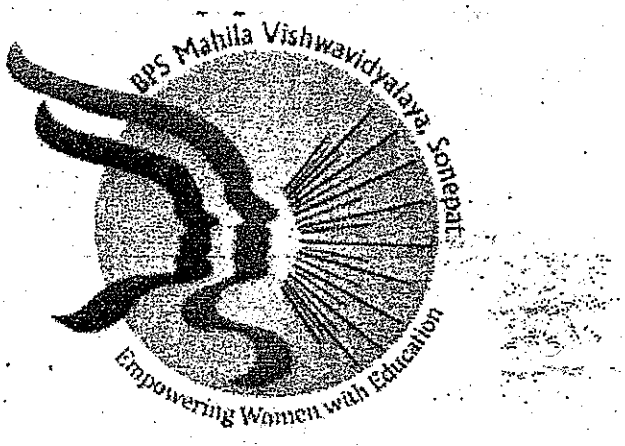
Annexure -36

BHAGAT PHOOL SINGH MAHILA VISHWAVIDYALAYA

(State University Established Under the Legislative Act No 31/2006)



SCHEME AND SYLLABUS

for

Ph.D Course Work

Under

FACULTY OF ENGINEERING & TECHNOLOGY

(w.e.f Session 2023-2024)

-633-

Faculty of Engineering and Technology
Bhagat Phool Singh Mahila Vishwavidyalaya,
Khanpur Kalan (Sonepat), Haryana-131305
Office No. 01263-283124, www.bpsmv.ac.in

Scheme and syllabi Ph.D Course work for Faculty of Engineering and Technology

S. No	Code	Course Title	Hrs/Week			Total Credit	Marks		Total Marks
			L	T	P		Internal Marks	External Marks	
1.	PHE-301	Research Methodology	4	0	0	4	20	80	100
2.	CPERPE-2203	Research and Publication Ethics	2	0	0	2	10	40	50
3	*	Department Specific Domain Core Course	4	0	0	4	20	80	100
4	PHE-302	Literature Survey and Seminar	2	0	0	2	50	--	50
Total			**12**	**0**	**0**	**12**	**100**	**200**	**300**

Note:-

- The duration of the Pre-Ph.D. course will be of one semester.
- Each student will have to opt one Departmental Elective Course out of the list of Department Electives as per suitability related to the topic and area of research and domain of the study as suggested by supervisor. Moreover, the Supervisor in consultation with Chairperson and DRC may offer other Departmental Elective Course not included in the list of Department Electives as per suitability related to the area of research chosen by students and domain of the study as approved by DRC & PGBOS. The students will be allowed to use non-programmable scientific calculator. However, sharing/ exchange of calculator is prohibited in the examination.
- Electronic gadgets including cellular phones are not allowed in the examination
- After successful completion of pre- Ph. D course works, the Department will conduct the DRC for the registration of respective candidate with next six months.
- The Minimum passing marks for Ph.D Course work will be applicable as per Ph.D Ordinance

Research Methodology

PHE-301
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective:

1. To understand the role of research methodology in engineering.
2. To develop understanding of the basic framework of research in process, publication and patent scopes.
3. To develop an understanding of various research design and techniques.
4. Appreciate the components of scholarly writing and evaluate its quality.

Course Outcomes: The course will enable the student to:

1. Explain key research concepts and issues
2. Read, Comprehend, and explain research articles in their academic discipline.

Content

UNIT- I	
Methods and Types of Research, Research Methods vs Methodology, Types of research- Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Conceptual vs Empirical, Research Proposals – design and components.	
UNIT- II	
Meaning of Research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and Objectives of research problem, Approaches of investigations of solutions for research problem, data collection, analysis, interpretation, Necessary Instrumentations	
UNIT- III	
Nature of Intellectual Property: Patents, Designs, Trade and Copyright, Process of Patenting and Development: Technological research, innovation, patenting, development, International Scenario: International cooperation on Intellectual Property, Procedure for grants of Patents, Patenting under PCT.	
UNIT- IV	
Reporting, Documentation & Presentation: Scientific Document: Organization and writing of Research Papers, Short Communications, Review articles, monographs, technical and survey reports, authored books and edited books, format of research proposal.	
Suggested Text Books	
1.	Stuart Melville and Wayne Goddard, " Research Methodolgy: An introduction for Science & Engineering Students".
2.	Ranjit Kumar, 2nd Edition, "Research Methodolgoy: A step by step Guide for Beginners"

3.	T. Ramappa, " Intellectual Property Rights Under WTO", S. Chand, Latest Edition
4.	C.R. Kothari, "Research Methodolgy: Methods and Trends", New Age International, Latest Edition.

