



CURRICULUM & SYLLABUS



Doctor of Philosophy (Ph.D.)
IN
ELECTRONICS AND COMMUNICATION
ENGINEERING

[w. e. f. 2025-2026]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
39, Rajiv Gandhi Education City, Sonapat
Haryana-131029



Program core	Total Credits
	14

Note:

1. All the subjects of course work are categorized in to four (04) groups. The Ph.D. candidate can choose the any two subjects within any group from the different groups (group-I, group-II and group-III) based on his/her specialization of Ph.D. work. The subjects listed in that particular group will be applicable for his/her course work examination.
2. Subject of group-IV is compulsory for all the Ph.D. candidates for their course work examination.



List of Courses:

S. No.	Course-Code	Title	Hrs./Week			Credits	Exam Hrs.	Max. Marks	
			L	T	P			Internal	External
Group-I									
1.	25PEC-0101	Digital VLSI Design	4	0	0	4	3	40	60
2.	25PEC-0102	Logic Behavior and Synthesis	4	0	0	4	3	40	60
3.	25PEC-0103	Analog VLSI Design	4	0	0	4	3	40	60
Group-II									
3.	25PEC-0104	Advance Radiation Systems	4	0	0	4	3	40	60
4.	25PEC-0105	Microwave and Optical Communication, Components and Devices	4	0	0	4	3	40	60
	25PEC-0106	Advance Electromagnetic Theory and Applications	4	0	0	4	3	40	60
Group-III									
5.	25PEC-0107	Digital Image Processing	4	0	0	4	3	40	60
6.	25PEC-0108	Fuzzy Logic Based Control	4	0	0	4	3	40	60
	25PEC-0109	Advance Digital Signal Processing	4	0	0	4	3	40	60
Group-IV (Compulsory)									
7.	RES701	Research Methodology	4	0	0	4	3	40	60
8.	RPE100	Research and Publication	2	0	0	2	3	40	60
TOTAL CREDITS			14						



Subject Code:25PEC0101

Subject: Digital VLSI design

Unit No.	Particulars	Contact hours
1.	<p>Physics and Modeling of MOSFETs: Basic MOSFET Characteristics – Threshold Voltage, Body Bias concept, Current-Voltage Characteristics – Square-Law Model, MOSFET Modeling – Drain-Source Resistance, MOSFET Capacitances, Geometric Scaling Theory – Full-Voltage Scaling, Constant-Voltage Scaling.</p> <p>Fabrication and Layout of CMOS Integrated Circuits: Overview of Integrated Circuit Processing – Oxidation, Photolithography, Self-Aligned MOSFET, Isolation and Wells – LOCOS, Trench Isolation, CMOS Process flow, Mask design and Layout – MOSFET Dimensions, Design Rules, Latch-up.</p>	8
2.	<p>CMOS Inverter: Basic Circuit and DC Operation – DC Characteristics, Noise Margins, Layout considerations, Inverter Switching Characteristics – Switching Intervals, High-to-Low time, Low-to-High time, Maximum Switching Frequency, Transient Effects on the VTC, RC Delay Modeling, Elmore Delay, Output Capacitance, Inverter Design – DC Design, Transient Design, Driving Large Capacitive Loads.</p> <p>Switching Properties of MOSFETs: nMOSFET/pMOSFET Pass Transistors, Transmission Gate Characteristics, MOSFET Switch Logic, TG-based Switch Logic, D-type Flip-Flop.</p>	8
3.	<p>Static CMOS Logic Elements: Complex Logic Functions, CMOS NAND Gate, CMOS NOR Gate, Complex Logic Gates, Exclusive OR and Equivalence Gates, Adder Circuits, Pseudo n-MOS Logic Gates, Schmitt Trigger Circuits, SR and D-type Latch, CMOS SRAM Cell, Tri-state Output Circuits.</p> <p>Power Dissipation in CMOS Digital Circuits: Dynamic Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Glitching Power Dissipation, Static Power Dissipation – Diode Leakage Current, Sub-threshold Leakage Current.</p>	8
4.	<p>Dynamic Logic Circuit Concepts and CMOS Dynamic Logic Families: Charge Leakage, Charge Sharing, Dynamic RAM Cell, Bootstrapping, Clocked-CMOS, Pre-Charge/ Evaluate Logic, Domino Logic, Multiple-Output Domino Logic, NORA Logic, Single-Phase Logic.</p>	8
5.	<p>Effects of Technology Scaling on CMOS Logic Styles: Trends and Limitations of CMOS Technology Scaling – MOSFET Scaling Trends, Challenges of MOSFET Scaling – Short-Channel Effects, Subthreshold Leakage Currents, Dielectric Breakdown, Hot Carrier effects, Soft Errors, Velocity Saturation and Mobility Degradation, DIBL, Scaling down V_{dd}/V_{th} ratio.</p>	8



