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INSTITUTE OF ENGINEERING AND TECHNOLOGY

RULES & REGULATIONS GOVERNING THE DOCTOR OF PHILOSOPHY (Ph.D.) PROGRAMME

Course Structure, Detailed Syllabus & Scheme of Examination

INTRODUCTION

This "Course Scheme Handout" contains detailed description of the course plan and evaluation component for Pre PhD Programme offered by the IET, JK Lakshmipat University. These courses are made to give an understanding of the subject to the students as per their research interest.

1. All candidates admitted for the Ph. D programme are required to undergo a 14 credit course work during the first semester of the programme. The courses offered for the Ph. D programme will be a combination of Lecture Courses, Laboratory Courses, Design Courses, Self-Study Courses, Minor Project work as the case may be, for the candidates registered under each discipline. The course work will be in two parts.

   1.1 Part 1: A common module of courses including Research Methodology, and Advanced Professional Communication carrying eight credits in total has to be taken by every Ph.D. candidate irrespective of the discipline under which he/she is registered.

   1.2 Part 2: All lecture courses, laboratory courses, design courses, self-study courses and minor project work shall carry a maximum of six credits.

Course Scheme Handout is presented in two parts. The first part is common across all the programmes and is presented in Section-I, while in Section-II, two elective courses have been offered to the students as per their preference.

Section – I (Mandatory Courses)

Course Code	Course Title
PHDA101	Research Methodology
PHLA05	Advanced Professional Communication

Section – II (Elective Courses)

Course Code	Course Title
PHEE02	Smart Grid Technology
PHEE03	Renewable Energy
PHCHE04	Organic Synthesis
PHME01	Material Science

Evaluation Scheme

Evaluation Scheme for Section I (Courses Common to all Programmes)

EC No.	Component	Duration	Marks
1.	Internal*	--	40
2.	Minor Project	--	20
3.	Written Test	2 hrs.	40
Total			**100**

Evaluation Scheme for Section II (Elective Courses)

EC No.	Component	Duration	Marks
1.	Internal*	--	40
2.	Minor Project	--	20
3.	Term Paper (Report)	--	24
4.	Term Paper (Presentation**)	--	16
Total			**100**

*The internal evaluation will be done on Library Assignment, Presentations, Quiz, Test, Case submissions etc. depending upon the nature of the course and the discretion of the course instructor.

** The candidates will be required to present their term paper before RPC after completion.

PHDA101: Research Methodology

Course Overview:
The course has been designed to enable the students irrespective of their discipline in developing the most appropriate methodology for their research studies and to make them familiar with the art of using different research methods and techniques.

Course contents:
Unit 1: Introduction to Research Methodology
Nature and Scope of Research Methodology in Business Administration / Management Studies/Technical Studies , Problem Formulation and Statement of Research Objectives, Value and Cost of Information, Bayesian Decision Theory, Organization Structure of Research, Research Process.

Unit 2: Research Design & Research Ethics
Research Designs-Exploratory, Descriptive and Experimental Research Designs, Methods of Data Collection, Observational and Survey Methods, Questionnaire Design, Attitude Measurement Techniques, Motivational Research Techniques, Administration of Surveys, Sample Design. Environmental impacts, Ethical issues, ethical committees, Commercialization, Copy right, royalty, Intellectual property rights and patent law, Trade Related aspects of Intellectual Property Rights, Reproduction of published material, Plagiarism, Citation and acknowledgement, Reproducibility and accountability.

Unit 3: Quantitative Methods & Statistical Technique
Selecting an Appropriate Statistical Technique, Field Work and Tabulation of Data, Analysis of Data, Use of SPSS and other Software Packages, Advanced Techniques for Data Analysis, ANOVA, Discriminant Analysis, Factor Analysis, Conjoint Analysis, Multidimensional Scaling, Clustering, Logit and Probit Analysis, Research applications.

Unit 4 : Computer Applications
Introduction to Computer and Computer Techonology, Computer Software : Meaning and Types, System Software, Operating system: Meaning, Types, Function set, Application Software, Utility Software and Features of MS Windows and features of MS Office (Word/Excel/Power Point), Introduction to Data Base Management System, Introduction to Micro Soft Access creating Data Base in Access, Internet, World Wide Web, Concept and Meaning of Internet, a Brief History of the Internet,Applications of the Internet Hardware and Software, The World Wide –Web: Introduction to WWW.Web Search Engines, Internet Service Providers, Net Surfing, Electronic Mail (e-mail): The Concept of e-mail, Advantages and Disadvantages of e-mail, Computer care- Virus, security and maintenance, Data Analysis, Data Interpretation, Reporting, Power Point Presentation.