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

Research and Publication Ethics

CPERPE-2203
L T P
2 0 0

Total Credits: 2
Internal Marks: 10
External Marks: 40
Total Marks: 50

Course Objective:

1. Produce competent scholar for doing original and independent research.
2. To increase knowledge about the laws, regulations, and policies—government and institutional—and professional guidelines that govern the conduct of research.
3. To describe possible threats to research integrity in your work (what might tempt you to engage in misconduct?).
4. To familiarize the scholar with the professional and University resources for addressing ethical issues.

Course outcomes:

1. Understanding of publication ethics and knowledge of identifying research misconduct and predatory publications.
2. Knowledge of Indexing and citation databases.
3. Knowledge of open access publications and research metrics.
4. Knowledge of various plagiarism tools.

Content

UNIT- I
Philosophy and Ethics: Introduction to philosophy: definition, nature and scope, concept, branches; Ethics: definition, moral philosophy, nature of moral judgments and reactions **Scientific Conduct:** Ethics with respect to science and research, Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP), Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data
UNIT- II
Publication Ethics: 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 behavior and vice versa, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals
UNIT- III
Open Access Publishing: 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.

Publication Misconduct: Subject specific ethical issues, FFP, authorship ; Conflicts of interest ; Complaints and appeals: examples and fraud from India and abroad; Use of plagiarism software like Tumitin, Urkund and other open source software tools	
UNIT- IV	
Databases and Research Metrics: Databases- Indexing databases; Citation databases- Web of Science, Scopus, etc.; Research Metrics - Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score; Metrics: h-index, g index, i10 index, altmetrics journal database	
Suggested Text Books	
1.	Bird, A. (2006). Philosophy of Science, Routledge
2.	MacIntyre, Alasdair (17) A short History of Ethics, London
3.	P. Chaddah (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarised, ISBN: 978-937480865
4.	National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2009). On being a Scientist: A guide to Responsible Conduct in Research, Third Edition, national Academic press
5.	Resnik, D.B (2011), What is Ethics in Research & why is it important, National Institute of Environmental Health Sciences, 1-10, Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cm
6.	Becall, J (2012), Predatory publishers are corrupting open access. Nature, 489(7415),179.
7.	Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019).

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

Literature Survey and Seminar

PHE-302
L T P
2 0 0

Total Credits: 2
Internal Marks: 50

Total Marks: 50

Course Objectives:

1. Literature Survey and Seminar is preliminary steps towards research problem formulation, developing a research plan and preparation of draft synopsis. Each student will carry out the exhaustive literature survey and the review of the work done earlier on the topic of research under the guidance of supervisor/Faculty. It also focuses on important steps in research methods and developing a research plan.

Course outcome:-

The students will be able to do original research work and will learn the basic step of Review of Literature. They will be able to formulate research problem, developing a research plan and preparation of draft synopsis.

Literature Survey

Overview – What is literature survey, Functions of literature survey, sources of literature, various referencing procedures, developing a Bibliography, maintain literature data using Endnote, Identifying the gap areas from the literature review and research database, Searching for publications – Publication databases, search engines and patent databases, Find some/all of the references for a given paper, including those that are not on the web Online tools – google, CiteSeer, ACM Digital Library, IEEE, The on-line Computer Science bibliography, Survey papers, Searching patents

Formulating Problem Statement

1. Overview of research process: Formulating the Research Problem, Extensive Literature Review, Developing the objectives, preparing the Research Design Problem Formulation, Identifying variables to be studied, determine the scope, objectives, limitations and or assumptions of the identified research problem, Justify basis for assumption, Formulate time plan for achieving targeted problem solution including Sample Design, Collecting the Data, Analysis of Data, Generalization and Interpretation, preparation of the Report or Presentation of Results-Formal write-ups of conclusions reached.
2. Problem statement – Conditions and steps in selecting a research problem, Understanding the Key research area of interest, How to get new ideas (Criticizing a paper), Finding a good problem: Top-down and Bottom-up approach, Creative thinking techniques, Coming up with a problem statement
3. Defining objectives – How to find objectives, characteristics of objectives.

Developing a research plan: Exploration, Description, Diagnosis and Experimentation.