Subject Code:25PEC0102

Subject: Logic behavior and synthesis

Unit. No.	Particulars	Contact hours
1.	<p>Introduction: Concepts of Hardware Description Languages and logic synthesis.</p> <p>Logic synthesis: Design cycle, types of synthesizers, design testing and verification, design optimization techniques, technology mapping, VHDL design hierarchy, objects, types and subtypes, design organization, VHDL design cycle.</p>	8
2.	<p>RTL Level Design: RTL design stages, VHDL description of the RTL design.</p> <p>Combinational Logic: Design units, entities and architectures, simulation and synthesis model, signals and ports, simple signal assignments, conditional signal assignments, selected signal assignment.</p> <p>Types: Synthesizable types, standard types, standard operators, scalar types, records, arrays, attributes.</p> <p>Operators: standard operators, operator precedence, Boolean operators, comparison operators, arithmetic operators, concatenation operators.</p>	8
3.	<p>Package std_logic_arith: std_logic_arith package, making the package visible, contents of std_logic_arith, resize functions, operators, shift functions, type conversions, constant values, mixing types in expressions, numeric packages.</p> <p>Sequential VHDL: Processes, signal assignments, variables, if statements, case statements.</p> <p>Registers: Simulation and synthesis model of register, register templates, clock types, gated registers, resettable registers, simulation model of asynchronous reset, asynchronous reset templates, registered variables.</p> <p>Hierarchy: Role of components, using components, component instances, component declaration, Configuration specifications, default binding, binding process, component packages, generate statements.</p>	8
4.	<p>Sub programs: Functions, type conversions, procedures, declaring subprograms.</p> <p>Test Benches: Test benches, verifying responses, clocks and resets, printing response values, reading data files, reading standard types, error handling.</p> <p>Libraries: Standard libraries, organizing files, library names, library work, incremental compilation.</p>	8
5.	<p>Basic principles of Combinational logic design, sequential logic design, arithmetic circuit design and control logic design.</p>	8



