

SRINIVAS UNIVERSITY

# Mukka, Mangaluru – 574146

Web : [www.srinivasuniversity.ac.in](http://www.srinivasuniversity.ac.in/)

**[In compliance of University Grants Commission (Minimum Standards and Procedures for Award of Ph.D. Degree) Regulations, 2016]**

**COURSEWORK SYLLABUS OF Ph.D. PROGRAMME IN MECHANICAL ENGINEERING**

**INSTITUTE OF ENGINEERING & TECHNOLOGY**

# Mukka, Mangaluru – 574 146.

**SRINIVAS UNIVERSITY**

**INSTITUTE OF ENGINEERING & TECHNOLOGY**

**Ph.D. PROGRAMME**

**SYLLABUS OF COURSEWORK**

### COURSEWORK PATTERN 400 Marks

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| --- | --- | --- | --- | --- | --- | --- |
| **Sl.**  **No.** | **Subjects** | **Exam (Hours)** | **Credits** | **Internal Marks** | **External Marks** | **Marks** |
| 1 | Research Methodology | 2 | 4 | 50 | 50 | 100 |
| 2 | Non-Conventional Energy Sources | 2 | 4 | 50 | 50 | 100 |
| 3 | Patent analysis and Presentation | 2 | 4 | 50 | 50 | 100 |
| 4 | Review of Literature leading to publish of review paper in journal | 2 | 4 | 50 | 50 | 100 |
| **Total** | |  | **16** | **200** | **200** | **400** |

**COURSEWORK SYLLABUS**

**RESEARCH METHODOLOGY (22SPHDRM)**

**(COMMON TO ALL ENGINEERING BRANCHES)**

**Module-1:**

Meaning, Objectives and Characteristics of research - Research methods Vs Methodology - Types of research - Descriptive Vs. Analytical, Applied Vs. Fundamental, Quantitative Vs. Qualitative, Conceptual Vs. Empirical - Research process - Criteria of good research -Developing a research plan. Defining the research problem - Selecting the problem - Necessity of defining the problem -Techniques involved in defining the problem - Importance of literature review in defining a problem - Survey of literature - Primary and secondary sources – Development of working hypothesis.

**Module -2:**

Research design and methods – Research design – Basic Principles- Need of research design –– Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models - Developing a research plan - Exploration, Description, Diagnosis, and Experimentation- Determining experimental and sample designs.

**Module -3:**

Sampling design - Steps in sampling design - Characteristics of a good sample design - Types of sample designs - Measurement and scaling techniques - Methods of data collection – Collection of primary data - Data collection instruments Testing of hypotheses - Basic concepts - Procedure for hypotheses testing flow diagram for hypotheses testing - Data analysis with Statistical Packages – Correlation and Regression - Important parametric test - Chi-square test - Analysis of variance and Covariance

**Module -4:**

IPRs- Invention and Creativity- Intellectual Property-Importance and Protection of Intellectual Property Rights (IPRs) - A brief summary of: Patents, Copyrights, Trademarks, Industrial Designs- Integrated Circuits-Geographical Indications-Establishment of WIPO-Application and Procedures.

**Module-5:**

Interpretation and report writing - Techniques of interpretation - Structure and components of scientific reports - Different steps in the preparation - Layout, structure and language of the report - Illustrations and tables - Types of report - Technical reports and thesis

**REFERENCES:**

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2021. An introduction to Research Methodology, RBSA Publishers.

2. Kothari, C.R., 2015. Research Methodology: Methods and Techniques. New Age International. 418p. 3. Anderson, T. W., An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi

4. Sinha, S.C. and Dhiman, A.K., 2012. Research Methodology, EssEss Publications. 2 volumes. se knowledge base, Atomic Dog Publishing.

5. Trochim, W.M.K., 2015. Research Methods: the conci 270p.

6. Fink, A., 2019. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications

7. Intellectual Property Rights in the Global Economy: Keith Eugene Maskus, Institute for International Economics, Washington, DC, 2019

8. Subbarau NR Handbook on Intellectual Property Law and Practice Publishing Private Limited.2008 S Viswanathan Printers.