1. Developing a Research Proposal: Format of research proposal, Individual research proposal, Institutional proposal, Proposal of a student

Note:-

Internal assessment will be carried out by the involved respective faculty members on the basis of student's progress in literature review and problem formulation. Internal Assessment/ evaluation of the candidate will be carried out by internal board of examiner on the basis of literature review, proposal, presentation and viva voce. Candidates have to give presentation based on the literature survey, which will carry 50 marks each. The candidate shall submit the three copies of presentation to the office of department through the respective supervisor. The presentation having drafted synopsis involving problem formulation, literature review, research gap, plan of the research work related to the topic of research and will be conducted in the presence of Supervisor, Chairperson & Faculty Coordinator and open to all students of the department. Other faculty members may attend and give suggestions relevant to topic of research. The student will submit review of literature as well as drafted synopsis at the end of semester in a specified format duly signed by supervisor/Faculty.

Departmental subjects in Computer Science & Engineering

Department Specific Domain Core Course

S.No.	Course Code	Course Title
1	PHE-401	IOT and Cloud Computing
2	PHE-402	Optimization Techniques
3	PHE-403	Artificial Intelligence and Machine learning
4	PHE-404	Security in Computing
5	PHE-405	Data Analytics
6	PHE-406	Advances in Network Technologies

03/07/2024

IoT and Cloud Computing

PHE-401
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The objective of this course is:

- To learn core issues of Internet of Things, IOT communication protocols and security concerns.
- To study the fundamental concepts of cloud computing, enabling technologies, cloud service models and security concerns.

Pre-requisite: None.

Course Outcomes: At the end of the course, students will be able to:

- understand concepts, architecture, applications and design principles for connected devices in IoT;
- explain, analyze and design IoT-oriented communication protocols and security concerns
- understand core issues of cloud computing and enabling technologies;
- design services based on cloud computing platforms;

Content

Unit –I	**08 Hours**
Internet of Thing (IoT): overview, conceptual framework, architecture, major components, common applications Design principles for connected devices: Modified OSI Model for IoT/M2M systems, ETSI M2M Domains and High-level capabilities. wireless communication technologies - NFC, RFID, Bluetooth BR/EDR and Bluetooth low energy, ZigBee, WiFi, RF transceiver and RF modules. Data enrichment. data consolidation & device management at gateway.	
Unit –II	**10 Hours**
Design principles for web connectivity: web communication protocols for connected devices: constrained application protocol, CoAP Client web connectivity, client authentication, lightweight M2M communication protocol. Message communication protocols for connected devices - CoAP-SMS, CoAP-MQ, MQTT, XMPP. IoT privacy, security and vulnerabilities and their solutions.	
Unit –III	**10 Hours**
Cloud Computing: Definition, roots of cloud computing, characteristics, cloud architecture, deployment models, service models. Virtualization: Benefits & drawbacks of virtualization, server virtualization, virtualization of - operating system, platform, CPU, network, application, memory and I/O devices etc.	
Unit –IV	**10 Hours**
Cloud Computing Service Platforms – Compute services, storage services, database services, application services, queuing services, e-mail services, notification services, media services, content delivery services, analytics services, deployment & management services, identity & access management services and their case studies. Security in cloud computing: issues, threats, data security and information security	

Suggested Text Books	
1.	Dimitrios Serpnos, Marilyn Wolf. Internet of Things (IoT) Systems, Architecture, Algorithms, Methodologies, Springer
2.	Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on Approach), VPT
3.	Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications
4.	Arshdeep Bahga, Vijay Madisetti, Cloud Computing – A Hands-on Approach, University Press.
5.	Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing – Principles and Paradigms, Wiley India Pvt. Ltd.

– 642 –

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6.	Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hills
7.	Kai Hwang, Geoffrey C.Fox, and Jack J. Dongarra, Distributed and Cloud Computing, Elsevier India Private Limited
8.	Saurabh Kumar, Cloud Computing, Wiley India Pvt. Ltd.
9.	Shailendra Singh, Cloud Computing, Oxford
10.	Coulouris, Dollimore and Kindber, Distributed System: Concept and Design, Addison Wesley
11.	Michael Miller, Cloud Computing, Dorling Kindersley India
12.	Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud computing: A practical Approach, McGraw Hill

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Optimization Techniques

PHE-402
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The objective of this course is:

- Learn the aspects of optimization.
- Learn different biological optimization techniques.
- Learn the applications of Genetic Algorithms.

Pre-requisite: None.