Reference Books:

- Bryman, Allan and Bell Emma (2003). *Business Research Methods*. Noida: Oxford.
- Kerlinger Fred. N.(2002). *Foundations of Behavioral Research*. USA: Holt and Rinehalt.
- Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*. New Delhi: New Age International

- Murthy, S. N. and Bhojanna,U.(2008). *Business Research Methods*. New Delhi: Excel
- Sekaran, Uma(2006). *Research Methods for Business: A Skill Building Approach*. New Delhi: John Wiley& Sons.

PHLA05: Advanced Professional Communication

Course Description:
The course includes elements and tasks related to advanced professional communication such as making effective oral presentations; using proper vocal cues and non-verbal communication; writing effective abstracts, e-mails, business letters, reports, proposals, research papers; drafting captivating speeches; using audio-visual aids appropriately; documenting, proofreading and editing the written text properly; citing sources and preparing bibliography accurately, etc.

Scope & Objective:
In view of the growing importance of communication skills the course has been designed to help researchers express themselves effectively in all forms of professional communication. Offering extensive exposure and practice, the course helps students write with clarity and precision and make effective presentations.

Text Books:
TB Lesikar, Raymond V. et al. *Business Communication: Making Connections in a Digital World*, 11th Edition, New Delhi: Tata McGraw Hill Education Pvt Ltd., 2009.

Reference Books:
R1 Leki, Ilona, *Academic Writing: Exploring Processes and Strategies*, 2nd Edition, New Delhi: Cambridge University Press, 2010.
R2 Arnold, George T., *Media Writer's Handbook: A Guide to Common Writing & Editing Problems*, 4th Edition, New Delhi: Tata McGraw Hill, 2010.
R3 Raman, Meenakshi and Sangeeta Sharma, *Technical Communication: Principles and Practice*, 2nd Edition, New Delhi: Oxford University Press, 2011.
R4 Krishna Mohan and N.P.Singh, *Speaking English Effectively*, New Delhi: Macmillan,1994.
R5 Sasikumar and P.V. Dhamija, *Spoken English: A Self-Learning Guide to Conversation Practice*, Tata-McGraw Hill, 2007.
R6 Lata, Pushp and Sanjay Kumar, *Communicate or Collapse: A Handbook of Effective Public Speaking, Group Discussions and Interviews*, 3rd Reprint, New Delhi: PHI Learning Pvt Ltd., 2010.
R7 Rizvi, M. Ashraf, *Effective Technical Communication*, 16th Reprint, New Delhi: Tata McGraw Hill Pvt Ltd., 2010.
R8 Asha Kaul, Business Communication, Second Edition, New Delhi: PHI, 2010.

Course Plan:

Module No.	Learning Objectives	Topics to be Covered
1	Introduction to the course.	Defining Communication with emphasis on various stages and skills in language acquisition
		Introducing students to characteristic features of effective communication; acquainting them with the barriers to communication and suggesting ways to overcome such barriers
	Oral	Helping students learn techniques for making effective

	Presentations	professional presentations; helping them observe the nuances of presentations such as using body and voice effectively; drafting captivating beginnings; organizing main body; using statistics; casting emphatic conclusions; using wit and humour; using audio-visual aids appropriately, etc.
2	Style of Writing	Helping students develop effective writing style
	Research Papers	Orienting students to the nature and process of writing research papers, dissertations and thesis
	Documentation and Editing	Helping students learn ways to document and edit a written text; helping them cite references appropriately, cast bibliography correctly and edit the text effectively
3	Draft documents	Helping students draft effective reports, proposals, letters, resumes, memos and e-mails

PHEE02: Smart Grid Technologies

Course Description:
This course provides the research scholars with Power Grids, Modelling Converters in Microgrid, Power Systems, Solar Energy Systems and Microgrid Wind Energy Systems.

Scope & Objective:
Smart power grid is the burning topic of power system. World is looking towards the clean and green energy. This subject deals with the utility at all the levels to renewable energy viz. solar and wind, and modeling of smart power grid for both of these. Generating the electrical energy from renewable energy sources is not a difficult task now but modelling this energy into a useable form is cumbersome and a matter of research. This subject focuses how to deal with imposed challenges.

