

**Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon**



**'A' Grade
NAAC Re-Accredited
(3rd Cycle)**

Faculty of Science

**Syllabus
F.Y.B.Voc.
Renewable Energy Technology & Management**

W.E.F. June 2018

Bachelor of Vocation (Renewable Energy Technology & Management) Course Structure

(W.E.F. June 2018)

Year	Name of the course	NSQF Level Certificate	Cumulative Credits
F.Y. B. Voc.	Diploma	Level-V	60 Credits
S.Y. B. Voc.	Advanced Diploma	Level-VI	120 Credits
T.Y. B. Voc.	B Voc Degree	Level-VII	180 Credits

Eligibility for Level V	
Eligibility:	10+2 in any stream or equivalent
Pattern:	Semester
Medium of Instruction:	English

- Duration of Period: 45 Lectures of 60 minutes or 60 Lectures of 45 min.
- Theory and Practical examination will be conducted at the end of every semester
- Each theory and practical course will be of 100 marks (40% marks -internal examination and 60% marks –external examination)
- Medium of instruction: The medium of instruction for the course shall be English.

F. Y. B. Voc. (Renewable Energy Technology & Management) Level V**(w. e. f. June 2018)**

Semester I					
General Education Component					
Paper No	Paper Code	Title of Paper	Mode	Credits	Marks
1	RET 101	Communication Skills I	Theory	3	100
2	RET 102	Computer Application I	Theory	3	100
3	RET 103	Practicals on Communication Skills I	Practical	3	100
4	RET 104	Practicals on Computer Application I	Practical	3	100
Skill Development Component					
Paper No	Paper Code	Title of Paper	Mode	Credits	Marks
5	RET 105	Basic of renewable energy sources	Theory	3	100
6	RET 106	Renewable Energy Sources and Technologies-I	Theory	3	100
7	RET 107	Solar Photovoltaic Technologies	Theory	3	100
8	RET 108	Waste Energy Management	Theory	3	100
9	RET 109	Laboratory-I (Electronics Lab)	Practical	3	100
10	RET 110	Laboratory-II (Electronics Lab)	Practical	3	100
Total				30	1000

Semester II					
General Education Component					
Paper No	Paper Code	Title of Paper	Mode	Credits	Marks
1	RET 201	Communication Skills II	Theory	3	100
2	RET 202	Computer Application II	Theory	3	100
3	RET 203	Practicals on Communication Skills II	Practical	3	100
4	RET 204	Practicals on Computer Application II	Practical	3	100
Skill Development Component					
Paper No	Paper Code	Title of Paper	Mode	Credits	Marks
5	RET 205	Industrial Electronics and Instrumentation	Theory	3	100
6	RET 206	Renewable Energy Sources and Technologies-II	Theory	3	100
7	RET 207	Solar Thermal Engineering and Applications	Theory	3	100
8	RET 208	Concentrating Solar Thermal Power Plants	Theory	3	100
9	RET 209	Laboratory-III (Analog and Digital Electronics)	Practical	3	100
10	RET 210	Laboratory-IV (Renewable Energy Lab-I)	Practical	3	100
Total				30	1000

SEMESTER I

RET 101 : Communication Skills I

Objectives -

- 1.To Understand the Concept Process, Importance and Objectives of Communication
- 2.To Know the Principles Of Effective Communication.
- 3.To acquire Communication Skills.
- 4.To Study Various Types Of Business Letters.
- 5.To Develop Skills To Draft Letters.
- 6.To Acquaint with Modern Technology In Communication.

Unit 1.

(Lectures 9)

Meaning , Definition & Scope of Communication
Types of Communication
Importance of Communication
Process of Communication

Unit 2

(Lectures 9)

Importance of Effective Communication
Benefits of Effective Communication
7c of Effective Communication
Better public speaking

Unit 3

(Lectures 9)

Writing Skills
Reading Skills
Speaking Skills
Listening Skills

Unit 4

(Lectures 9)

Presentation Skills
Planning Skills
Documentation Skills
Process of preparing Effective business Messages

Unit 5

(Lectures 9)

Job Application Process
File Arrangement Skills
Resume Writing Skills
Improving Oral Presentation/Communication

References :

- 1.Bovee, Courtland, John Thill & Mukesh Chaturvedi. Business Communication Today : Dorling kindersley, Delhi
- 2.Kaul, Asha:Business Communication:Prentice-Hall of India, Delhi
- 3.Monippally, Matthukutty M. Business Communication Strategies. Tata McGraw -Hill Publishing Company Ltd., New Delhi
- 4.Sharma, Sangeeta and Binod Mishra. Communication Skills for Engineers and Scientists: PHI Learning Pvt. Ltd., New Delhi.
5. Basics of Business Communication – Lesikar & Fl atley, Tata McGraw Hills
6. Business Communication – Sushmita Day & Others, Reliable Publications, Mumbai
7. Business Communication – N.Gupta, P.Mahajan, Sa hitya Bhavan Publication, Agra.
8. Business Communication – U.S.Rai, S.M.Rai, Hima laya Publishing House, Mumbai.

RET 102 : Computer Application I

Objective:

- To familiarize the Students with basics of Internet.
- To understand the use of Office application.
- To know the role of word processor, Spread sheet, presentation in industry .

UNIT I – A. Computer Basics (7 Lectures)

1. Overview of computers
2. Uses of computer
3. Input and Output Devices
4. Understanding Input, Process and Output
5. Computer Hardware and Software
6. Advantages and disadvantages

UNIT II -- Operating System (7 Lectures)

1. Overview of Operating System
2. Basic Operations
 - a. How to start a computer
 - b. How to logoff and hibernate a laptop
 - c. How to connect a headset to computer
 - d. Learn to interact with computers
3. Personalizing Desktop
 - a. Changing the Desktop Background

UNIT III – Microsoft Office 2013 –Word Part I (7 Lectures)

- 1: Introduction to Microsoft Word 2013
- 2: Working with Documents and the Keyboard
- 3: Navigating Through a Word Document
- 4: Basic Text Editing
- 5: Text Formatting
- 6: Paragraph Formatting
- 7: More Ways to Format Text and Paragraphs
- 8: Style Formatting
- 9: Page Formatting
- 10: Templates

UNIT IV – Microsoft Office 2013 –Word Part II (8 Lectures)

- 1: Working With Graphics and Pictures
- 2: Tables
- 3: Desktop Publishing
- 4: Long Documents
- 5: Technical Documents
- 6: Mail Merge
- 7: Proofing, Printing, and Publishing
- 8: Comparing, Merging, and Protecting Documents
- 9: Customizing and Expanding Word

UNIT V - Microsoft Office 2013 – Power Point Part I (8 Lectures)

- 1: Introduction to Microsoft Word 2013
- 2: The Basics of Creating Presentations
- 3: Applying Themes and Layouts to Slides
- 4: Working with Objects
- 5: Entering, Editing, and Formatting Text
- 6: Working in Outline View
- 7: Proofing Presentations
- 8: Notes

UNIT VI - Microsoft Office 2013 – Power Point Part II (8 Lectures)

- 9: Inserting Pictures, Graphics, Shapes, and Other Things
- 10: Inserting Tables into Presentations
- 11: Charts and Smart Art
- 12: Adding Sound and Video
- 13: Adding Transitions and Animation
- 14: Master Slides
- 15: Printing and Running Slide Shows
- 16: Saving, Sharing, and Exporting Presentations

Books for Reference

1. Step by Step Microsoft Word 2010
2. Step by Step Microsoft Excel 2010
3. Step by Step Microsoft PowerPoint 2010

RET 103 : Practicals on Communication Skills I

List of Practicals:

1. Presentation skills
2. Listening skills
3. Preparing File and Documentation
4. Preparation of Effective business messages
5. Resume writing skills
6. Telephonic Conversation
7. Non verbal communication
8. Group Discussion on burning issues
9. Debating Competition on burning issues
10. Elocution Competition on burning issues
11. News Room Communication
12. Power point presentation
13. Quotation writing skills
14. Interpersonal communication on particular topic
15. Personal Interview techniques
16. Group Interview
17. Walk in Interview
18. Corporate meeting-Vertical and horizontal communication
19. Function wise communication process
20. Use of Informal communication

RET 104 : Practicals on Computer Application I

Objective:

- To familiarize the Students with basics of Internet.
- To understand the use of Office application.
- To know the role of word processor, Spread sheet, presentation in industry .

List of the practicals:

1. Write 10 lines or 10 sentences and then change the font, style, color and size of each sentence. Make each one different than previous and next.
2. Decorate word document with page border, content border, add pattern and write beautiful text in it.
3. Create Table in word and format it (e.g. Time Table, Mark sheet etc.).
4. Design Happy Birthday Message by using Word Art and print it.
5. Get the newspaper and see the text based advertisement and Design that advertisement in Microsoft Word.
6. Insert Images and Practice on Format Menu and Image options.
7. Perform Mail Merge in word.
8. Create a slide show in power point (use at least 5 slides)
9. Create a slide show, make use of Images, sound and hyperlinks.
10. . Applying the animations to slide by using presentation program
11. Creation of Personal resume for Job purpose
12. Writing official letters in Microsoft word
13. Draw pie chart in Microsoft word
14. Draw bar chart in Microsoft word
15. Connoting of wireless devices to computer
(Blue tooth, Wi-Fi, wireless head set, wireless speakers projector)

Books for Reference

1. Step by Step Microsoft Word 2010
2. Step by Step Microsoft Excel 2010
3. Step by Step Microsoft PowerPoint 2010

RET – 105 : Basic of Renewable Energy Sources

TOTAL LECTURES REQUIRED: 45

LEARNING OBJECTIVES

1. To understand the social, economic impacts of various energy sources.
2. To discuss the financial aspects like pricing and reforms of energy sources.
3. To make the students aware about conservation act, security of energy and environment.
4. To understand the vision and policies of government.