Subject Code: 25PEC 0103

Subject: Analog VLSI Design

Unit No.	Particulars	Contact Hours
1	<p>Basic MOS Device Physics: MOS IV Characteristics, second order effects, short-channel effects, MOS Device Models, Review of small signal MOS Transistor Models, MOSFET Noise.</p> <p>Analog MOS, Process: Analog CMOS Process (Double Poly Process), Digital CMOS Process tailored to analog IC fabrication, Fabrication of active Devices , Passive Devices and interconnects, analog layout techniques, symmetry, multi-finger transistors, passive devices : capacitors and resistors, substrate coupling, ground bounce.</p>	8
2	<p>Single Stage Amplifier: Common source Stage, Source Follower, Common Gate Stage, Cascode, Folded Cascode.</p> <p>Differential Amplifier: Single Ended and Differential Operation, Qualitative and Quantitative Analysis of Differential Pair, Common Mode Response, and Gilbert Cell.</p> <p>Current Sources and Mirrors: Current sources, basic current mirrors, cascade current mirrors, Wilson current mirrors large V signal and small-signal analysis.</p> <p>Frequency Response of Amplifiers: Miller Effect, Association of Poles with Zeros , Frequency Response of All Single Stage amplifiers.</p>	8
3	<p>Voltage References: Different Configurations of Voltage References, Major Issues, Supply Independent Biasing , Temperature-Independent References.</p> <p>Feedback : General Considerations , Topologies, Effect of loading.</p> <p>Operational Amplifier: General Considerations Theory and Design, Performance Parameters, Single –stage Op Amps, Two -stage Op-Amps, Design of 2- stage MOS Operational Amplifier, Gain Boosting, Comparison of various topologies.</p>	7
4	<p>Stability and Frequency Compensation: General Considerations, Multi-Pole systems Phase Margin, Frequency Compensation, Compensation techniques.</p> <p>Noise: Noise Spectrum, Sources, Types, Thermal and flicker noise, Representation in circuits, Noise Bandwidth, Noise Figure.</p> <p>Switched-Capacitor Circuits: Sampling Switches, Speed Considerations, Precision Considerations, Charge Injection Cancellation, Switched-Capacitor Amplifiers, Switched-Capacitor Integrator, Switched-Capacitor Common- Mode Feedback. Packaging materials.</p>	9
5	<p>Non Linearity and Mismatch: Nonlinearity of Differential Circuits, Effect of Negative Feedback, Capacitor Nonlinearity, Linearization Techniques, Offset Cancellation Techniques, Reduction of Noise by Offset Cancellation.</p> <p>Laboratory: Review of Tanner Tools. Analysis of Various Analog Building Blocks such as, Current and voltage References/Sources, Current Mirrors, Differential Amplifier, Output Stages, Design and</p>	8



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Subject Code:25PEC0103

Subject: Advance Radiation Systems

Unit. No.	Particulars	Contact hours
1.	Basics Concepts of Radiation: Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-Current distribution of Antennas, Impedance concept-Balanced to Unbalanced transformer	8
2.	Radiation from Apertures: Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinet's principle, Geometrical theory of diffraction, Reflector antennas, and Design considerations - Slot antennas	8
3.	Synthesis of Array Antennas: Types of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array patterns, Continuous aperture sources, Antenna synthesis techniques	8
4.	Micro Strip Antennas: Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Microstrip dipole, Microstrip arrays	8
5.	EMI S/EMC/Antenna Measurements: Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Travelling Wave antenna, Antenna measurement and instrumentation, Amplitude and Phase Measurement, Gain, Directivity. Impedance and polarization measurement, Antenna range, Design and Evaluation	8

Text Books:

1. Kraus.J.D., "Antennas" 2nd edition, John Wiley and Sons, 2002.
2. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 2005

Reference Books:

3. Collin.R.E. and Zucker.F., "Antenna Theory" Part I, Mc Graw Hill, New York, 1996.
4. R..C.Hansen, "Phased Array Antennas", John Wiley & Sons, 1998



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Subject Code:25PEC0104

**Subject: Microwave and Optical Communication
Components and Devices**

Unit. No.	Particulars	Contact hours
1.	Review of Semiconductor properties, Principles of Microwave devices, Microwave BJTs. GaAs FETs, low noise and power GaAs FETs and their applications. Microwave Mixers. Gunn diodes, IMPATT diodes; TEAPATTs; BARPATTs; mixer diodes; Step recovery diodes; Introduction to epitaxial growth for these structures; elements of device fabrication. MESFETs; Transport in low dimensional structures: HEMTs, Design of high frequency amplifiers and oscillators, RTD oscillators.	10
2.	Microwave Waveguides: Rectangular and Circular waveguides, Microwave cavities, Directional couplers, circulators and oscillators, Klystron, Magnetron and TWT amplifiers, Microwave IC's.	10
3.	LED and LASER diodes, Light source materials, Quantum efficiency, light coupling, Hetero structure LED and LASER diodes, SQW and MQW LASERS, Photodiodes, p-i-n photodiodes, APDs, Metal-Semiconductor-Metal(MSM) Photo detectors.	10
4.	Connectors and Amplifiers: Fiber joints, Joint Loss, Fiber Splices, Fusion Splices, Mechanical Splices, Fiber connectors, ferrule connectors, Biconical ferrule connectors, Double eccentric connectors, Expanded beam connectors, Fiber couplers, Three port couplers, Four port couplers, Star couplers. Optical amplifiers, Semiconductor laser amplifiers and Fiber amplifiers. Integrated optics, Beam splitters, Directional couplers, switches, Modulators, Opto-electronic integration, Optical bistability.	10