Course Outcomes: At the end of the course, students will be able to:

- understand the role and principles of optimization techniques using LPP;
- solve problems based on artificial intelligence, fuzzy logic and fuzzy sets
- understand the basics and theorem of genetic algorithm
- able to implement genetic algorithms in different data structures

Content

Unit –I	**08 Hours**
Introduction: Goal of optimization, local and global optima, Multi-objective optimization, Problems in global optimization, Need of evolution, Biological terminology, Search spaces and fitness landscapes, Conventional Optimization and Search Techniques - Gradient-Based Local Optimization Method.	
Unit –II	**10 Hours**
Basic concepts of neuro-computing: Artificial Neural Network (ANN) and their biological roots and motivations, Learning Paradigms, ANN training Algorithms - perceptions, Training rules, Delta, Back Propagation Algorithm. Fuzzy Logic: Overview of Classical Sets & Fuzzy Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets, Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Fuzzy Equations.	
Unit –III	**10 Hours**
Genetic Algorithm(GA): Difference between Genetic Algorithm and traditional methods, Encoding, Initialization, Selection – elitism, rank selection, tournament selection, Boltzmann selection, steady state selection etc.; Crossover, mutation, Replacement; Schema theorem – schemata and masks, Wildcards, Holland's schema theorem and criticism; convergence.	
Unit –IV	**10 Hours**
Computer Implementation of Genetic Algorithm: Data Structures, Mapping objective functions to fitness form, Fitness scaling. Random Optimization: Simulated Annealing, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, Memetic Algorithms	
Suggested Text Books	
1.	S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley - India, 2007.
2.	Goldberg D. E., Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989.
3.	Mitchell M.; An Introduction to Genetic Algorithms, Prentice-Hall, 1998.
4.	Weise Thomas, Global Optimization Algorithms – Theory and Application, http://www.it-weise.de/projects/book.pdf

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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—644

Artificial Intelligence and Machine Learning

PHF-403
L T P
3 0 0

Total Credits: 3
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objectives:
The objectives of this course are:

- To introduce students to the basic principles and approaches of Machine Learning.
- To become familiar with regression methods and classification techniques.
- To understand a range of machine learning algorithms along their strengths
- To be able to apply machine learning algorithms to solve simple modern day problems.

Pre-requisite: None.

Course Outcomes: At the end of the course, students will be able to:

- Gain information regarding fundamental features of Machine Learning.
- Identify various machine learning mechanisms suitable for solution of given problem.
- Solve the required queries pertaining to AI using ML.
- Implement different machine learning techniques for the optimal solution.
- Develop application programming interface using machine learning.

Contents

Unit –I	**11 Hours**
Introduction to AI - Intelligent Agents, Problem-Solving Agents, Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search; Games - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution; Knowledge Engineering in First-Order Logic, Inference in First-Order Logic: Propositional vs. First-Order Inference.	
Unit –II	**10 Hours**
Machine Learning Fundamentals: Types; Supervised Learning (Regression/Classification) Unsupervised, Semi supervised, Reinforcement learning, Batch and Online Learning, Instance-Based Versus Model-Based Learning, Main Challenges of Machine Learning, Non-representative Training Data, Poor-Quality Data, Over fitting and Under fitting the Training Data, Testing and Validating, Hyper parameter Tuning and Model Selection, Data Mismatch.	
Unit –III	**9 Hours**
End-to-End Machine Learning Project and Classification: Look at the big picture, Get the data, Discover and visualize the data to gain insights, Prepare the data for Machine Learning algorithms, Select a model and train it, present the solution, Launch, monitor, and maintain your system, Training a Binary Classifier. Performance Measures, Multiclass Classification, Error Analysis, Multi label Classification, Multi output Classification.	
Unit –IV	**9 Hours**
Training Models and Support Vector Machines: Linear Regression, Gradient Descent and its types, Polynomial Regression, Learning Curves, Regularized Linear Models, Logistic Regression, Linear SVM Classification, Nonlinear SVM Classification (Polynomial Kernel, Adding Similarity Features, Gaussian RBF Kernel, Computational Complexity), SVM Regression, Decision Function and Predictions, Quadratic Programming, The Dual Problem.	
Suggested Text Books	
1.	Scikit-Learn, Keras, and Tensor Flow: Hands-On Machine Learning with Concepts, Tools, and Techniques to Build Intelligent Systems; 3rd edition, O'Reilly Publishers, 2022
2.	Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

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3.	Machine Learning For Absolute Beginners; Oliver Theobald, 2nd Edition, 2017 .
4.	Artificial Intelligence, 3rd Edn., E. Rich and K. Knight (TMH).
5.	Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
6.	Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (free online)

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Security in Computing

PHE-404
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The objective of this course is:

- To understand the basics of Cryptography and Network Security.
- To be able to secure a message over insecure channel by various means
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.

Pre-requisite: Basics of Computer Networks.

Course Outcomes: At the end of the course, students will be able to:

- Describe network security services and mechanisms.
- