SRINIVAS UNIVERSITY

Mukka, Mangaluru – 574146

Web : www.srinivasuniversity.ac.in

[In compliance of University Grants Commission (MinimumStandards and Procedures for Award of Ph.D. Degree) Regulations, 2022]

COURSEWORK SYLLABUS OF Ph.D. PROGRAMME IN MECHANICAL ENGNEERING

INSTITUTE OF ENGNEERING AND TECHNOLOGY

SRINIVAS UNIVERSITY

Mukka Mangaluru – 574146.

A. COURSE WORK PATTERN **400 M**

Sl. No.	Subjects	Credits	Internal Marks	External Marks	Marks
1	Research Methodology (22SPHDRM001)	4	50	50	100
2	Non-Conventional Energy Sources (22SPHDMEC02)	4	50	50	100
3	Analysis And Presentation Of Proposed Research Topic (22SPHDPUB003)	4	50	50	100
4	Review Of Literature (22SPHDPUB004)	4	50	50	100
Total		**16**	**200**	**200**	**400**

COURSE WORK SYLLABUS

1. RESEARCH METHODOLOGY (22SPHDRM001)

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

Data Analysis using MS Excel Introduction to Spreadsheets Spreadsheet Functions to Organize Data, Introduction to Filtering, Pivot Tables, and Charts, Advanced Graphing and Charting. 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

Module-5

Ethics in Research: Importance, Principles, Developing a code of ethics, Ethics and Respondents, Ethics and Clients, Ethics and research firm. Plagiarism. Patent and Copyrights

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
9. Research Methodology, Shashi k Gupta and Praneet Rangi. Kalyani Publishers, 6th edition

NON-CONVENTIONAL ENERGY SOURCES
(22SPHDMEC02)

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 2

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 3

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 4

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 5

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.

ANALYSIS AND PRESENTATION OF PROPOSED RESEARCH TOPIC
(22SPHDPUB003)

The candidates should publish the proposed work in the conference abstract book/ proceedings/ Journal.

Article quality and its presentation carries 50% weightage as internal marks and final end exam carries 50% weightage.

Exam descriptive. Questions will be general. Answers can be in relation to his/her published

REVIEW OF LITERATURE
(22SPHDPUB004)

The candidate should publish the review article of his/her proposed work and they should submit the proof of published paper. Review article quality and its presentation carries 50% weightage as internal marks and final end exam carries 50% weightage.
Exam Descriptive. Questions will be General. Answers can be in relation to the published review paper.

NOTE:
IA Components

DDLR completion certificate
One MOOCs/Online certificate on Research methodology
One review paper with ISSN No (Connected to fourth paper of coursework)
One paper presented in conference – Proof (Connected to third paper)
Assignment for Second paper (given by the Guide or Coordinator)
Assignment for first paper (given by the Guide or Coordinator)