meteorological aspects of air pollution – urban air pollution – carbon-di-oxide & climate change – Acid deposition – Industrial air pollution – Automobile air pollution – Sampling, measurement and analysis of air pollutants such as SO_x, NO_x, CO, NH₃, C_nH_n, SPM, Opacity, Volatile organic compounds, Trace metals.

UNIT - III WATER POLLUTION

9

Water Sources – Origin of waste water – Classification of Water Pollutions – Effects of water pollutants – Water Pollution Laws and Standards – Water Pollution & Health – Waste Water Sampling – BOD – COD analysis – Waste Water Treatment – primary treatment – secondary

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treatment – Advanced waste water treatment – Anaerobic Digestion. Desalination over micro
filtration – ultra filtration – Reverse Osmosis.

UNIT - IV SOLID WASTE DISPOSAL

9

Solid waste- Sources, types, Compositions and Properties - Land Fill Method of Solid Waste Disposal – Land Fill Classification, Types, Methods and Siting Consideration – Layout and Preliminary Design of Land Fills – Composition, Characteristics, generation, Movement and Control of Landfill Leach ate and Gases – Environmental Monitoring System for Land Fill Gases.

UNIT - V OTHER TYPES OF POLLUTION

7

Noise Criteria - Noise Sources - Noise Control Measures - Thermal Pollution - Oil pollution – Pesticides - Radioactivity Pollution control - Tanneries and other Industries and their control

L:45, Total: 45

TEXT BOOKS

1. James Gilbert M.Masters, “Introduction to Environmental Engineering And Science”, 2nd edition, Prentice Hall, 1998.

REFERENCES:

Rao C.S Environmental Engineering and Pollution Control, 1st edition, New Age International Publishers, 1991.

YRE105B - CARBON SEQUESTRATION AND TRADING

3 0 0 3

UNIT - I GREENHOUSE GAS

9

Stabilization of greenhouse gas concentrations – greenhouse gas risks and reservoirs – green gas mitigation – Carbon di oxide and climate change, acid rain, global warming, impacts of global warming-Kyeto-procal.

UNIT - II CARBON

9

Practices for sequester carbon - car bon sequestration types – carbon credits – carbon testing – potential for carbon sequestration.

UNIT - III MANAGEMENT

9

Risk management and risk reduction – carbon economics – Verification of carbon change.

UNIT - IV CASE STUDIES

9



Carbon trading model – Century Model – Case Studies.

UNIT - V RULES AND REGULATIONS

9

Implication Methanol and Nitrous Oxide carbon bank – Best Management Practices 0 Publics issues – policies.

L:45; Total:45 implication

TEXT BOOKS

1. Emission Trading:Environmental Policies New approach-Richard F. Kosobud, Douglas L. Schreder, Holly M. Biggs Published 2000 John Wiley and Sons.

REFERENCES:

- 1 Agricultural Practices and Policies for Carbon Sequestration in Soil By John M. Kimble, Rattan Lal Published 2002CRCPress
2. The Impact of Carbon Dioxide and Other Greenhouse Gases on Forest Ecosystems By David F. Karnosky Published 2001 CABI Publishing.

YRE105C- WASTE MANAGEMENT AND ENERGY RECOVERY 3 0 0 3

UNIT – I SOLID WASTE

8

Definitions – Sources, types, Compositions, Properties of Solid Waste – Municipal Solid Waste – Physical, Chemical and Biological Property – Collection – Transfer Stations – Waste Minimization and Recycling of Municipal Waste.

UNIT – II WASTE TREATMENT

8

Size Reduction – Aerobic Composting – Incineration – Furnace Type and Design, Medical/Pharmaceutical Waste Incineration – Environmental Impacts – Measures of Mitigate Environmental Effects due to Incineration

UNIT – III WASTE DISPOSAL

9

Land Fill Method of Solid Waste Disposal – Land Fill Classification, Types, Methods and Sitting Consideration – Layout and Preliminary Design of Land Fills – Composition, Characteristics, generation, Movement and Control of Landfill Leachate and Gases – Environmental Monitoring System for Land Fill Gases.

UNIT – IV HAZARDOUS WASTE MANAGEMENT

10

Definition and Identification of Hazardous Waste – Sources and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste Control – Minimization and Recycling Assessment



of Hazardous Waste – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation and Closure.

UNIT – V ENERGY GENERATION FROM WASTE**10**

Types – Biochemical Conversion – Sources of Energy Generation – Industrial Waste, Agro Residues – Anaerobic Digestion – Biogas Production - Types of Biogas Plant Thermochemical Conversion – Sources of Energy Generation – Gasification – Types of Gasifiers – Briquetting – Industrial Applications of Gasifiers – Utilization and Advantages of Briquetting – Environment Benefits of Biochemical and Thermochemical Conversion. **L:45; Total:45**

TEXT BOOKS**REFERENCES:**

1. Parker, Colin & Roberts, Energy from Waste – An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
2. Shah, Manoj Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House, 1997.
3. Rich, Gerald et.al., Hazardous Waste Management Technology, Podevan Publishers, 1997.
4. Bhide AD., Sundaresan BB, Solid Waste Management in Developing Countries, INSDOC, New Delhi, 1983.