UNIT - I

[11 LECTURES]

Introduction to Energy: Definition and units of energy and power, Conversion, Energy terms, calorific value, Forms of energy, Classification of energy sources Quality and concentration of energy sources, Energy and Thermodynamics, Energy parameters, Conservation of energy, Energy flow diagram to the earth, Origin of fossil fuels, Time scale of fossil fuels, Role of energy in economic development and social transformation, Energy security.

UNIT - II

[11 LECTURES]

Energy and Growing Economy: Commercial energy production, Final energy consumption, Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy conservation and its importance, Energy strategy for the future, Energy Conservation Act-2001 and its features.

UNIT - III

[11 LECTURES]

Global Energy Scene: Energy consumption in various sectors, projected energy consumption for the next century, exponential increase in energy consumption, energy resources, coal, oil, natural gas, nuclear power and hydroelectricity, impact of exponential rise in energy consumption on global economy, future energy options.

UNIT - IV

[12 LECTURES]

Indian Energy Scene: Commercial and non-commercial forms of energy, energy consumption pattern and its variation as a function of time, India's Power Scene, Gas-Based Generating Plants, Nuclear Power Programme, urban and rural energy consumption, energy as a factor limiting growth, need for use of new and renewable energy sources, Socio-economic impacts, Rural development, Poverty alleviation, Employment; Security of supply and use, Environmental and ethical concerns, Economical aspects of renewable energy systems vs large hydro and thermal power projects.

RECOMMENDED REFERENCES:

1. Bani P. Banerjee, Energy and the Environment in India, Oxford University Press, New Delhi.
2. G. D. Rai, Non- conventional Sources of Energy, Khanna Publishers, Delhi.
3. Gopalkumar, Energy Independence Vision of a Hybrid, Unbound Future, Deep and Deep Publications Pvt. Ltd., New Delhi.
4. D. K. Asthana, Meera Asthana, Environment Problems and Solutions, S.Chand and Company Ltd., New Delhi.
5. Abdul Mubeen, M. Emran Khan, M. Muzaffar-ul-Hasan, Energy and Environment, Anamaya Publishers, New Delhi.
6. Upender Pandel, M.P.Poonia, Energy Technologies for Sustainable Development, Prime Publishing, Ghaziabad (UP).
7. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Singal K. C, New Arrivals - PHI; 2 edition (2011)

RET 106 : Renewable Energy Sources and Technology I

TOTAL LECTURES REQUIRED: 45

LEARNING OBJECTIVES

1. To introduce various kinds of renewable energy sources.
2. To know how the technologies work.
3. To understand the scenario of power generation in both conventional and non-conventional in Indian context.
4. Various kinds of fuels available and what are their impacts on environment.

UNIT - I

[12 LECTURES]

Introduction to Non-conventional energy sources: Solar energy, Wind energy/power, Energy from biomass and biogas, Ocean energy ,Wave energy, Tidal energy/power, Geothermal energy, Hydrogen energy, Thermo-electric power, Fuel cell, Magneto-Hydro-dynamic (MHD) generator.

UNIT - II

[12 LECTURES]

Renewable and Non-renewable energy sources: Renewable (Non-conventional) energy sources, Non-renewable energy sources, Alternative energy sources, Energy Scenario in India context, Electricity Generation from Non-conventional energy sources, Impact on environment, Fuels, Classification of fuels, Solid fuels ,Liquid fuels, Gaseous fuels.

UNIT - III

[11 LECTURES]

Solar Thermal Technologies: Solar Thermal Energy Systems: Absorption and Radiation, Heat Gain and Loss, Solar Cooking Systems ,Principle of Cooking, Cooking by Boiling, Speed of Cooking, Energy Required for Cooking, Types of Solar Cooker, **Distillation:** Solar Distillation System, Natural Process for Purifying Water.

UNIT - IV

[12 LECTURES]

Wind Energy: Wind Flow, Motion of Wind, Vertical Wind Speed Variation, Distribution of Wind Speeds, Power in the Wind, Conversion of Wind Power: Wind Turbine, Efficiency of Wind Power Conversion: C_p , Types of Wind Turbines, Components of a Wind Turbine, Worldwide Wind Installations, Wind Turbine Sizing and systems Design, Energy Derived from a Wind Turbine.

RECOMMENDED REFERENCES:

1. Renewable Energy Technologies: A Practical Guide for Beginners, Chetan Singh Solanki, PHI School Books (2008)
2. Fundamentals of Renewable Energy Systems Paperback – D. Mukherjee, New Age International Publisher; First edition (2011)
3. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Singal K. C, New Arrivals - PHI; 2 edition (2011)
4. G. D. Rai, Non- conventional Sources of Energy, Khanna Publishers, Delhi.

RET 107 : Solar Photovoltaic Technologies

TOTAL LECTURES REQUIRED: 45

LEARNING OBJECTIVES

1. To understand the solar radiation on earth surface.
2. To understand the various solar cell parameters
3. The principle of photovoltaic technologies and there characteristics.
4. Estimation of cost of PV Systems.

UNIT - I

[10 LECTURES]

Solar Radiation: Solar Spectrum, Extraterrestrial Radiation, Radiation on the Earth Surface, Global, Direct and Diffuse Solar Radiation, Solar Radiation at a Given Location, Annual Variation in Solar Radiation, Optimal Tilt for Solar Equipment, Monthly Averaged Global Radiation at Optimal Tilt.