Text Books:

1. S.Y. Liao, Microwave Circuit Analysis and Amplifier Design, Prentice Hall.
2. G.D. Vendelin, A.M. Pavio, U.L. Rohde, Microwave Circuit Design, Using Linear and Non-linear Techniques, John Wiley.
3. Y. Konishi, Microwave Integrated Circuits, Marcel Dekker.
4. Optical Fiber Communication - G. Keiser, McGraw Hill.
5. Optical Fiber Communications, Principles & Practice - J.M. Senior, PHI.



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Subject Code: 25RFC-101

Subject: Applied Electromagnetics & Applications

Unit No.	Particulars	Contact Hours
1	Electromagnetic Field & Waves: Physical interpretation of gradient divergence & curl, Gauss Law & Stokes theorem, Time varying field & Maxwell's equations, Boundary conditions, wave equations & its solution, Energy & power.	8
2	Transmission Line Theory: General Transmission Line (TL) equations, Wave Characteristics on finite TL, Transients on TL, TL Impedance matching, Some application of TL.	8
3	Waveguide & Resonators: General Solutions for TEM, TE & TM waves, parallel-plate waveguide, rectangular waveguides, circular waveguides, surface wave on a grounded dielectric slab, strip line, transverse resonance technique, wave velocities, dispersion, series & parallel resonant circuits, TL resonators, Rectangular Circular waveguide cavities, dielectric resonators, excitation of resonators.	7
4	Electromechanical Dynamics (Field, Forces & Motion): Field & moving media, magnetic diffusion & charge relaxation, force densities & stress tensor including magnetization, polarization, propagation & stability of electromechanical waves and charge transport phenomenon.	9
5	Biological Effects of EM Field: Clinical utilization of electromagnetic field effect, medical application of microwave technique, microwave hyperthermia, biomedical application of electromagnetic fields, Measurement techniques for the characterization of biological materials.	8

Text Books:

1. D. M. Pozar: Microwave Engineering, 3rd Edition, Wiley Publications.



Subject Code:25 PEC0105

Subject: Digital Image Processing

Unit. No.	Particulars	Contact hours
1.	<p>Review of Digital Image Processing (DIP) Fundamentals and Filtering : Review of DIP basics and systems, sampling and Quantization, Representation of digital images, spatial and Gray-level resolution, Relationships between pixels: neighbours of pixel, Adjacency, connectivity, regions, and boundaries, distance measures, Image operations on a pixel basis.</p> <p>Intensity Transformations and Spatial Filtering: Intensity Transformation Functions: Image negatives, log transformations, Power-Law(Gamma) transformations, piecewise Linear Transformation functions; Histogram Processing: Histogram Equalization, Histogram Matching (Specifications), Local Histogram Processing, Using Histogram Statistics for Image Enhancement, spatial filtering: Spatial Correlation and Convolution, Vector Representation of Linear filtering, Generating Spatial Filter Masks, Smoothing Spatial Filters: Smoothing Linear Filters, Order Statistics (Nonlinear) Filters; Sharpening Spatial Filters: Using the second derivative for Image Sharpening-The Laplacian; Unsharp Masking and High boost Filtering.</p>	8
2.	<p>Image Filtering in Frequency Domain, Wavelets and Multi Resolution Processing</p> <p>Filtering in Frequency Domain: Relationship between the sampling and Frequency intervals, 2-D Impulse and shifting Properties, 2-D Sampling & 2-D Sampling Theorem, Aliasing in Images, 2-D Discrete-Fourier Transform and its Inverse, Properties of 2-D DFT, Additional Characteristics & Filtering Fundamentals in the frequency domain, correspondence between filtering in the spatial and frequency domains; Smoothing frequency domain filters: Ideal Low pass Filters, Butterworth Low pass Filters, Gaussian Low pass Filters; sharpening frequency domain filters: Ideal High pass Filters, Butterworth High pass Filters, Gaussian High pass Filters, Laplacian in Frequency Domain; Unsharp Masking, High boost Filtering, and High Frequency Emphasis Filtering, Homomorphic filtering, Implementation of DFT: computing 2-D DFT using 1-D DFT Algorithm, Computing IDFT using DFT Algorithm.</p> <p>Wavelets and Multi Resolution Processing: Introduction, Multi resolution Expansions, Wavelet Transforms in One Dimension: Wavelet Series Expansion, Discrete Wavelet Transform, Continuous wavelet transform, The Fast Wavelet Transform, Wavelet Transforms in two Dimensions, Wavelet Packets.</p>	8