YRE204A - OPTIMUM UTILISATION OF HEAT AND POWER 3 0 0 3**UNIT - I ENERGY CONVERSION TECHNIQUES****12**

Energy resource assessment – energy supply, demand and storage planning methods – economic feasibility and assessment methods – energy transfer and conversion methods – thermodynamic and efficiency analysis methods – system analysis methodologies.

UNIT - II TOTAL ENERGY SCHEMES**12**

Basic concepts of CHP – The benefits of CHP – Problems associated with CHP – The balance of energy demand – Types of Prime demand – Types of prime movers – The economics of CHP generation – CHP in the industrial sector – CHP in the commercial sector – CHP in the domestic sector district heating – Conclusions.

UNIT - III PROCESS INTEGRATION AND PINCH TECHNOLOGY**10**

Pinch Technology – Basic concepts of pinch technology – Streams networks – The significance of the Pinch – Design of energy recovery systems – Selection of pinch temperature difference –



Tabular method – Stream splitting – Process retrofit – Installation of heat pumps – Installation of heat engines – The grand composite curve – General comments about process integration.

UNIT - IV ENERGY RECOVERY

6

Insulation – Recuperative heat exchanger – Run -around coil systems – Regenerative heat exchangers – Heat pumps – Heat pipes – Selection of energy recovery methods, Cogeneration.

UNIT - V APPLICATION OF CHP

5

CHP in agricultural sector - processing - energy requirements - potential. CHP in industrial sector - Processing - energy requirements - source of waste heat.

L:45; Total:45

Text Books;

1. Eastop T.D & Croft D.R, “Energy efficiency for engineers and Technologists”, 2nd edition, Longman Harlow, 1990.

REFERENCES:

O’Callaghan, Paul W, “Design and Management for energy conservation”, Pergamon, ,1993.

YRE204B - STATISTICAL TOOLS FOR DATA ANALYSIS

3 0 0 3

UNIT - I RESEARCH

8

Objectives – types: descriptive, analytical, applied fundamental, quantitative, qualitative, conceptual, empirical – approach – significance – methods – process – Research design – need – concepts – sampling design.

UNIT - II LITERATURE SEARCH

11

Offline search: Abstracts-subject index, author index, formula index and other indices-examples-current. Contents – organization – titles and index. On line Search: Computer browsing for literature search and down loading-basics of internet services-sources of abstracts, articles for browsing for literature search and down loading – basics of internet services-sources of abstracts, articles for browsing and downloading, technique for conversion form one format to another.

UNIT - III STATISTICAL PROCESS CONTROL (SPC)

9



The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT - IV DESIGN AND ANALYSIS OF EXPERIMENTS 9

Treatment and interpretation of engineering data. Curve fitting non linear least square regression.. Tests of significance – test of hypothesis, chi square test, analysis of variance and covariance. Introduction to factorial designs- 2^k factorial designs, introduction-Blocking and confounding in two level factorial designs- 2^{k-p} fractional factorial designs,

introduction -Random factors in experiments - Random factors in factorial experiments, mixed models

UNIT - V ERROR ANALYSIS IN MECHANICAL MEASUREMENTS 8

Types of errors-Precision and accuracy-Statistical tests on the accuracy of results-Binomial distribution-Gaussian distribution T-tests, Comparison of precision of two methods by test.

**L:45; Total :45
TEXT BOOKS**

1. C.R.Kothari, Research Methodology – Methods and techniques, Wishwa Prakashan, New Delhi, 1996.
 2. Design and Analysis of Experiments, 5th edition, by D.C. Montgomery, John Wiley & Sons, New York, 2001
- REFERENCES:**

- 1..W.I.Cochron, ‘Statistical methods’, Oxford and IBH publishers.
- 2.<http://www.sciencedirect.com/science/journal>
- 3.James R.Evans & William M.Lidsay, The Management and Control of Quality, (5thEdition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5

YRE204C – SUSTAINABLE DEVELOPMENT 3 0 0 3

UNIT - I INTRODUCTION 12

Industrial activity and Environment industrialization and sustainable development – Industrial Ecology – Prevention versus control of industrial pollution – Regulations to encourage cleaner production based approached.

UNIT - II CLEANER PRODUCTION CONCEPT 7

Importance – Historical evolution – Benefits – promotion – barriers – Role of Industry, government and Institutional – Resume, recovery, recycle, substitution – Internet information & other CP resources.

UNIT- III CLEANER PRODUCTION PROJECT DEVELOPMENT 10



Overview of CP Assessment steps & skills – preparing for the site – material balance
Technical and Environmental feasibility analysis – Economic Evolution of alternatives – Total cost analysis – CP financing - Established programme – Preparing & programme plan – reset audit – Environmental statement

**UNIT - IV LIFE CYCLE ANALYSIS & ENVIRONMENTAL
MANAGEMENT SYSTEM**

8

Elements of LCA - life cycle costing – ECO labelling - Design for the Environment
Environmental standards – ISO 14001 – Environmental audit.

UNIT - V CASE STUDY

8

Industrial application of CP, LCA, EMS & Environmental audit
L:45; Total: 45

REFERENCES:

1. Pollution prevention: Fundamental and Practice, Paul L Bishap, McGrawhill , INC
2. Pollution prevention and abatement Handbook – Towards cleaner production – World bank and UNDP, Washington, D.C
3. Cleaner Production Audit, Prasad Modak, Asian Institute of Technology, Bangkok

**YRE205A- INSTRUMENTATION TECHNOLOGY FOR ENERGY
SYSTEMS**

3 0 0 3

UNIT - I INTRODUCTION TO MEASUREMENT TECHNIQUES

6

General concepts of measurements, static and dynamic characteristics, Introduction to calibrations, calibration standards – characteristics of instruments – Definition – True value – Accuracy – Precision – Sensitivity – Resolution – errors & its measurements, Data acquisition & Display.

UNIT - II MEASUREMENT OF PRESSURE AND TEMPERATURE

9

MEASUREMENT OF PRESSURE

Different units of pressure – Classification of pressure gauges – manometers – pressure balance gauges – force balancing gauge – elastic deformation – commercial pressure gauges using the above principles – ring balance type elements. Measurement of vacuum–McLeod gauge – Pirani



gauge. Measurement using strain gauges. Measurement of Pressure using electronic / micro processor based transmitter, calibration of the instrumentation.

UNIT-III MEASUREMENT OF TEMPERATURE & HEAT FLUX

9

Difference temperature scales – Non-electrical methods – change in volume of liquid – change in pressure of gas – change in vapour pressure. Electrical methods – Thermocouple – Resistance Temperature Detector – Radiation Pyrometer – Optical Pyrometer – Thermostats. Temperature measurement using electronic / micro processor based transmitter, Incidental radiation heat flux, conduction heat flux, calibration. Measurement of Electrical Energy – Voltage – Current – Power Factor.

UNIT - IV MEASUREMENT OF FLOW, LEVEL, HUMIDITY AND OTHER MISCELLANEOUS PARAMETERS

12

Flow measurement – types – differential pressure type flow meter – orifice meter – ventury tube – flow nozzle – pitot tube – positive displacement type flow meter – Inferential flow meter – turbine flow meter – variable area flow meter (rotameter) – mass flow meter. Low flow

measurement using pizzo ring, Ultra Sonic flow meter for high flow. Level measurement – Basic methods – Measuring hydrostatic pressure – measuring the movement of the float – electric conduction method – sight glass. Non-Contact measurement techniques. Level measurement by DP transmitter. Definition of humidity – hydrometer & psychrometer – Humidity measurement. Measurement of pH:-pH scale – methods of pH measurements.mass spectrometer & Chromotograph. Hazardous area and its classification, calibration.

UNIT - V TRANSDUCERS & PROCESS CONTROL

Classification of Transducers – Active and passive transducers - Analog and digital transducers. Advantages of electrical transducers over mechanical transducers – Different types: Resistance – Inductance – Capacitance – Piezo electric transducers.

Functional block diagram of a process control loop and their elements. Definition of set point, dead zone, dead time, disturbance, deviation- Control system – Open and closed loop control system – feed forward control – Ratio control – cascade control. Closed loop conyrollers with examples. Programmable logic controllers & Disturbed controlled system. Computer control using Supervisory Computer.

L:45; T:15; Total: 60

TEXT BOOKS

1. John P.Bentley, “Principles of Measurement System”, 3rd edition, Addison Wsley Longman Ltd.UK,2000.

REFERENCES:

1. Instrument Transducers: An introduction, Neubert H.K.P., Their performance and Design. 2nd edition, Oxford University Press, Cambridge, 1999, Sensors and Transducers, Patranabis, Wheeler Publishing 1999.



2. Stephanopoulos, “Chemical Process Control – An Introduction, to Theory and practice”, PHI, New Delhi, 1984.

YRE 205B - HYDROGEN AND NUCLEAR ENERGY**3 0 0 3****UNIT - I HYDROGEN ENERGY****9**

Hydrogen as a renewable energy source - Sources of Hydrogen - Fuel for Vehicles - Hydrogen Production - Direct electrolysis of water - direct thermal decomposition of water - biological and biochemical methods of hydrogen production - Storage of hydrogen - Gaseous, Cryogenic and Metal hydride - Utilization of hydrogen.

UNIT - II BATTERIES & FUEL CELL**12**

Battery – Storage cell Technologies -storage cell fundamentals- characteristics – Emerging trends in batteries-Carbon- Zinc & alkaline cells, Mercury, Zinc –air & Silver oxide button cells, Lead acid, Edison, Ni cad & Ni mg cells and lithium Technology

Fuel cell – Principle of working- construction- Design and performance analysis of fuel cells- The alkaline fuel cell, Acidic fuel cells, PEM Fuel cells, SOFC - Emerging trends in fuel cells, - Applications – Industrial and commercial

UNIT - III NUCLEAR POWER**9**

Nuclear energy conversion - Chemical and nuclear equations - Nuclear reactions -Fission and fusion - Energy from fission and fuel burn-up - Radioactivity – Neutron energies - Fission reactor types - Nuclear power plants - Fast breeder reactor and power plants - Production of nuclear fuels.

UNIT - IV NUCLEAR POWER**10**

Fuel rod design - Steam cycles for nuclear power plants - reactor heat removal – Coolant channel orificing - Core thermal design - Thermal shields - Fins in nuclear plants – Core thermal hydraulics - Safety analysis - LOCA - Time scales of transient flow and heat transfer processes.

UNIT - V NUCLEAR WASTE MANAGEMENT**5**

Segregation and safe disposal of nuclear waste –case studies

L:45; Total:45**TEXT BOOKS'**

1. M. M. El-Wakil: Power Plant Technology, McGraw Hill, 1985
2. Hand book of Batteries and Fuel cells ,3rd Edition, Edited by David and Thomas, B. Reddy, McGrawhill Book company,N.Y 2002



3. Fuel cell, Principles and applications ,Viswanathan,B and Seibion,Aulice M. Universities Press.2006

REFERENCES:

1. A. W. Culp Jr: Principles of Energy Conversion, McGraw Hill, 2001
2. Principles of fuel cells by Xianguo Li, Taylor & francis,2006
3. T. F. Morse: Power Plant Engineering, Affiliated East West Press, 1978
4. R. H. S. Winterton: Thermal Design of Nuclear Reactors, Pergamon Press, 1981
5. R. L. Murray: Introduction to Nuclear Engineering, Prentice Hall, 1961

**YRE205C - ENERGY MODELING, ECONOMICS AND PROJECT
MANAGEMENT**

3 0 0 3

UNIT - I MODELS AND MODELING APPROACHES

8

Macroeconomic Concepts - Measurement of National Output - Investment Planning and Pricing
- Economics of Energy Sources - Reserves and Cost Estimation.

UNIT - II INPUT OUTPUT ANALYSIS

9

Multiplier Analysis - Energy and Environmental Input / Output Analysis - Energy Aggregation
-Econometric Energy Demand Modeling - Overview of Econometric Methods.

UNIT - III ENERGY DEMAND ANALYSIS AND FORECASTING

12

Methodology of Energy Demand Analysis - Methodology for Energy Technology Forecasting -
Methodology for Energy Forecasting - Sectoral Energy Demand Forecasting.

UNIT - IV ECONOMICS OF STANDALONE POWER SUPPLY SYSTEMS

10

Solar Energy - Biomass Energy - Wind Energy and other Renewable Sources of Energy -
Economics of Waste Heat Recovery and Cogeneration - Energy Conservation Economics.

UNIT - V PROJECT MANAGEMENT-FINANCIAL ACCOUNTING

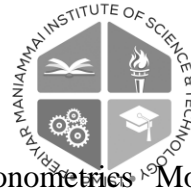
6

Cost Analysis - Budgetary Control - Financial Management - Techniques for Project
Evaluation.

L:45; Total:45

REFERENCES:

1. M.Munasinghe and P.Meier (1993): Energy Policy Analysis and Modeling, Cambridge University Press.
2. W.A.Donnelly (1987): The Econometrics of Energy Demand: A Survey of Applications, New York.



3. S.Pindyck and Daniel L.Rubinfeld (1990): *Econometrics Models and Economic Forecasts*, 3rd edition MC Graw -Hill, New York.
4. *Energy Management handbook*, Turner.

YRE302A ENERGY AUDIT AND MANAGEMENT**3 0 0 3****UNIT - I INTRODUCTION****10**

Energy scenario – Principles and imperatives of energy conversion – Energy consumption pattern – Resource availability – Why save energy – reasons to save energy – an over view of energy consumption and its effects – current energy consumption in India – Role of Energy Managers in Industries.

UNIT - II ENERGY CONSERVATION OF THERMAL UTILITIES**10**

Energy Audit–Characteristic Methods Employed in Certain Energy Intensive Industries – Various Energy Conservation Measures in Steam – Losses in Boiler. Methodology of Upgrading Boiler Performance – Boiler Blow Down Control – Excess Air control – Pressure Reducing Stations. Energy Conservation in Steam Systems – Importance of correct Pressure, Temperature, & Quality of Steam – Condensate Recovery – Condensate Pumping – Thermo Compressors – Recovery of Flash Steam – Air Removal & Venting – Moisture Removal. Steam Traps – Types, Function, Necessity – Section and application. Co-generation – in-plant power generation systems – co-generation Schemes and configuration – Design Considerations – Heat Rate Improvement. Case studies.

UNIT - III ENERGY CONSERVATION OF UTILITIES**10**

Centrifugal pumps – energy consumption & energy saving potentials – Design consideration minimizing over design – case studies – Fans & Blowers – Specification – Safety margin – choice of fans controls – design considerations. Air compressor & compressed air systems – selection of compressed air layout – Encon aspects to be considered at design – Design consideration. Refrigeration & Air conditioning – Heat load estimation – methods of minimizing heat loads – optimum selections of equipments – case studies. Energy conservation in cooling towers & spray ponds – Case studies.

UNIT - IV ENERGY AUDITING**8**

Potential areas for Electrical Energy Conservation in various Industries – Conservation methods – Energy Management Opportunities in Electrical Heating, Lighting System, Cable Selection – Energy Efficient Motors – Factors Involved in Determination of Motor Efficiency Adjustable AC Drivers, Application & its Uses – Variable speed Drivers / Belt Drives Energy Efficiency in



Electrical Systems – HT Power Distribution – Control system in HT/LT side, Harmonics
 Energy Efficiency in Lighting – Case studies.

UNIT - V ENERGY MANAGEMENT**7**

Organizational background desired for energy management persuasion / motivation / publicity role, tariff analysis, detailed process of M&T Energy monitoring, auditing & targeting – Economics of various Energy conservation schemes, instrumentation and calibration Electronics Control and Industrial Energy Management Systems. Thermostats, Boiler controls; proportional, differential and integral control, optimizers; compensators.

L:45; T:15; Total:60**TEXT BOOKS**

1. Eastop T.D & Croft D.R, Energy Efficiency for Engineers and Technologists,. Longman Scientific & Technical, ISBN – 0-582 – 03184, 1990.

REFERENCES:

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. Larry C whitetal, Industrial Energy Management & Utilization.

YRE302B- UNIT OPERATIONS IN INDUSTRIES**3 0 0 3****UNIT - I CRUSHING, GRINDINGSIZE SEPARATION & CONVEYING OF BULK SOLIDS****12**

Various Laws of Crushing – classification of crushing and grinding machineries – Coarse crushers – Intermediate crushers – fine grinders – jaw crusher – Gyratory Crusher – Crushing rolls – Hammer mills – Ball and tube mills – Ultrafine grinders – Closed circuit grinding – Grindability Index. Introduction – characterization of solid particles – standard screens – screen analysis – Types of screening equipments – Air separation methods – Cyclone and bag filters – Size separation by settling - Laws of Settling – Classifiers – Material separation by difference in density – Heavy media cyclone - Froth floatation – Hindered settling – working of thickener. Conveying of bulk solids – conveyor of bulk materials – screw conveyors – Belt conveyors – Bucket Elevators – Pneumatic Conveyers.

UNIT - II MIXING AND FILTRATION**8**

Introduction – mixing of liquids/Liquids, Liquids/Gases, Liquids/Solid – Types of mixers – various mixing equipments – Power requirement for an Impeller Mixer. Theory of Industrial filtration – Constant pressure and constant rate filtration – Filter Aids – Filtration Equipment Classification – Filter Presses – Leaf Filters – Rotary Drum Filter – Centrifuges

UNIT - III EVAPORATION**8**



Introduction – Duhrings Chart – Boiling Point Elevation – Capacity and Economy of Evaporators – Evaporators Classification – Short tube and Long Tube Evaporators – Forced Circulation Evaporators – Climbing and Falling Film Evaporators – Multiple Effect Evaporator – Evaporator Accessories

UNIT - IV HUMIDIFICATION AND DRYING**8**

Definition – Adiabatic Saturation Temperature – Humidity Chart – Wet bulb Temperature and Measurement of Humidity – Spray Ponds and Cooling Towers – Cooling Tower Designing considerations. Introduction – Drying Theory – Equilibrium Moisture Content – Bound, Unbound, Free Moisture – Drying Rate Curves – Constant Drying Rate – Falling Rate Period – Classification of Dryers – Tray Dryers – Rotary Dryers – Turbo Dryer – Cylinder Dryer – Festoon Dryer – Drum Dryer – Spray Dryer – Fluid Bed Dryer

UNIT - V DISTILLATION**9**

Introduction – Various Distillation Methods – Flash Distillation – Batch Distillation – Steam Distillation – Continuous Distillation – Minimum Reflux Ratio- Total Reflux – Optimum Reflux Ratio – Steam Distillation Calculations – Ideal Plate – Actual Plate – Plate Efficiency - Distillation column Internals – Concepts of Azeotropic and Extractive Distillation – Enthalpy Balance for a Continuous Distillation Column (for binary system)

L:45; Total:45**REFERENCES:**

1. P.Chattopadhyay, “Unit operations of chemical Engineering”, 2nd edition, Khanna Publishers, 1996.
2. W.L.McCabe and J.C.Smith, “Unit operations of Chemical Engineering”, 5th edition, McGraw Hill International editions, 1993.
3. Alan S Foust, “Principles of Unit Operations”, 2nd edition, Wiley International Edition, 1960.