UNIT - II

[12 LECTURES]

Fundamentals of Solar Cells : Characteristics of semiconductors, Differences between semiconductors, insulators and conductors Theory of p n junction, Principle of operation of p-n junction Solar Cell, I-V Characteristics Solar Cell parameters V_{oc} , I_{sc} , FF, conversion efficiency and power output of solar cell, Status of Photovoltaic Technologies.

UNIT - III

[11 LECTURES]

Solar Photovoltaic Technologies: Solar PV Technology: Advantages and Limitations, Brief History of the Technology, Basics of Technology, Amount of Power Generated, the Rated Power and Actual Power from a Module, Generating More Power Using Solar PV, Protection of Solar Cells.

Unit - IV

[12 LECTURES]

Solar PV Systems and their Applications : Solar PV Module Ratings and Cost, Battery Ratings and Cost , Inverter Ratings and Cost, Maximum Power Point Tracking (MPPT), Solar PV Lantern, Design and Costing, Stand-alone PV System: Home Lighting and Other Usage, Solar PV System Designing , Case Study, Cost Estimation of a PV System.

RECOMMENDED REFERENCES:

1. Renewable Energy Technologies: A Practical Guide for Beginners, Chetan Singh Solanki, PHI School Books (2008)
2. Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki PHI; 3 edition 2015
3. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Singal K. C, New Arrivals - PHI; 2 edition (2011)
4. Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, Chetan Singh Solanki PHI (1 January 2013)
5. Fundamentals of Renewable Energy Systems Paperback – D. Mukherjee, New Age International Publisher; First edition (2011)
6. Science & Technology of Photovoltaics P Jayrama Reddy, BS Publications ,CRC Press 2010.
7. From Sunlight to Electricity: A Practical Handbook on Solar Photovoltaic Applications, Suneel Deambi, The Energy and Resources Institute, TERI (30 January 2009)

RET 108 : Waste Energy Management

TOTAL LECTURES REQUIRED: 45

LEARNING OBJECTIVES

1. To understand the various waste generation sources and their management.
2. To know the various waste to energy conversion technologies.
3. To understand various impacts like health and environment issues and significance of different technologies.
4. To get acquainted with commercial aspects of waste to energy.

UNIT - I

[12 LECTURES]

Introduction: Introduction to waste and waste processing, Definitions, sources, types and composition of various types of wastes; Characterization of Municipal Solid Waste (MSW) , Industrial waste and Biomedical Waste (BMW), Waste collection and transportation; Waste processing-size reduction, Separation; Waste management hierarchy, Waste minimization and recycling of MSW; Life Cycle Analysis (LCA), Material Recovery Facilities (MRF), Recycling processes of solid waste.

UNIT - II

[12 LECTURES]

Waste Treatment and Disposal: Aerobic composting, Incineration, different type of incineration; medical and pharmaceutical waste incinerations, Landfill classification, types, methods and siting consideration, layout and preliminary design of landfills: composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases, Rules related to the handling, treatment and disposal of MSW and BMW in India.

UNIT - III

[12 LECTURES]

Waste to Energy Conversion Technologies: Sources of energy generation, incineration, gasification of waste using gasifiers, briquetting, utilization and advantages of briquetting. Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, land fill gas generation and utilization.

UNIT - IV

[09 LECTURES]

Environmental and Commercial Aspects of Waste to Energy: Present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages, Environmental and health impacts of incineration and other waste to energy conversion systems, case studies of commercial waste to energy plants, Strategies for reducing environmental impacts.

RECOMMENDED REFERENCES:

1. Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, ISBN: 9780470539675, John Wiley and Sons.
2. Velma I. Grover and Vaneeta Grover, Recovering Energy from Waste Various Aspects, ISBN 978-1-57808-200-1.
3. Shah, Kanti L., Basics of Solid and Hazardous Waste Management Technology, Prentice Hall.
4. Rich, Gerald et.al., Hazardous Waste Management Technology, Podvan Publishers.
5. Marc J. Rogoff, Waste-to-Energy, Elsevier.
6. Parker, Colin and Roberts, Energy from Waste - An Evaluation of Conversion Technologies, Elsevier Applied Science, London.
7. Manoj Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House.
8. Bhide A. D., Sundaresan B. B., Solid Waste Management in Developing Countries, INSDOC, New Delhi.