3.	<p>Image Restoration and Reconstruction</p> <p>Restoration in presence of Noise only: A model of the image degradation/restoration process, Noise models: Spatial and frequency properties of noise, some important noise probability density functions, Periodic Noise, Estimation of Noise Parameters; Restoration in the presence of noise only spatial filtering: Mean Filters, Order Statistic Filters, Adaptive Filters; Periodic noise reduction by frequency domain filtering: Band reject Filters, Band pass Filters, Notch Filters</p> <p>Restoration in presence of Degradations: Linear, Position Invariant Degradations, Estimating the Degradation Function: Estimation by Image Observation, Estimation by Experimentation, Estimation by Modelling; Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering</p>	8
4.	<p>Image Compression & Segmentation</p> <p>Image Compression: Fundamentals: Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, measuring Image Information, Fidelity Criteria, Image Formats, Containers, and Compression Standards; Basic Compression Methods: Huffman Coding, Arithmetic Coding, LZW Coding, Run length Coding, Symbol Based Coding, Bit Plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding, Digital Image Watermarking.</p> <p>Image Segmentation: Detection of Discontinuities: Point, Line, and Edge detection, Boundary detection, Thresholding: Role of Illumination, basic global thresholding, Optimum global Thresholding using Otsus method, Using Image Smoothing to improve global thresholding, Using Edges to improve global thresholding, Multiple thresholds, Variable Thresholding, Multivariable Thresholding, Regional Based segmentation: Region growing, region splitting and merging, Segmentation Using Morphological Watersheds: Background, Dam Construction, Watershed Segmentation Algorithm, Use of Markers, use of motion in segmentation: Spatial Techniques, Frequency Domain Techniques.</p>	8

Text and Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing , Pearson
2. Anil KJain, Fundamentals of Digital Image Processing ,PHI Edition1997.
3. Keenneth R Castleman, "Digital Image Processing , Pearson
4. Chanda & Majumder, Digital Image Processing & Analysis , PHI