J.M. Coulson & Richardson, Chemical Engineering, 5th edition, Butterworth Heinemann, 1996.

YRE302C- CAD/CAM AND SIMULATION OF RENEWABLE ENERGY SYSTEMS**3 0 0 3****UNIT - I BASIC CONCEPTS OF CAD****9**

CAD Hardware and software operating system, application software, CAD workstation Principles of computer graphics – graphics programming, input techniques, transformation. Elements of mechanical drafting package, graphic standards, graphic libraries, design and drafting interface. Advanced modeling techniques.

UNIT - II ADVANCED MODELLING TECHNIQUES**9**



Modeling of curve and surface, non uniform rotational of splines , commercial surface modeling software – principles of solid modeling – rendering methods – CAD/CAM data base development and database management systems –principles of optimum design

UNIT- III COMPUTER AIDED MANUFACTURING AND PROCESS 9

Computer aided manufacturing- fundamentals of CAD/CAM – computers in manufacture – Programming languages, process interface hardware – hierarchy of computers in CAM. Computer process monitoring, types of production monitoring systems – process control – modeling and analysis – direct digital control – supervisory computer control – steady state optimal control – adaptive control, on – line search strategies. Systems for manufacturing support.

UNIT- IV CAD MODELLING AND SIMULATION OF SOLAR AND WIND ENERGY SYSTEMS 9

Solar collectors, solar cooker, solar water heater, solar pasteuriser, solar drier, wind mill and wind generator.

UNIT- V CAD MODELLING AND SIMULATION OF SYSTEMS USING BIOMASS 9

Updraft gasifier – downdraft gasifier, cross draft gasifier – multi fuel gasifier – fixed and fluid bed gasifier –Biogas plant.

L:45; Total: 45

REFERENCES:

1. William M Newman and Robert Sproul “principles of interactive graphics” McGraw Hill, 1984.
2. Radha Krishnan.P. & Kothandaraman.C.P. “Computer graphics design” Dhanpat Rai and Sons, 1990.
3. Groover.M.P. “Automation, Production systems and Computer Aided Manufacturing” Prentice Hall, 1984.
4. CAD/CAM Theory & practice, Inbrahim & Zeid Pub: Tata McGraw Hill.



OPEN ELECTIVES(**)**

YREOE1 – HYDRO POWER TECHNOLOGY

3 0 0 3

UNIT - I HYDROLOGY

9

Overview of Hydropower systems-Preliminary Investigation-Rainfall and run off measurements-Hydrographs-Flow duration graph and mass storage graphs-determination of site selection- Types hydro electric power plants-General arrangements and layouts - preparation of Reports and Estimates-Review of World Resources- Basic Factors in Economic Analysis of Hydropower projects-Project Feasibility-Load Prediction and Planned Development

UNIT- II DEVELOPMENT OF PROTO TYPE SYSTEMS

9

Advances in Planning, Design and Construction of Hydroelectric Power Stations-Trends in Development of Generating Plant and Machinery-Plant Equipment for pumped Storage Schemes-Some aspects of Management and Operations-Updating and Refurbishing of Turbines- case studies

UNIT – III SELECTION AND ANALYSIS OF TURBINES

9

Pelton,Francis and Kaplan Turbine Measurement of pressure head, Velocity-Variou parameters for finding out the potential of Hydro energy-Selection of turbines based on specific quantities –case study.

UNIT - IV HYDRO POWER STATION OPERATION, MAINTENANCE AND TROBLE SHOOTING

9

Governing of Power Turbines-Functions of Turbine Governor-Condition for Governor Stability-Surge Tank Oscillation and Speed Regulative Problem of Turbine Governing in Future- Planning, Design and Construction of Hydroelectric Power Stations-Remaining Life cycle analysis

UNIT–V SMALL, MINI AND MICRO HYDRO POWER PLANTS TURBINES

9

Introduction – analysis of micro hydro and mini hydro turbines – Economical and electrical aspects of small, mini and micro hydro turbines potential developments – design reliability of small, mini micro hydro turbines – case studies.

L:45; Total: 45

TEXT BOOKS:

1. P.K Nag “Power plant Engineering” Tata McGrawHill, New Delhi,2004
2. Domkundwar and Arora “a course inPower plant Engineering” Khanna publishers, New Delhi

**REFERENCES:**

1. L.Monition,M.Lenir and J.Roux, Micro Hydro Electric Power Station(1984)
2. AlenR. Inversin, Micro Hydro Power Source Book(1986)

YREOE2 ENERGY EFFICIENT BUILDING**3 0 0 3****UNIT - I INDOOR ENVIRONMENT****9**

Introduction of Architecture as the art and science of designing. Building Science its significance indoor Environment. Components of Indoor Environment. Quality of Indoor Environment.

UNIT - II THERMAL ANALYSIS AND DESIGN FOR HUMAN COMFORT**12**

Human comfort- Thermal, Visual, Acoustical and Olfactory comfort, comfort, En ergy and indoor Environment. Concept of Solar temperature and its significance. Calculation of instantaneous heat gain through building envelops. Calculation of solar radiation on buildings. Building orientation and significance. Introduction to design of shading devices (horizontal, vertical and egg-crate). Factors that affect energy use in buildings. Ventilation and its significance. Lighting and visual ability- Lighting system Design – Day lighting Economics.

UNIT - III SOLAR PASSIVE CONCEPTS FOR COOLING FOR BUILDINGS**8**

Passive concepts- passive heating concepts, passive cooling concepts and passive heating & cooling concepts. passive concepts appropriate for the various climatic zones in India.

UNIT-IV ENERGY MANAGEMENT AND ENERGY AUDIT OF BUILDINGS**9**

Introduction to energy management of buildings and energy audit of buildings. Aims of energy management of buildings. The historical and diagnostic energy audit, their objectives and benefits. Introduction energy management matrix monitoring and targeting. Building energy survey and audit report form.

UNIT V ENERGY EFFICIENT LANDSCAPE DESIGN**7**

Modification of microclimate through landscape elements for energy conservation. Energy conservation through site selection, sitting & orientation. Energy conservation through integration of buildings and site, site planning and design.

L:45; Total:45



REFERENCES:

1. Sodha M. Bansal, N.K.bansal, P.K., Kumar. A, and Malik, M.A.S., “Solar Passive Buildings” Pergamon Press, 1986.
2. Evans, Martin, “ Housing , Climate and Comfort.” ISBN 0 85139 102 8, The Architectural Press, London, 1980.
3. Bureau of Indian standards, I.S. 11907- 1986 Recommendations for calculation of Solar Radiation Building, 1986.
4. Givoni,. B, “ Man, Climate and Architecture”, Elsevier, Amsterdam, 1986.
5. Smith Ajitha, D. ., “ Building Environment”, Tata McGraw Hill publishing company Limited, New Delhi, 1985
6. Robinette, G.O., (ed), “ Landscape Planning for Energy Conservation”. Van Nostrand Reinhold, New Yark, 1990.

MANDATORY COURSES – AUDIT COURSES

Syllabuses for YRE109 and YRE208****

1. ENGLISH FOR RESEARCH PAPER WRITING

UNIT 1:- Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness **4**

UNIT 2:- Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction **4**

UNIT 3:- Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. **4**

UNIT 4:- key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, **4**

UNIT 5:- Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions **4**

UNIT 6:- useful phrases, how to ensure paper is as good as it could possibly be the first- time submission **4**

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman’s book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

2. DISASTER MANAGEMENT:-

UNIT 1:- Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. **4**



UNIT 2:- Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts. **4**

UNIT 3:- Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics **4**

UNIT 4:- Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness. **4**

UNIT 5:- Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. **4**

UNIT 6:- Disaster Mitigation Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India. **4**

SUGGESTED READINGS:

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies” ,Deep &Deep Publication Pvt. Ltd., New Delhi.

3. SANSKRIT FOR TECHNICAL KNOWLEDGE

UNIT 1 :-

Alphabets in Sanskrit
Past/Present/Future Tense **8**
Simple Sentences

UNIT 2 :-

Order
Introduction of roots **8**
Technical information about Sanskrit Literature

UNIT 3:-

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics **8**

Suggested reading:-

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi



2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbhastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

4. VALUE EDUCATION:-

UNIT 1:-

- 1.Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- 2.Moral and non- moral valuation. Standards and principles. **4**
- 3.Value judgements

UNIT 2 :-

- 1.Importance of cultivation of values.
- 2.Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
- 3.Honesty, Humanity. Power of faith, National Unity. **6**
- 4.Patriotism.Love for nature ,Discipline

UNIT 3:-

- 1.Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking.
- 2.Integrity and discipline.
- 3.Punctuality, Love and Kindness.
- 4.Avoid fault Thinking. **6**
- 5.Free from anger, Dignity of labour.
- 6.Universal brotherhood and religious tolerance.
- 7.True friendship.
- 8.Happiness Vs suffering, love for truth.
- 9.Aware of self-destructive habits.
- 10.Association and Cooperation.
- 11.Doing best for saving nature