RET 109 : Laboratory I

[ELECTRONICS LAB]

1. To identify the connection & component testing.
2. Study of Forward Characteristics of Silicon diode.
3. Study of Reverse Characteristics of Germanium Diode.
4. Study of characteristics of Zener diode
5. Study of Characteristics of Light Emitting Diode (LED)
6. Study of Half-wave Rectifier
7. Study of Full-wave Center-tapped Rectifier
8. Study of Full-wave Bridge Rectifier
9. To calculate the Ripple Factor and Efficiency of various Rectifiers
10. Study of Zener Diode as a voltage regulator, when input voltage, V_{in} is fixed while load resistance, R_L is variable.
11. Study of Zener diode as a voltage regulator, when input voltage, V_{in} is variable while load resistance, R_L is fixed.
12. Study of Characteristics of SCR and plotting V-I Characteristics.
13. To determine the characteristics of transistor for both PNP & NPN in Common Emitter Configuration
14. To examine the relationship between the Gate to Source voltage (V_{GS}) drain current (I_D) and the Drain to Source voltage (V_{DS}) in an N-channel junction FET and measure the corresponding values & plot these values to form a set of drain characteristics curves.
15. To examine the relationship between the Gate to Source voltage (V_{GS}) drain current (I_D) and the Drain to Source voltage (V_{DS}) in an N-channel depletion mode IGFET and measure the corresponding values & plot these values to form a set of drain characteristic.
16. To study characteristics of Low pass filter.
17. To study characteristics of High pass filter.
18. To study characteristics of Band pass filter.
19. To study characteristics of Notch filter.

RET 110 : Laboratory II

[PHOTOVOLTAIC LABORATORY]

1. To demonstrate I-V and P-V characteristics of single solar cell of PV module in field.
2. To demonstrate I-V and P-V characteristics of series and parallel combinations of PV module in field.
3. To measure I-V and P-V characteristics of a single solar cell at constant intensity using mini solar simulator.
4. To measure I-V and P-V characteristics of a solar cell in series and parallel combination at constant intensity using mini solar simulator.
5. To measure I-V and P-V characteristics of a single solar cell at variable intensities using mini solar simulator.
6. To measure I-V and P-V characteristics of a solar cell in series and parallel combination at variable intensities using mini solar simulator.
7. To measure I-V and P-V characteristics of a single solar cell at constant intensity using solar simulator.
8. To measure I-V and P-V characteristics of a solar cell in series and parallel combination at constant intensity using solar simulator.
9. To measure I-V and P-V characteristics of a single solar cell at variable intensities using solar simulator.
10. To measure I-V and P-V characteristics of a solar cell in series and parallel combination at variable intensities using solar simulator.
11. To measure I-V and P-V characteristics of a single solar cell at variable temperature & fixed intensity using solar simulator.
12. To measure I-V and P-V characteristics of a solar cell in series and parallel combination at variable temperature & fixed intensity using solar simulator.
13. To measure the spectral response of a solar cell and to learn about quantum efficiency.
14. Study I-V characteristics of solar panel at different tilt angles
15. Study of the parameters of Series and parallel connection of solar panels at different tilt and Seasonal angles
16. To demonstrate the effects of radiant energy on LDR & to show how radiant energy on LDR can be used to control electronic circuits.
17. Evaluate U_L (Heat loss coefficient) of solar thermal kit in thermo-symphonic mode of flow with fixed input parameters.

SEMESTER II

RET 201 : Communication Skills II

Objectives -

- 1.To Understand the Concept Process, Importance and Objectives of Communication
- 2.To Know the Principles Of Effective Communication.
- 3.To acquire Communication Skills.
- 4.To Study Various Types Of Business Letters.
- 5.To Develop Skills To Draft Letters.
- 6.To Acquaint with Modern Technology In Communication.

Unit 1.

(Lectures 9)

Project Proposals
Referencing
Writing for media
Social media and its effects

Unit 2

(Lectures 9)

Introduction and importance of business correspondence
Parts of business letters
Format- Complete Block and Modified Block
Principles of business correspondence

Unit 3

(Lectures 9)

Business letters
Presentation and Group discussion skills
Interview Techniques
Participation in Meetings

Unit 4

(Lectures 9)

The Role of technology in communication
Blogging and Emailing
Video Conferencing
Technical writing

Unit 5

(Lectures 9)

Grammar – Introduction , common errors
Concord (subject –verb agreement)
Lexicon
Synonyms, Antonyms and One word substitution

References :

- 1.Bovee, Courtland, John Thill & Mukesh Chaturvedi. Business Communication Today : Dorling kindersley, Delhi
- 2.Kaul, Asha:Business Communication:Prentice-Hall of India, Delhi
- 3.Monippally, Matthukutty M. Business Communication Strategies. Tata McGraw -Hill Publishing Company Ltd., New Delhi
- 4.Sharma, Sangeeta and Binod Mishra. Communication Skills for Engineers and Scientists: PHI Learning Pvt. Ltd., New Delhi.
4. Basics of Business Communication – Lesikar & Fl atley, Tata McGraw Hills
6. Business Communication – Sushmita Day & Others, Reliable Publications, Mumbai
7. Business Communication – N.Gupta, P.Mahajan, Sa hitya Bhavan Publication, Agra.
8. Business Communication – U.S.Rai, S.M.Rai, Hima laya Publishing House, Mumbai.

