SCHEME OF EXAMINATION
&
SYLLABUS OF PH. D. COURSE WORK
With
Learning Outcomes based Curriculum Framework
(LOCF)
for
Ph.D. (ELECTRONICS) PROGRAMME
(Program Code: 0307)
(Academic Session 2024-25)

FACULTY OF SCIENCE

Approved by Board of Studies in Electronics
Effective from Academic Session from Starting
JULY 2024

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10.5.24
(Dr. Prafulla Uyesi)
(Dr. B. Acharya)
10/5/2024

PT.RAVISHANKAR SHULKA UNIVERSITY, RAIPUR

SCHEME OF EXAMINATION & SYLLABUS PRESCRIBED FOR THE EXAMINATION OF COURSE WORK FOR Ph. D. (Electronics)

EFFECTIVE FROM JULY 2024

Programme Objectives:

The primary objective this programme is to develop the critical and creative thinking in the specific research field of Electronics. Writing and the presentation skills of students are also developed. This programme also promotes the multidisciplinary and collaborative research work. The students will also aware with values of research and professional ethics and be made ready to contribute to society as responsible individual.

Programme Specific Outcomes:

- Student will be able to develop a clear research vision in the area of electronics.
- Student will become aware about plagiarism, Intellectual property rights (IPR), and publication ethics.
- Student will be able to design, analyse, and present the research work.
- Student will also be able to develop the skill to write research and review papers, research projects, thesis and technical articles etc.
- This programme will help to develop the skill to handle the sophisticate instruments and also develop scientific understanding.

Scheme of Examination

The course work for PhD degree in Electronics is a six month course after completion of P.G. Degree in the subject. There shall be two compulsory papers based on the research areas of Electronics discipline. The structure of the course is given below:

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Course Code	Name of Course	Marks
Ph.D. P1	Research Methodology, Quantitative Methods and Computer Applications	100
Ph.D. P2	Review of Literature Concerned Subject, Seminar/Project Report	100
Total		**200**

Ph.D. P1 Paper I

Research Methodology, Quantitative Methods & Computer Applications

Course Objective:

- To develop understanding of Research methodology.
- To provide knowledge and concepts of research in the area of electronics.
- To be able to operate research instruments as well as computer applications such as simulation softwares, data analyse applications and other relevant computer applications.

Course Outcomes:

- Student will able to develop a clear research vision in the area of electronics.
- Student will become aware about plagiarism, Intellectual property rights (IPR), and publication ethics.

Activities with direct bearing on Employability/ Entrepreneurship/ Skill development:

It helps in Skill Development of Research Methodology, Quantitative Methods & Computer Applications

Unit I– Introduction and Design of research

Meaning, objective and significance of research, types and parameters of research, research process, identification and definition of the research problem, definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative Vs quantitative research methodology, Research Methods Vs Methodology, Research and Scientific Method, field studies, field experiments Vs laboratory experiments, research design in social and physical sciences.

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Unit II- Data Analysis

Procedure for testing of Hypothesis, the null hypothesis, determining level of significance, types I and types II errors, grouped data distribution, measures of central tendency, measures of spread/ dispersion, normal distribution, analysis of variance : one way, two way, chi square test and its application, students 'T' distribution, non parametric statistical techniques, binomial test, Correlation and regression analysis-discriminate analysis- factor analysis-cluster analysis, measures of relationship.

Unit III- Solar PV fundamentals and Emerging Solar Cell Technologies

P-N junction under illumination: Generation of Photo voltage, Light Generated current, I-V equation, Solar Cell Characteristics, parameters of solar cells, Relation of V_{oc} and E_g

Design of solar cells: Upper limit of cell parameters, Losses in solar cell, Design for High I_{sc}, Voc and FF

Analytical Techniques: Solar Simulator–IV measurement, Quantum efficiency measurement, Minority carrier lifetime & diffusion length measurement.

Thin film solar cell technologies: amorphous Si solar cells, CdTe solar cells, Quantum Dot Solar Cells, Dye Sensitized Solar cells, Perovskite solar Cells, Present status of different PV technologies, Shockley-Queisser limit.

Unit IV- Molecular Devices and Semiconductor Device Simulation

Molecular Devices: Operation fundamentals of organic LEDs, Organic FETs and Organic solar cells, Basic physics underlying device operation, Fundamental benefits and limitations of the organic materials.

Introduction to Semiconductor Device Simulation: Need of Simulation, Process Simulation, Device Simulation device simulation sequence, hierarchy of transport models, DD Model, Relationship between various transport regimes and significant length-scales. Numerical solution Methods–finite difference scheme, discretization of Poisson's and current continuity equations.

Unit V- Image Fundamentals

Digital Image representation, fundamental steps in Digital Image processing, Elements of Digital Image Processing Systems: image acquisition, storage, processing, communication & display, Simple image model, sampling and quantization, some basic relationships between pixels: Neighbors of a pixel, connectivity, Labelling of connected Components, Relations, distance Measures.

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Image Transforms

Introduction to Fourier Transform, The Discrete Fourier Transform, some properties of two dimensional Fourier transform: Separability, translation, periodicity & conjugate symmetry, rotation, distributive and scaling, average value, Laplacian, convolution and correlation, sampling. **The Fast Fourier Transform:** FFT algorithm, number of operations, the inverse FFT, implementation. **Other Separable Image Transforms:** Walsh Transforms, Discrete Cosine Transform, Hadamard Transform, the Haar & Slant transform.
Study of basic functions of image processing toolbox of Matlab software

Reference Books-

1. Research in education, By J W Best and J V Kann.Pearson/Allyn and Bacon.
2. Research Methodology- Methods and Techniques, CK Kothari, New Age International.
3. Solarphotovoltaic's: Fundamentals, Technologies and Applications, C.S.Solanki, 2nd Edition, Prentice hall of India,2011.
4. Solar cells: Operating principles,technology and system applications, by Martin A. Green, Prentice- hall Inc, Englewood Cliffs, NJ,USA,
5. Physics of Solar Cells: From Basic Principles to Advanced Concepts Peter Würfel Wiley-VCH; 1 edition
6. Organic Electronics:Materials, Manufacturing, and Applications Hagen Klauk Wiley-VCH;1edition
7. Organic Molecular Solids Markus Schwoerer(Author), Hans Christoph Wolf, Wiley- VCH;1 edition (March 27, 2007)
8. Semiconductor Devices Modeling and Technology" by Nandita Das Gupta Amitava DasGupta,Prentice Hall of India Pvt.Ltd.
9. Digital image processing: Gonzalez and Woods,2nd Edition, Pearson EducationPublication
10. Fundamental of Digital Image processing-A.K. Jain,PHI.

Ph.D. P2 Paper – II

Review of Literature Concerned Subject, Seminar/Project Report

Course Objective:

- To introduce basic concept of writing the research article
- To develop the understanding of literature review in the specific field of electronics.

Course Outcomes:

- Student will able to design, analyse, and present the research work.

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- Student will also able to develop the skill to write research and review paper, research projects, thesis and technical article etc.

Activities with direct bearing on Employability/ Entrepreneurship/ Skill development:

It helps in Skill Development of Review of Literature

Review of Literature in Concerned Subject, Seminar/ Project Report

Review work related to latest developments in any related field excluding Ph.D. thesis topics.

The student should submit a detailed report of the review work and deliver a seminar before submission of report and final seminar.

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