



மனோன்மணியம் சுந்தரனார் பல்கலைக்கழகம்

**MANONMANIAM SUNDARANAR UNIVERSITY**

**SYLLABUS FOR DIPLOMA IN RENEWABLE ENERGY - SOLAR SYSTEMS & TRAINING PROGRAM OFFERED THROUGH DIRECTORATE OF VOCATIONAL EDUCATION (COMMUNITY COLLEGES AND VOCATIONAL SKILL DEVELOPMENT CENTRES) FROM 2019 - 2020**



கல்விசார் நிலைக்குழுக் கூட்டம்

**MEETING OF THE STANDING COMMITTEE ON  
ACADEMIC AFFAIRS HELD ON WEDNESDAY  
THE 22<sup>nd</sup> JANUARY 2020**

**DIPLOMA IN RENEWABLE ENERGY - SOLAR SYSTEMS & TRAINING**

புதுப்பிக்கத்தக்க ஆற்றல் சூரிய ஒளி உபகரணங்கள் மற்றும் பயிற்சி பட்டயம்

**SCHEME OF EXAMINATION**

Subject Code	Title of the Courses	Credit	Hours	Passing Minimum
<b>Semester I</b>				
C19SS11/E19SS01	Renewable and Non-renewable energies	6	90	40/100
C19SS12/E19SS02	Electrical and Electronic Principles	6	90	40/100
C19SS13/E19SS03	Solar Energy Generation and utilization	6	90	40/100
C19CE10/E19CE10	Communicative English	6	90	40/100
C19SSP1/E19SSP1	Practical I-Electrical and Electronic Principles – Practical knowledge of Electrical & Electronic components - I	4	120	40/100
<b>Semester II</b>				
C19SS21/E19SS04	Entrepreneurship and small business	6	90	40/100
C19SSP2/E19SSP2	Practical II-Electrical and Electronic Principles – Practical knowledge of Electrical & Electronic components - II	4	120	40/100
C19LS23/E19LS05	Life skill	6	90	40/100
C19SSP3/E19SSP3	Practical III-Solar energy generation and utilization solar system – Installing & Servicing	4	120	40/100
C19SSPW/E19SSPW	Project & Field Trip	12	150	40/100

**Eligibility for admission:** Pass in 10<sup>th</sup>std examination conducted by the Govt. of Tamil Nadu Board of Secondary Education, Government of Tamil Nadu or any other equivalent examination.

**Examination:** Passing Minimum for each Course is 40%. Classification will be done on the basis percentage marks of the total marks obtained in all the Courses and as given below:

40 % but less than 50 %	- Third class
50 % but less than 60 %	- Second class
60 % and above	- First class

## **Theory Paper**

Internal Marks-25

External Marks-75

## **Syllabus**

### **First Semester**

Course-I : Renewable and non renewable energies

Course-II : Electrical and electronic principles

Course-III : Solar energy generation and utilization

Course-IV : Communicative English

Course-V : Practical I-Electrical and electronic principles- Practical Knowledge of Electrical & Electronic components I

### **Second Semester**

Course-VI : Entrepreneurship and small business

Course-VII : Practical II-Electrical and electronic principles -Practical Knowledge of Electrical & Electronic components II

Course-VIII : Life Skill

Course -IX : Practical III-Solar energy generation and utilization Solar system Installing & Servicing

Course -X : Project & Field Trip

### **\*(Semester Pattern for Community College Only)**

#### **Preamble of the Program:**

To attain energy security for India, it is important to create awareness about renewable energy resources among the educated population. With the dwindling of conventional resources such as coal, oil and gas, it is very urgent for a democratic country like India to switch over to renewable energy resources as early as possible. Per capita annual energy consumption of Indian is the lowest in the world. Fortunately India is blessed with rich renewable energy resources like solar, wind, ocean, bio and hydro energies. With the development of suitable technologies alone these renewable energy resources can be utilized by the Indian population. Educating the technologist in the areas of renewable energy resources is the pertinent need of the hour. This technology provides unlimited job opportunities for young Indians. Recently, Manonmaniam Sundaranar University has taken steps to establish a 1MW Solar PV Plant in the University campus. The project consists of 3080 solar modules and is established in 3.5 acres of land. One MW Solar photovoltaic power plant will generate about 4500 – 5000 units every day. This facility will be of highly useful for the PG graduate diploma students to learn more about the installation, generation and distribution of power. Also this facility will extend the more detailed technical knowledge about the solar generation energy.