RET 202 : Computer Application II

UNIT I - Concepts of network

[12 lectures]

- 1) What is Computer Network?
- 2) Types of Networks (with Features and Application): LAN, WAN, MAN Wired Network, Wireless Network, MANET, Internet
- 3) Study of Web Browsers
- 4) Search Engines
- 5) E-mail – drafting, saving & sending email (with attachment)

UNIT II – Computer virus

[11 lectures]

- 1) Computer virus : Indication of computer virus
- 2) Types of viruses : Boot sector virus ,program virus, macro virus, worms, multipartite virus
Polymorphic virus, malware: spyware, adware, Antivirus
- 3) Computer Ethics: spamming, Phishing, Hacking, software piracy

UNIT III – Microsoft Excel Part I Basic

[11 lectures]

- 1) Basic text and cell formatting
- 2) Basic arithmetic calculation
- 3) Creating tables, adding and editing records in table
- 4) Conditional formatting
- 5) Importing data and text to columns

Unit IV - Microsoft Excel Part II

[11 lectures]

Advanced Excel capabilities

- 1) Data Analysis tools and Techniques: , Advanced Filter Command, IF Condition Command
- 2) Sorting table data
- 3) Functions i) Mathematical ii) String iii) IF, AND, OR iii) searching: match, search
- 4) Pivot tables
- 5) Recording and editing Macros
- 6) Creating charts and graphs in excel

Reference Books:

- 1) Problem Solving Cases in Microsoft Access and Excel (English) 9th Edition by Gerard S. Cook, Joseph Brady, Ellen Monk, Course Technology
- 2) Learning MS-PowerPoint & MS-Access by RohitKhurana, APH Problem Solving Cases in Microsoft Access and Excel (English) 9th Edition by Gerard S. Cook, Joseph Brady, Ellen Monk, Course Technology

RET 203 : Practicals and Communication Skills II

List of the practicals:

- 1.Preparing project reports
- 2.Discussion on Cyber crime
- 3.Group discussion on the uses of social media
- 4.Presentation on the role of Print and electronic media.
- 5.Prepare a matter of news event
6. Practical on blog writing
- 7.Preparing an E-mail
- 8.Discussion on importance of meeting
- 9.Practical on Book reviews
- 10.Presentation on various technical devices of communication
- 11.Preparing a complaint letter
- 12.Word play (Synonyms-antonyms)
- 13 Technical Descriptions
- 14.Effective manual writing
- 15.Presentation on useful techniques of meeting
- 16.Confidential discussion
- 17.Preparation of various business letters
- 18.Various plays on Effective communication
- 19.Mock Interview II
- 20.Power point presentation on burning is

RET 204 : Practicals on Computer Application II

List of Practicals :

1. Create your email account; send mail to your friend.
2. Sending mail to more than one person.
3. Send and receive files from mail. (mail with attachment)
4. Create a table in excel and format it.
5. Create table and apply sum, average, max and min on this table.
6. Create table and sort data in ascending and descending order.
7. Draw a bar chart for given data.
8. Draw pie chart for given data.
9. Create table , Insert data and apply conditional formatting.
10. Practical on Connecting networks in LAN
11. Practicals on Different web browsers
12. Preparing mark sheets in Microsoft excel
13. Preparing Pivot tables for given data.
14. Settings for printing of documents in excel.
15. Preparation of Balance sheet in excel.

RET 205 : Industrial Electronics and Instrumentation

TOTAL LECTURES REQUIRED: 45

LEARNING OBJECTIVES

1. To familiarize with the characteristics of instruments.
2. To familiarize with the properties of transducer.
3. To understand the fundamentals of amplifiers & OPAMP's.

UNIT - I

[12 LECTURES]

Performance Characteristics of Instrument: Need of measurement, Classification of electronic instruments, Selection of Instruments, Static characteristics: Accuracy, Resolution, Precision, Expected value. **Instruments:** Solar radiation Measurement; Lux Meter, Pyrheliometer, Pyranometer, Sunshine Recorder, wind speed measurement anemometer, Temperature measurement, Pressure, velocity and flow measurement, Heat flux measurement.

UNIT - II

[11 LECTURES]

Transducers: Principles and classification of transducers, basic requirements of transducers, displacement, strain gauge, LVDT & RVDT, potentiometer, capacitive & inductive, Temperature Transducer - Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Piezo-electric transducer, Optical Transducer- Photo emissive, Photo conductive, Photo voltaic, Photo-diode, Photo Transistor.

UNIT - III

[11 LECTURES]

Feedback Amplifiers: Classification: Feedback concept; Ideal Feedback amplifier: Properties of Negative Feedback Amplifier Topologies: Method of Analysis of Feedback amplifiers: Voltage series Feedback: Voltage series Feedback pair: Current series, Current shunt and Voltage shunt feedback; Effect of feedback on amplifier Bandwidth and stability.

UNIT - IV

[11 LECTURES]

Operational Amplifier: Idea of operational amplifier (OPAMP), Ideal OPAMP as black box, input and output impedance, OPAMP circuits as buffer, inverting and non-inverting amplifiers, adder and subtractor. **Signal Generators & Conditioners:** Square Wave Generator, Triangular Wave Generator, Sawtooth Wave generator, Differentiator & Integrator.