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| --- | --- | --- | --- |
| **NON-CONVENTIONAL ENERGY SOURCES** | | | |
| **Sub Code:** | **22SPHDME01** | **IA Marks :** | **50** |
| **Exam Hours :** | **2** | **Exam Marks:** | **50** |
| **Credits:** | **4** |  |  |
| **Course Objectives:** | | | |
| * To introduce the concepts of solar energy, its radiation, collection, storage and application. * To introduce the concepts and applications of Wind energy, Biomass energy, Geothermal energy and Ocean energy as alternative energy sources. * To explore societies present needs and future energy demands. * To examine energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, etc. | | | |
| **Course Outcomes:** | | | |
| At the end of the course, the student will be able to:  CO1: Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.  CO2: Know the need of renewable energy resources, historical and latest developments.  CO3: Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying, cooking etc.  CO4: Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.  CO5: Understand the concept of Biomass energy resources and their classification, types of biogas Plants applications  CO6: Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.  CO7: Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications. | | | |
| **Module I** | | | |
| **Introduction:** Energy source, India’s production and reserves of commercial energy sources, need for non-conventional energy sources, energy alternatives, solar, thermal, photovoltaic. Water power, wind bio- mass, ocean temperature difference, tidal and waves, geothermal, tar sands and oil shale, nuclear (Brief descriptions); advantages and disadvantages, comparison (Qualitative and Quantitative).  **Energy from Bio Mass** : Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation, description of bio-gas plants, transportation of bio-gas, problems involved with bio-gas production, application of bio-gas, application of bio-gas in engines, advantages. | | | |
| **Module II** | | | |
| **Solar Radiation** : Extra-Terrestrial radiation, spectral distribution of extra terrestrial radiation, solar constant, solar radiation at the earth’s surface, beam, diffuse and global radiation, solar radiation data.  **Measurement of Solar Radiation:** Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.  **Solar Radiation Geometry:** Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, zenith angle, solar altitude angle expression for the angle between the incident beam and the normal to a plane surface (No derivation) local apparent time. Apparent motion of sum, day length, numerical examples. | | | |
| **Module III** | | | |
| **Radiation Flux on a Tilted Surface:** Beam, diffuse and reflected radiation, expression for flux on a tilted surface (no derivations) numerical examples.  **Solar Thermal Conversion:** Collection and storage, thermal collection devices, liquid flat plate collectors, solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis); sensible heat storage, latent heat storage, application of solar energy water heating. Space heating and cooling, active and passive systems, power generation, refrigeration. Distillation (Qualitative analysis) solar pond, principle of working, operational problems. | | | |
| **Module IV** | | | |
| **Photovoltaic Conversion:** Description, principle of working and characteristics, applications.  **Wind Energy** : Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, elementary design principles; coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design, numerical examples. | | | |
| **Module V** | | | |
| **Tidal Power:** Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.  **Ocean Thermal Energy Conversion:** Principle of working, Rankine cycle, OTEC power stations in the world, problems associated with OTEC. | | | |
| **TEXT BOOKS:**   1. Non-Conventional Energy Sources by *G.D Rai K*, Khanna Publishers, 2003. 2. Solar energy, by *Subhas P Sukhatme* – Tata McGraw Hill, 2nd Edition, 1996.  **REFERENCE BOOKS:**  1. Renewable Energy Sources and Conversion Technology by *N.K.Bansal, Manfred Kleeman & Mechael Meliss*, Tata McGraw Hill, 2001. 2. Renewable Energy Resources, *John W.Twidell Anthony D. Weir El*, BG 2001. 3. Solar Power Engineering, *P.K.Nag*, Tata McGraw Hill, 2003. | | | |

**PATENT ANALYSIS AND PRESENTATION (22SPHDME02)**

The candidates should submit the review of literature of granted patents in the form of report and present the report in front of a Committee. The report carries 50% weightage and presentation carries 50% weightage.

**REVIEW OF LITERATURE LEADING TO PUBLISH OF REVIEW PAPER IN JOURNAL (22SPHDME03)**

The candidates should submit the review of literature of published papers and publish this work in peer reviewed journals. The candidates should present the paper in front of a Committee. The published paper carries 50% weightage and presentation carries 50% weightage.

**EXAMINATION PATTERN**

For Research Methodology and Electrochemistry and techniques papers carries 50% weightage for assignments. The candidates are required to submit the hand written assignment given by the guide and it carries 50% weightage.

The examination will be conducted for remaining 50% marks. The question paper pattern will be as follows:

1. Two questions from each module will be asked in the examination and the candidates are required to answer any one question.
2. Each question will carry 10 marks.

**NOTE:** One online course in Research Methodology should be completed and the candidates are required to submit the certificate compulsorily.