## SEMESTER I

### (C19SS11/E19SS01)COURSE – I

#### RENEWABLE AND NON RENEWABLE ENERGIES

##### OBJECTIVES:

To know about the energy sources and their technologies. → To learn the environmental pollution and climate change. → To understand the basic need of carbon free energy.

##### UNIT-I

18 Hrs

Energy – Form of energy – Energy need – availability of energy – Natural energy sources –

##### UNIT-II

18 Hrs

Conventional Energy sources – petroleum – Natural Gas – Coal and Lignite – scarcity of natural energy source – Raise in demand of energy and fuel

##### UNIT-III

18 Hrs

Alternate energy – renewable energy – Merits and demerits of renewable energy – Renewable energy sources – Wind – Ocean tide and wave – Solar – bio gas – geo thermal

##### UNIT-IV

18 Hrs

Wind energy: Potential and Availability - Characteristics of Wind, Estimation and Measurement - Wind Machines - Uses and Applications, Limitations Wave Energy: Tidal, OTEC: Basic Principle & Systems-Applications and Limitations. – Aerodynamics – season and location – Mechanical conversion – power generation – water pumping – bio gas – generation – utilization – large scale plants – power generation using Tide and wave – geo thermal power plants.

##### UNIT-V

18 Hrs

Sun Solar Radiation, Earth Sun Relationship (Angles and Models, Earth and Sun Relation), Measurement, Solar Cookers, Solar Collectors, Flat Plate Collectors for Water, Flat Plate Collectors for Air, Concentrating Collectors – energy form – heat and light – energy from sun – solar cycle – Heating effect – Solar water heater – solar cooker – Room heater – Power generation.

##### Text Book:

- 1) Non- Conventional Energy Sources; G D Rai, Published by Khanna Publishers, New Delhi
- 2) Renewable Energy Engineering & Technology – A Knowledge compendium Edited by V V N Kishore; Published by TERI Press, New Delhi
- 3) Fundamental of Renewable Energy Sources; G N Tewari & M K Ghosal, Published by Narora Publishing House, New Delhi
4. Geothermal Energy, Dickson
5. Wind Energy Conversation Systems, Fneris L.L.
6. Renewable Energy, Thomas B, Johansson
7. Solar Energy; Principal of Thermal Collection & Storage, Sukhatme, S.P.

## **COURSE – II**

### **(C19SS12/E19SS02)ELECTRICAL AND ELECTRONIC PRINCIPLES**

#### **OBJECTIVES:**

This syllabus helps the students to impart the theoretical knowledge of the electrical & Electronics components includes basic logic gates, diode characteristics, operational amplifier, and power supply.

#### **UNIT-I**

**18 Hrs**

Electron theory - flow of electron - current flow and direction - potential difference - Current - voltage - power - basic units - AC - DC - power supplies - frequency - frequency standards in power supply.

#### **UNIT-II**

**18 Hrs**

DC power supply - source of DC power - Chemical cell - battery - battery array - Types of batteries - electrical parameters of batteries - Alternate DC power supplies - DC generators - Rectifiers - battery chargers - maintenance.

#### **UNIT-III**

**18 Hrs**

AC power supply - need for AC supply - Source of AC power supply - Conversion from AC to DC - AC supply frequency and wave form - Sine wave, Square wave, modified sine wave, DSP wave forms - Conversion of DC to AC

#### **UNIT-IV**

**18 Hrs**

Resistance - Capacitance - Inductance - Transformer - step Up and step down transformers - Tools and Instruments - Measuring tools - Ammeter, volt meter, Ohm meter, watt meter watt-hour meter.