RECOMMENDED REFERENCES:

1. A Course in Electrical and Electronic Measurements and Instrumentation, A. K Sawhney, Dhanpat Rai & Co.
2. Electronic Instrumentation & Measurement by William Cooper & Albert C. Helfric, PHI Pub.
3. Instrumentation, Measurement & Analysis by K.K. Chaudhury & R.C. Nakra, TMH.
4. OP-AMP and linear integrated circuits 2nd edition, PLHI by Ramakant A. Gayakwad.
5. Integrated Electronics by Millman & Halkias, TMH Publishing Co.
6. Electronic Instrumentation, H S Kalsi, Tata McGraw-Hill Education.
7. Instrumentation Devices and Systems, C.S. Rangan, Tata McGraw-Hill Education.

RET 206 : Renewable Energy Sources and Technology II

TOTAL LECTURES REQUIRED: 45

LEARNING OBJECTIVES

1. To understand various kinds of renewable energy sources.
2. To know how the technologies work.
3. To get acquainted with and will enable students to compare amongst the various available energy sources.

UNIT - I

[13 LECTURES]

Wind Electricity Generation: Types of turbines, Coefficient of Power, Betz limit, Wind electric generators, Power curve; wind characteristics and site selection; Windfarms for bulk power supply to grid; Potential of wind electricity generation in India and its current growth rate.

UNIT - II

[10 LECTURES]

Biomass Energy: Sources and Characteristics; Wet biogas plants; Biomass gasifiers: Classification and Operating characteristics; Updraft and Downdraft gasifiers; Gasifier based electricity generating systems; Maintenance of gasifiers.

UNIT - III

[12 LECTURES]

Small Hydro Sources: Advantages and disadvantages, layout of small hydro scheme, water turbines, characteristics and selection, generators, present scenario of SHS.

UNIT - IV

[10 LECTURES]

Geothermal Energy: Geothermal sites in India; High temperature and Low temperature sites; Conversion technologies- Steam and Binary systems; Geothermal power plants.

RECOMMENDED REFERENCES:

1. *Non-Conventional Energy Resources*, B.H. Khan, Tata McGraw-Hill Education (2006).
2. *Renewable Energy Technologies: A Practical Guide for Beginners*, Chetan Singh Solanki, PHI School Books (2008).
3. *Fundamentals of Renewable Energy Systems Paperback* – D. Mukherjee, New Age International Publisher; First edition (2011)
4. *Renewable Energy Sources and Emerging Technologies*, Kothari D.P. and Singal K.C., New Arrivals - PHI; 2 edition (2011)
5. *G. D. Rai, Non- conventional Sources of Energy*, Khanna Publishers, Delhi.

RET 207 : Solar Thermal Engineering and Applications

TOTAL LECTURES REQUIRED: 45

LEARNING OBJECTIVES

1. Understand the fundamentals of solar flat plate collectors.
2. Analyze the performance of solar flat plate collectors.
3. Understand the fundamentals of concentrating solar collectors.
4. Analyze the performance of concentrating solar collectors.
5. Familiar with the solar low, medium and high temperature applications.

UNIT I

[12 LECTURES]

Solar Flat Plate Collectors: Fundamentals of solar collectors as devices to convert solar energy to heat, Non- concentrating low temperature flat-plate and evacuated tube collectors, Design and structures of collectors for heating liquids and air.

UNIT II

[13 LECTURES]

Performances of Flat Plate Collectors: Optimal collector tilt and orientation, Collector performance, Useful energy gain, energy losses, efficiency, Use of selective coatings to enhance the collector efficiency, Concentrating collectors for middle and high temperature applications.

Performance of Solar Concentrators: Concentrating collector performance- concentration ratio, useful energy, gain, energy losses, efficiency, Solar collector design, testing, installation and operation.

UNIT III

[10 LECTURES]

Solar Concentrating Collectors: Plane receiver with plane collectors, compound parabolic with plane collectors, cylindrical parabolic collectors, Collector with fixed circular concentrator and a moving receiver, Fresnel lens collector, paraboloid dish collector, heliostat field with central receiver.

UNIT IV

[10 LECTURES]

Applications of Solar Collectors: Application of non-concentrating collectors in low temperature solar thermal plants for space heating and cooling, drying, seawater desalination, use of concentrating collectors for process heat production and power generation.

RECOMMENDED REFERENCES:

1. *Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley & sons.*
2. *Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Singal K.C., New Arrivals - PHI; 2 edition (2011)*
3. *Solar Energy, Fundamentals, Design, Modelling & Applications, G.N.Tiwari, Narosa Publishing House.*
4. *Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, Chetan Singh Solanki, PHI (1 January 2013)*
5. *Fundamentals of Renewable Energy Systems– D. Mukherjee, New Age International Publisher; First edition (2011)*
6. *Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki PHI; 3 edition 2015.*
7. *From Sunlight to Electricity: A Practical Handbook on Solar Photovoltaic Applications, Suneel Deambi, The Energy and Resources Institute, TERI (30 January 2009).*

RET 208 : Concentrating Solar Thermal Power Plants

TOTAL LECTURES REQUIRED: 45

LEARNING OBJECTIVES

1. To gain knowledge on solar passive heating and cooling.
2. The fundamentals of design calculations and analysis of solar thermal systems.
3. The functioning and design of solar thermal cooling systems.
4. The basics of solar thermal technology for process heating applications.
5. The fundamentals of design calculations and economics of solar power generation.