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Subject Code:25PEC0106

Subject: Fuzzy Logic Based Control

Unit. No.	Particulars	Contact hours
1.	Introduction: A prologue to intelligent control; The all-pervasive uncertainty; role of heuristics; Fuzzy Knowledge Based Control (FKBC) from an industrial perspective; Benefits of fuzzy control; Early and recent major applications of fuzzy theory, Industrial and consumer products applications. The Mathematics of Fuzzy Control: Definition of a Fuzzy set; Membership Function and their genesis; Methods to obtain mfs; Differentiating fuzzy and probability theory; Similarities and dissimilarities between classical set theory, probability theory and fuzzy set theory; Operations on fuzzy sets and their context sensitiveness.	8
2.	Essential Elements of Fuzzy Logic Controllers (FLCs): Structure of Mamdani Fuzzy Controller; Rationale for normalization and denormalization; Fuzzification; Singleton; N-valued logic, Fuzzy Logic; Classical inference rules; Classical and fuzzy implication; Classical and fuzzy relation; Composition of fuzzy relations; Max-min, Max-product and Max-avg. compositions; Approximate Reasoning or Fuzzy Inferencing; Fuzzy inference rules: Compositional rule of inference, Composition based inference and Individual rule-based inference; Defuzzification. Design of FLC: Choice of input and output variables; Choice of content of rules; Choice of term sets and Universe of Discourse; Choice of scaling factors and membership functions; Choice of fuzzification; Derivation of rules; Choice of defuzzification procedure; Centre-of-area / gravity, Centre-of-sums, Centre-of-largest-area, First-of-maxima, Middle-of-maxima, and Height defuzzification.	8
3.	Nonlinear, PID-like and TSK FLC: Myths and facts about nonlinear fuzzy control; Linear and nonlinear rules, The two ways of introducing nonlinearity in fuzzy rules. The FLC as a non-linear transfer element (mathematical proof of each block's nonlinearity/linearity); Distinction between PID-like FLC and FLC of PID type; Structure of TSK FLC and differences from Mamdani type FLC.	8
4.	Adaptive Fuzzy Control: Rationale for adaptive FLC; Extra components in adaptive FLC; Tunable parameters; Design and performance evaluation; The process monitor (Performance measures and Parameter estimators); The adaptation mechanism (altering sfs, fuzzy set definitions, rules); The main approaches to design: mf tuning using Gradient descent / Steepest Descent Algorithm (SDA); mf tuning using performance criterion; The Self Organizing Fuzzy Controller (SOFC): Performance monitor, Adaptation algorithm.	8

Text Books: 1. D. Driankov, H. Hellendoorn and M. Reinfrank, "An Introduction to Fuzzy Control," Narosa Publishing House, New Delhi.

Reference Books: 1. Timothy Ross, "Fuzzy Logic with Engineering Applications," Tata McGraw Hill. 2. Kandel and G. Ingholz, "Fuzzy Control Systems," Narosa Book Distributors Pvt. Ltd., New Delhi.



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Subject Code: 25RFE-105
Advance Digital Signal Processing

Subject:

Unit No.	Particulars	Contact Hours
1	Discrete Time Signal & System: Discrete time signal- sequences, Discrete time systems, LT1 system, Frequency domain representation of discrete time signal, constant coefficients difference equation.	8
2	Orientation of DSP: Introduction of programmable signal system (DSP tasks; DSP processors and embodiments), Numeric Representation and Arithmetic Operation format (Fixed point and floating point representation), Extended precision, floating point emulation, Q-notation, Fixed point and floating point arithmetic operations.	8
3	Digital Signal Processing: Architecture of Programmable Digital Signal Processors (CPU-Data and program memory features Peripheral interfacing/Execution control), Digital signal processor specific assembly language programming (Instruction types; addressing modes, assembly language programming for specific fixed/floating point DSP processor, pipelining)	7
4	Transform and Advanced DSP Algorithm: Z-Transform and properties, RCO, Inverse Z- Transform, Recursive and non-recursive system, Algorithm for Convolution and FFT, DFT & IDFT Algorithm, Method for generation of elementary functions, pseudorandom number generation software.	9
5	Low Power DSP Processor Design: Design for Low power DSP processor, sources of power consumption in a programmable DSP/Software power estimation, Software techniques for low power.	8

Text Book:

1. Steven W. Smith, "Digital Signal Processing: A Practical Guide for Engineers and Scientists", Elsevier, 2003.

Reference Books:

1. John G. Proakis, "Digital Signal Processing Principles, Algorithms and Applications", 4th edition, PHI 2007.
2. Lawrence R. Rabiner, Bernard Gold, "Theory and Application of Digital Signal Processing", PHI 2001.
3. Roberto Cristi "Modern Digital Signal Processing", Thomson Brooks/Cole, 200