#### **UNIT-V**

**18 Hrs**

Type of load - resistive load- inductive load - Calculating total load - Estimating current rating - ampere calculation - power factor - VA vs WATT - Power Supply planning - protective methods

#### **Text book :**

- Basic Electronics – B.L Theraja
- Basic Electrical – B.L. Theraja

## COURSE – III

### (C19SS13/E19SS03)SOLAR ENERGY GENERATION AND UTILIZATION

#### OBJECTIVES:

This course helps the students to understand the solar energy radiation, conversion Technologies. It also includes Thermal energy conversion, Electrical energy conversion and their utilization in industrial application like grain drying, battery charging, solar pumping.

#### UNIT-I

**18 Hrs**

Material classification according to electrical behavior - Semiconductor - Crystal - photo characteristics of semiconductors - Photovoltaic effect.

#### UNIT-II

**18 Hrs**

Photovoltaic cells - mono crystal - poly crystal - other types of cells - comparison between cell types - Selecting suitable photovoltaic cell - photovoltaic panels - Preparation of panels - Rating of panels

#### UNIT-III

**18 Hrs**

Inverters - inverter working principle - hybrid inverters - inverter rating - Selecting proper inverter rating - Working voltage of inverter - Sine wave, Square wave, modified sine wave, DSP wave form inverters

#### UNIT-IV

**18 Hrs**

Installation of solar panels - selecting location - calculating power level - method of arrangements of panel - angle of inclined - snow load test - other mechanical ratings - Trouble shooting - maintenance.

#### UNIT-V

**18 Hrs**

Additional equipments - independent chargers - PWM and MPPT chargers - Cascading solar panels - cascading batteries - battery Equalizers - Grid tie Inverters -Precautions in installing panels and inverters.

#### Text books:

- 1) Solar Cells: Operating Principles, Technology and System Applications, Martin Green Published by the University of New South Wales, 1980 (Required) available at the BU Barnes and Noble book store
- 2) Solar Engineering of Thermal Processes, Third Edition, John A. Duffie and William A. Beckman, John Wiley and Sons. Inc. 2005 (Chapters 1, 2,3, and 7) Recommended
- 3) [www.pveducation.org](http://www.pveducation.org)

#### Reference Books:

- 1) Photovoltaic Science and Engineering Handbook, Second Edition, Antonio Luque and Steven Hegedus, John Wiley and Sons, 2012
- 2) Thin film Solar Cells, Jeff Poortmans and Vladimir Arkhipov (Ed) John Wiley and Sons Ltd. 2006
- 3) Solar Cell Device Physics, Second Edition, Stephen J. Fonash, Elsevier, Inc., 2010
- 4) Solar Electricity, Second Edition, Thomas Markvart (Editor), John Wiley and Sons, Ltd., 2000.
- 5) Photovoltaic Engineering Handbook, F. Lasnier and T. G. Ang, IOP Publishing UK

## Course IV

### (C19CE10/E19CE10)COMMUNICATIVE ENGLISH

1. **Basic Grammar:**
  - a. Review of grammar
  - b. Remedial study of grammar
  - c. Simple sentence
  - d. Word passive voice etc.
2. **Bubbling Vocabulary:**
  - a. Synonyms
  - b. Antonyms
  - c. One – work Institution
3. **Reading and Understanding English**
  - a. Comprehension passage
  - b. Précis – writing
  - c. Developing a story from hints.
4. **Writing English**
  - a. Writing Business letters.
  - b. Paragraph writing
  - c. Essay writing
  - d. Dialogue writing
5. **Speaking English**
  - a. Expressions used under different circumstances
  - b. Phonetics

#### Reference:

1. V.H.Baskaran – “English Made Easy”
2. V.H.Baskaran – “English Composition Made Easy”  
(Shakespeare Institute of English Studies, Chennai)
3. N.Krishnaswamy – “Teaching English Grammar” (T.R.Publication,  
Chennai)
4. “Life Skill” – P.Ravi, S.Prabakar and T.Tamzil Chelvam, M.S.University,  
Tirunelveli.