UNIT 4:-

- 1.Character and Competence –Holy books vs Blind faith.
- 2.Self-management and Good health. **6**
- 3.Science of reincarnation.
- 4.Equality, Nonviolence ,Humility, Role of Women.
- 5.All religions and same message.
- 6.Mind your Mind, Self-control.
- 7.Honesty, Studying effectively

Suggested reading:-

- 1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

5. CONSTITUTION OF INDIA:-

UNIT 1-

- History of Making of the Indian Constitution:
History Drafting Committee, (Composition & Working) **4**

UNIT 2 –



Philosophy of the Indian Constitution: • Preamble Salient Features

4

UNIT 3 –

Contours of Constitutional Rights & Duties:

1. Fundamental Rights
2. Right to Equality
3. Right to Freedom
4. Right against Exploitation
5. Right to Freedom of Religion
6. Cultural and Educational Rights
7. Right to Constitutional Remedies
8. Directive Principles of State Policy
9. Fundamental Duties.

4

UNIT 4-

Organs of Governance:

1. Parliament
2. Composition
3. Qualifications and Disqualifications
4. Powers and Functions
5. Executive
6. President
7. Governor
8. Council of Ministers
9. Judiciary, Appointment and Transfer of Judges, Qualifications
10. Powers and Functions

4

UNIT 5-

Local Administration:

1. District's Administration head: Role and Importance,
2. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
3. Pachayati raj: Introduction, PRI: Zila Pachayat.
4. Elected officials and their roles, CEO Zila Pachayat: Position and role.
5. Block level: Organizational Hierarchy (Different departments),
6. Village level: Role of Elected and Appointed officials,
7. Importance of grass root democracy

4

UNIT 6 –

Election Commission:

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

4

Suggested reading:-

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



6. PEDAGOGY STUDIES:-

UNIT 1 –

- 1.Introduction and Methodology
- 2.Aims and rationale, Policy background, Conceptual framework and terminology **4**
- 3.Theories of learning, Curriculum, Teacher education.
- 4.Conceptual framework, Research questions.
- 5.Overview of methodology and Searching.

UNIT 2-

- 1.Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- 2.Curriculum, Teacher education. **2**

UNIT 3 –

- 1.Evidence on the effectiveness of pedagogical practices
- 2.Methodology for the in depth stage: quality assessment of included studies.
- 3.How can teacher education (curriculum and practicum) and the school **4**
- 4.curriculum and guidance materials best support effective pedagogy? Theory of change.
- 5.Strength and nature of the body of evidence for effective pedagogical
- 6.practices. Pedagogic theory and pedagogical approaches.
- 7.Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT 4-

- 1.Professional development: alignment with classroom practices and follow-up support
- 2.Peer support
- 3.Support from the head teacher and the community.
- 4.Curriculum and assessment **4**
- 5.Barriers to learning: limited resources and large class sizes

UNIT 5-

1. Research gaps and future directions
- 2.Research design
- 3.Contexts
- 4.Pedagogy
- 5.Teacher education
- 6.Curriculum and assessment 7.Dissemination and research impact. **2**

Suggested reading:-

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



6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

7. STRESS MANAGEMENT BY YOGA:-

UNIT 1 –

Definitions of Eight parts of yog. (Ashtanga) **8**

UNIT 2-

Yam and Niyam.

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

- i) Ahinsa, satya, astheya, bramhacharya and aparigraha **8**
- ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT 3-

Asan and Pranayam

- i) Various yog poses and their benefits for mind & body **8**
- ii) Regularization of breathing techniques and its effects
Types of pranayam

Suggested reading:-

1. 'Yogic Asanas for Group Training-Part-I' : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

8. PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

UNIT 1- Neetisatakam-Holistic development of personality

1. Verses- 19,20,21,22 (wisdom) **8**
2. Verses- 29,31,32 (pride & heroism)
3. Verses- 26,28,63,65 (virtue)
4. Verses- 52,53,59 (dont's)
5. Verses- 71,73,75,78 (do's)

UNIT 2-

1. Approach to day to day work and duties. **8**
2. Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
3. Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
4. Chapter 18-Verses 45, 46, 48

UNIT 3-

Statements of basic knowledge. **8**

1. Shrimad Bhagwad Geeta: Chapter 2-Verses 56, 62, 68
 2. Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:
Chapter 2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39

DEPARTMENT OF MECHANICAL ENGINEERING

Periyar Nagar, Vallam, Thanjavur - 613 403, Tamil Nadu, India
Phone: + 91 - 4362 – 264600 Fax: + 91- 4362 - 264660
Email: headmech@pmu.edu Web: www. pmu.edu



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Chapter18 – Verses 37,38,63

Suggested reading:-

1. “Srimad Bhagavad Gita” by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata ,
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.