Subject Code: RES701

Subject: RESEARCH METHODOLOGY



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Unit No.	Particulars	Contact Hours
1	Introduction to Research Introduction, Philosophical Underpinnings, Meaning of Research, Objectives of Research, Motivations in Research, Types of Research, Research Approaches, Significance of Research, Scope of Research, Literature Review, Research Methods vs. Research Methodology, Research Process, Research and Scientific Methods, Criteria of Good Research, Research Questions, Research problem, Selecting the Problem, Necessity and Techniques of Research Problem, Qualitative & Quantitative Research, Research Proposal, Synopsis, Transdisciplinarity, Multidisciplinarity & Interdisciplinarity in Research.	8
2	Data Collection & Sampling Collection of Primary Data/Sources, Secondary Data/Sources, Observation Method, Interview, Libraries, Archives & Repositories, Questionnaire, Schedules, Case Study and other Innovative Methods, Research Procedure. Sampling, Steps and Criteria for selecting a Sample procedure, Characteristics of Good Sampling, Types of Sample Design, Selecting Random Samples, Complex Random Sampling Design.	8
3	Data Analysis & Interpretation Measures of Central Tendency, Dispersion, Correlation & Regression, Chi-Square Test: applications, Steps, Characteristics, Limitations, Analysis of Variance & Co-variance. Hypothesis: Meaning, Basic Concepts, Flow Diagram, Testing, of Means, Testing of Hypothesis testing of Correlation coefficients, Limitations of Tests of Hypothesis. Theory & Empirical approaches, Ethnographic, Comparative and Interpretative Research.	7
4	Research Tools & Ethics in Research Computer Fundamentals, Basics, Data Representation, Word Processing Package, Creating & Editing a Word Document. Ethical issues related to Publishing & Plagiarism, LaTeX tool for Detection& Elimination of Plagiarism, Intellectual Property Rights, Copy Rights & Patent Laws.	9
5	Research Report & Presentations Structure & Components of Research Report, Types of Report, Layout of Research Report, Mechanism of Writing a Research Report. Presentation: Tailoring the presentation to the target audience, Oral Presentation, Poster Presentation, Submission of Research Article, Thesis Writing, Visual& Delivery.	8



Text books

- Adam Pzreworsky and Frank Solomon. *On the Art of Writing Proposals*, rev. edn, New York, 1995.
- Blaxter Loraine, Hughes Christina and Tight Malcolm. *How to Research*, Open University Press, 2006. Gerard Guthrie. *Basic Research Methods*, Sage, London, 2010.

Reference books:

- Kothari, C. R. *Research Methodology: Methods and Techniques*, New Age Publishers, Delhi, 2018.
- Rand R. Wilcox, *Fundamentals of Modern Statistical Research*, Springer, New York, 2010.
- Ross, Timothy J. *Fuzzy Logic with Engineering Applications*, 2ndEdn. Wiley Publications, 2005.



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Subject Code: RPE 100

Subject: Research and Publication Ethics

Unit No.	Particulars	Contact Hours
1	<p>PHILOSOPHY AND ETHICS</p> <p>Introduction to philosophy: definition, nature and scope, concept, branches</p> <p>Ethics: definition, moral philosophy, nature of moral judgments and reactions</p>	3
2	<p>SCIENTIFIC CONDUCT</p> <p>Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP), Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data</p>	5
3	<p>PUBLICATION ETHICS</p> <p>Publication ethics: definition, introduction and importance, Best practices / standards setting initiatives and guidelines: COPE, WAME, etc., Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice-versa, types, Violation of publication ethics, authorship and contributorship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals</p>	7
4	<p>OPEN ACCESS PUBLISHING</p> <p>Open access publications and initiatives, SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies, Software tool to identify predatory publications developed by SPPU, Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.</p>	4
5	<p>PUBLICATION MISCONDUCT</p> <p>(A) Group Discussions</p> <ol style="list-style-type: none"> 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest 3. Complaints and appeals: examples and fraud from India and abroad <p>(B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools</p>	4
6	<p>DATABASES AND RESEARCH METRICS (7hrs.)</p> <p>(A) Databases</p> <ol style="list-style-type: none"> 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. <p>(B) Research Metrics</p>	7



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	<ol style="list-style-type: none">1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score2. Metrics: h-index, g index, i10 index, altmetrics	
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