## COURSE V

### (C19SSP1/E19SSP1)PRACTICAL I

#### Electrical and Electronic Principles – Practical knowledge of Electrical & Electronic components - I

#### OBJECTIVES:

This course helps the students to impart the practical knowledge of the electrical & Electronics components includes basic logic gates, diode characteristics, operational amplifier, characteristics of LED, Transistor input and transfer characteristics Electrical and electronic principles - Practical Knowledge of Electrical & Electronic components

**SEMESTER II**  
**COURSE – VI**  
**(C19SS21/E19SS04)ENTREPRENEURSHIP AND SMALL BUSINESS**

**OBJECTIVES:**

This syllabus helps the students to impart the subject knowledge Management roles and functions in a small business, Principles of double-entry book-keeping and find out the Issues in small business marketing.

**UNIT-I**

**18 Hrs**

Er.-Entrepreneurship-Enterprise: Conceptual issues. Entrepreneurship vs. Management. Roles and functions of er in relation to the enterprise and in relation to the economy. Entrepreneurship is an interactive process between the individual and the environment. Small business as seedbed of Entrepreneurship. [The teachers should emphasize to students the desirability as well as feasibility of a career in Entrepreneurship in the Indian scenario.] Entrepreneur competencies, Entrepreneur motivation, performance and rewards.[The teachers may make use of Entrepreneurship Development Institute of India's Inventory of Entrepreneur Competencies and National Institute of Entrepreneurship and Small Business Developments training kit for arousing Entrepreneur motivation and capacity and capability building].

**UNIT-II**

**18 Hrs**

Opportunity scouting and idea generation: role of creativity and innovation and business research. Sources of business ideas. Entrepreneur opportunities in contemporary business environment, for example opportunities in net-work marketing, franchising, business process outsourcing in the early 21 century.[The students be advised to visit various product/service franchises, BPO concerns and meet up/down links in the net-work marketing.] The process of setting up a small business: Preliminary screening and aspects of the detailed study of the feasibility of the business idea and financing/non-financing support agencies to familiarize themselves with the policies/programs and procedures and the available schemes.] Preparation of Project Report and Report on Experiential Learning of successful and unsuccessful entrepreneurs. [The students may be advised to develop a structured instrument [questionnaire] for conducting surveys of the various aspects of entrepreneur/enterprise. They may also be advised to prepare a comprehensive business plan. The desirability and feasibility of liaison with relevant funding and non-funding agencies may also be explored.

**UNIT-III**

**18 Hrs**

Management roles and functions in a small business. Designing and re-designing business process, location, layout, operations planning and control. Basic awareness on the issues impinging on quality, productivity and environment. Managing business growth. [The pros and cons of alternative growth options: internal expansion, acquisitions and mergers, integration and diversification. Crisis in business growth.



**UNIT-IV****18 Hrs**

Principles of double-entry book-keeping: journal entries, cash-book, pass book, and Bank Reconciliation Statement, ledger accounts, trail balance and preparation of final accounts: Trading and Profit and Loss Account; Balance-sheet. Brief introduction to Single-Entry system of record keeping. Sources of risk/venture capital, fixed capital, working capital and a basic awareness of financial services such as leasing and factoring.

**UNIT-V****18 Hrs**

Issues in small business marketing. The concept and application of product life cycle [plc], advertising and publicity, sales and distribution management. The idea of consortium marketing, competitive bidding/tender marketing, negotiating with principal customers. The contemporary perspectives on Infrastructure Development, Product and Procurement Reservation, Marketing Assistance, Subsidies and other Fiscal and Monetary Incentives. National state level and grass-root level financial and non-financial institutions in support of small business development.