Text Books:
TB1. Ali Keyhani, "Design of Smart Power Grid Renewables Energy Systems", IEEE-Wiley Press.

Course Plan:

Module No.	Unit Name	Topics to be covered
1	Power Grids	Introduction, Electric power grid, Basic concept of power grid, Load models, Transformers in electrical power grid, Modelling of a microgrid system, Modelling 3-phase Transformers, Tap changing Transformers, Modelling transmission lines
	Modelling Converters in Microgrid Power Systems	Introduction, Single phase DC/AC inverter with two switches and four switch bipolar, 3-phase DC/AC inverters, Pulse width modulation methods, Analysis of DC/AC 3-phase inverter, Microgrid of renewable energy systems, The DC/DC converters in green energy systems, Rectifiers, PWM rectifiers, Three phase voltage source rectifier using sinusoidal PWM switching, Sizing of an inverter, rectifier, DC/DC converter for microgrid operation
2	Solar Energy Systems	Introduction, Solar energy conversion process, Photovoltaic power conversion, Photovoltaic materials, Photovoltaic statistics, Photovoltaic efficiency, Design of photovoltaic system, Modelling of a photovoltaic module, Measurement of photovoltaic performance, Maximum power point of a photovoltaic array, Battery storage system, Storage system based on a single cell battery, Energy yield of a photovoltaic module and the angle of incidence, State of photovoltaic generation Technology, Estimation of photovoltaic module, Model parameters
3	Microgrid Wind Energy Systems	Introduction, Wind power, Wind turbine generator, Modelling of induction machines, Power flow analysis of an induction machine, Operation of an induction generator, Dynamic

		performance, Doubly-Fed induction generator, Brushless induction generator systems, Variable speed permanent magnet generator, Generator with a converter isolated from the grid

PHEE03: Renewable Energy

Course Description:
This course provides the research scholars with an exposure of Non-conventional energy and Renewable energy. The various section of this course includes in-depth study of traditional energy systems, solar photovoltaic systems, solar thermal systems, wind, microhydel, biomass, costing and hybrid systems.

Scope & Objective:
With the increasing populations, energy demands are increasing day by day. The traditional energy systems are proven to be insufficient and unsustainable. This course provides an in-depth exposure of various Non-conventional and Renewable energy systems. The objective of this course is to provide the research scholars with a reasonable knowledge of updates in energy systems so that they are able to apply this knowledge in their future research in this area or any other related areas.

Text Books:
TB1. B H Khan, Non-Conventional Energy Sources, TMH Publishers.
TB2. Ali Keyhani, Design of smart power grid renewable energy systems, Wiley and IEEE

Course Plan:

Module No.	Learning Objectives	Topics to be covered
1	Introduction	Fossil fuel based systems. Impact of fossil fuel based systems. Non-conventional energy – Seasonal variations and availability. Renewable energy – sources and features. Hybrid energy systems Distributed energy systems and dispersed generation (DG)
	Traditional Energy Systems	Sources. Features and characteristics. Applications: Transport – bullock cart, horse carriage, camels; Agriculture – ox plough, water lifting devices; Human power – bicycle, cycle rickshaw etc.; House hold – cooking (bio mass), lighting etc.
	Solar Photovoltaic Systems	Operating principles. Photovoltaic cell concepts. Cell, module, array. Series and parallel connections. Maximum power point tracking. Applications: Battery charging, Pumping, Lighting, and Peltier cooling
2	Solar Thermal Systems	Solar radiation spectrum. Radiation measurement. Technologies. Applications: Heating, Cooling, Drying, Distillation, Power generation
	Wind	Wind patterns and wind data. Site selection. Types of windmills. Characteristics of wind generators. Load matching
	Microhydel	Operating principles. Components of a microhydel power plant. Types and characteristics of turbines. Selection and modification. Load balancing

3	Biomass	Operating principles. Combustion and fermentation. Anaerobic digester. Wood gassifier. Pyrolysis. Applications: Biogas, Wood stoves, Bio diesel, Combustion engine
	Costing	Life cycle costing (LCC). Solar thermal system LCC. Solar PV system LCC. Microhydel LCC. Wind system LCC. Biomass system LCC
	Hybrid Systems	Need for Hybrid Systems. Range and type of Hybrid systems. Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles Non-Conventional Energy Systems Syllabus

PHCHE04: Organic Synthesis

UNIT-1 **Stereochemistry & Chiral Techniques:**

Optical isomerism due to asymmetric carbon atoms,Racemic modifications; racemisation; thermal, anion, cation, reversible formation,Epimerization; mutarotation; I and II order asymmetric transformations, Resolution of racemic modifications; asymmetric transformations; asymmetric

synthesis destruction; Cram's and Prelog's rules; absolute asymmetric synthesis, Criteria for optical purity; D, L, R, S-notations; Cahn-Ingold-Prelog rules, absolute and relative configuration; configurations of allenes, spiranes, and biphenyls.