UNIT - I

[12 LECTURES]

Solar Passive Heating and Cooling: Direct heat gain, indirect heat gain, isolated gain and sunspaces, Passive cooling concepts - Evaporative cooling, absorption cooling system, Passive desiccant cooling, application of wind, water and earth for cooling, roof cooling, earth air tunnel.

UNIT - II

[10 LECTURES]

Solar Liquid and Air Heating System: Flat plate collector - Liquid and air heating - Evacuated tubular collectors - Overall heat loss coefficient, heat capacity effect - Thermal analysis, Design of solar water heating systems, with natural and pump circulation, energy efficient landscape design, solar greenhouses, solar furnace and applications.

UNIT - III

[11 LECTURES]

Thermodynamic Cycles and Power Plants: The Carnot Cycle, The Rankine Cycle, The Stirling Cycle, The Brayton Cycle, Combined Cycle Power Plant, Solar Ponds, Solar Pumping System, Solar Air Heaters Solar Crop Drying, Solar Kilns, Integrated Solar Dryers, Distribution Solar Dryers.

UNIT - IV

[12 LECTURES]

Solar Thermal Power Plants: Low temperature solar power plant, Medium temperature solar power plant, High temperature solar thermal power generator, Central receiver power plants, Solar thermal electric power plants based on parabolic trough, Concentrated solar power using Fresnel lenses, Fundamentals of design calculations and analysis of solar power plants, Economic analysis.

RECOMMENDED REFERENCES:

1. *Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Singal K. C, New Arrivals - PHI; 2 edition (2011)*
2. *Solar Energy, Fundamentals, Design, Modelling & Applications, G.N.Tiwari, Narosa Publishing House.*
3. *Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley & sons.*
4. *Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, Chetan Singh Solanki, PHI (1 January 2013)*
5. *Fundamentals of Renewable Energy Systems Paperback – D. Mukherjee, New Age International Publisher; First edition (2011)*
6. *Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki PHI; 3 edition 2015.*

RET 209 : Laboratory III (Analog and Digital Electronics)

1. Study of forward and Reverse biased characteristics of PN Junction Diode
2. Study of breakdown characteristics and voltage regulation action of Zener diode
3. Study of output characteristics of Bipolar Junction Transistor in CE mode
4. Study of output and transfer characteristics JFET/MOSFET
5. Study of I-V characteristics of UJT and UJT based relaxation oscillator .
6. Study of I-V characteristics of SCR
7. Design, build and test Low pass and High pass RC filters
8. Study of low voltage Half-wave , Full-wave and Bridge rectifier circuits
9. Study of switching and amplification actions of BJT and JFET/MOSFET
10. Study of potential divider biasing of BJT and its use in DC motor driving
11. Build and test Inverting and noninverting amplifier using OPAMP.
12. Build and test adder and subtractor circuits using OPAMP.
13. Basic Logic gates using Diodes and transistors
14. Interconversion of logic expression , develop a circuit using ICs
15. Study of RS, JK and D flip flops using NAND gates
16. Study of Up/Down Counter
17. Study of decade counter IC circuit configurations
18. Study of 4-bit Shift register IC
19. Build and Test 4 bit parity checker/ generator using X-OR gate IC
20. Build and Test Half Adder, Full Adder and Subtractor using basic gate
21. Build and Test 2:1 Multiplexer / 1:2 Demultiplexer using gates
22. Build and Test 3X4 matrix Keyboard Encoder
23. Build and Test a Debounce switch using NAND or NOR gate IC
24. Build and Test Diode matrix ROM

RET 210 : Laboratory IV (Renewable Energy Laboratory I)

1. Evaluate the Tip Speed Ratio “TSR” at different wind speeds.
2. To Evaluate the cut-in speed of wind turbine experimentally.
3. Draw the turbine power versus wind speed curve.
4. Evaluate the DC power for a given load at different wind speeds.
5. Evaluate U_L , F_R , η in thermosyphonic mode of flow with fixed input parameters.
6. Evaluate U_L , F_R , η in thermosyphonic mode of flow with different wind speeds.
7. Evaluate U_L , F_R , η in thermosyphonic mode of flow with different intensity.
8. Evaluate U_L , F_R , η in thermosyphonic mode of flow with different tilt angles.
9. To study the operation of solar based battery charger using solar based single phase power generation module.
10. To study the open loop and close loop control operator of single phase inverter using solar based single phase power generation module.
11. To test the performance of the given thermal storage system containing phase change material (PCM) under charging mode.
12. To test the performance of the given thermal storage system containing phase change material (PCM) under dis charging mode.
13. To calculate the overall efficiency of PCM.
14. Study of PWM charge controllers using single solar panel.
15. Study of PWM charge controllers with series connection of solar panels
16. Study of PWM charge controllers with parallel connection of solar panels
17. To study the MPPT Charge controllers with series connection of solar panels