**Reference books:**

1. Brandt, Steven C., The 10 Commandments for Building a Growth Company, Third Edition, Macmillan Business Books, Delhi, 1977
2. Bhide, Amar V., The Origin and Evolution of New Business, Oxford University Press, New York, 2000.
3. Dollinger M.J., 'Entrepreneurship strategies and Resources', 3rd edition, Pearson Education, New Delhi 2006.
4. Desai, Vasant Dr. (2004) Management of small scale enterprises New Delhi: Himalaya Publishing House,
5. Taneja, Gupta, Entrepreneur Development New Venture Creation,,: 2nd ed. Galgotia Publishing Company
6. Holt, David H., Entrepreneurship: Strategies and Resources, Illinois, Irwin, 1955.
7. Panda, Shiba Charan, Entrepreneurship Development, New Delhi, Anmol Publications.
8. Patel, V.G., The Seven Business Crises and How to Beat Them, Tata-Mcgraw, New Delhi, 1995.
9. SIDBI Report n Small Scale Industries Sector[latest edition]
10. Verma, J.C., and Gurpal Singh, Small Business and Industry-A Handbook for Entrepreneurs, Sage, New Delhi, 2002 11. Vesper, Karl H., New Venture Strategies, [Revised Edition], New Jersey, Prentice Hall, 1990

**COURSE VII**  
**(C19SSP2/E19SSP2)PRACTICAL II**  
**Electrical and Electronic Principles – Practical knowledge of Electrical & Electronic components - II**

**OBJECTIVES:**

This course helps the students to impart the practical knowledge of the electrical & Electronics components includes basic logic gates, diode characteristics, operational amplifier, characteristics of LED, Transistor input and transfer characteristics.

Electrical and electronic principles - Practical Knowledge of Electrical & Electronic components

**List of Practical's II: Electrical and Electronic Principles**

(Any 10 practical's may be selected)

1. Verification Kirchoff's laws
2. Construction of 5 amps distribution box
3. Study of various wiring components: wires, fuses, sockets, plugs, lamps, indicators etc. - Their rating and uses
4. Wiring exercise – control of two lamps from two switches and staircase wiring
5. To study RLC circuit
6. To study the speed control D.C. shunt motor - armature voltage control method
7. Determination of VI characteristics of PN junction diode
8. Determination of VI characteristics of Zener diode
9. Determination of input/output characteristics of transistor
10. Determination of characteristics operational amplifier IC741
11. A simple circuit using IC 555
12. Construction of Power pack rectifier circuit
13. Construction of IC regulated power supply

## Course VIII

### (C19LS23/E19LS05)Life Skill

#### OBJECTIVES:

To educate about Life skills includes on Life Coping or adjustment, Attitude, Problem solving and basic computer Knowledge with internets

#### I Life Coping or adjustment

- (a) External and internal influence in one's life
- (b) Process of coping or adjustment
- (c) Coping with physical change and sexuality
- (d) Coping with stress, shyness, fear, anger far live and criticism.

#### II Attitude

- (a) Attitude
- (b) Self-acceptance, self – esteem and self-actualization
- (c) Positive thinking

#### III Problem Solving

- (a) Goal Setting
- (b) Decision Making
- (c) Time Management and stress Management.

#### IV Computers

- (a) Introduction to Computers
- (b) M.S.Office
- (c) Power Point

#### V Internet

- (a) Introduction to internet
- (b) E – mail
- (c) Browsing

#### References:

- 1) Life Skill Programme course I & II by Dr. Xavier Alphona MCRDCE Publications. R.K.Mutt Road, Chennai – 28
- 2) ஆளுமை பண்பு வளர்த்தல் மற்றும் தகவல் தொடர்பு by M.Selvaraj Community College,Palayamkottai
- 3) “Life Skill” –P.Ravi, S.Prabahar & T.Tamil Chelvam, M.S. University, Tirunelveli

## **COURSE IX**

### **(C19SSP3/E19SSP3)PRACTICAL III**

#### **Solar energy generation and utilization solar system – Installing & Servicing**

#### **OBJECTIVES:**

- This course helps the students to impart the practical knowledge of the Installing & servicing of solar panel which includes mounting of solar panel, estimation of solar DC pumping system, AC pumping system, sun meter efficiency, efficiency of solar cooker, solar hot water system.
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- Solar energy generation and utilization Solar system – Installing & Servicing

## **COURSE X**

### **(C19SSPW/E19SSPW) PROJECT & FIELD TRIP**

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