Molecular dissymmetry; specific and molar rotations; polarimetry; Fischer, Newmann and Sawhorse notations; Geometrical isomerism; E,Z notations; optical isomerism of lactic and tartaric acids.

UNIT-2 **Mechanisms, stereochemistry and applications of following individual reactions:**

1. Hydrogenation
2. Wittig Reaction
3. Clemensen Reduction
4. Wolf Kishner reduction
5. Birch Reduction
6. Meerwein-Pondorff reduction
7. Oppennauer oxidation
8. Allylic Bromination
9. Grignard Reaction
10. Pinacol and related rearrangements
11. Beckmann rearrangement and ozonolysis
12. Heck reaction
13. Sharpless oxidation

UNIT-3 **Heterocyclic Chemistry:**

Reactions, Mechanism of heterocyclic compounds; Azoles, Pyrazole group, Imidazole group, Oxazole group, Thiazole group, Pyrimidines, Benzodiazine, Phenoxazines

Text & Reference Books for Theory & Practicals

1.Sykes- A Guidebook to Mechanism in Organic Chemistry.

2. March- Advanced Organic Chemistry –Reaction Mechanisms.

3. Eliel- Stereochemistry of Carbon Compounds.

4. Alexander- Principles of Ionic Organic Reaction.

5. I.L.Finar- Reaction in Organic Chemistry.

6. Practical Organic Synthesis: A Student's Guide -Reinhart Keese,Martin Brändle,Trevor Toube.

7.P.S. Kalsi, Stereochemistry, 3rd edn, New Age International Publishers, 1995.

PHME01: Materials Science

Course Description:
This course provides the research scholars a basic understanding about the scientific concepts behind the structure – property relationships in different engineering materials. Understanding the atomic and molecular structure of materials and relating that to the bulk properties of the materials will be the main objective of this course.

Scope & Objective:
The research nowadays has been increasing in order to develop new and improved engineering applications and performance for the products in every sector be it health, automobile, electronics, construction, food or agriculture. The innovation and improved performance and functionality can be introduced in the products mainly by the innovation in the materials that is by restructuring the existing materials and/or developing new or modified materials. The structure property relationship in the materials is needed to be understood in order to design new materials and to improve the existing materials in order to realize the innovative applications of the variety of products.

Text Books:
TB1. W. D. Callister, Materials Science & Engineering, John Wiley.
TB2. William Smith, Ravi Prakash and Javed Hashemi, Materials Science & Engineering, Tata McGraw Hill.

Course Plan:

Module No.	Learning Objectives	Topics to be covered
1	Introduction	Introduction : Historical perspective, importance of materials
	Basic science	Brief review of modern & atomic concepts in Physics and Chemistry.
	Atomic and molecular structure	Atomic models, Chemical bondings.
	Crystal structure	Concept of UNIT cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density, Miller indices and directions.
2	Defects and imperfections	Imperfections, Defects & Dislocations in solids. Types of dislocations, Burgers vector and its representation; Planar defects, stacking faults, twins, grain boundaries
	Mechanical Properties	Mechanical Properties of Materials, Concepts of stress and strain, Stress-Strain diagrams; Properties obtained from the Tensile test; Elastic deformation, Plastic deformation. Impact Properties, Strain rate effects and Impact behavior. Hardness

		of materials;
3	Phase diagrams	Uniary and Binary diagrams, Phase rules; Types of equilibrium diagrams: Solid solution type, eutectic type and combination type; Iron-carbon equilibrium diagram.
	Heat treatment	Various types of carbon steels, alloy steels and cast irons, its properties and uses. Various types of heat treatment such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams
	Composites	Composite Materials- Introduction, classification; concrete, metal-matrix and polymer –matrix composites; Applications of composite materials.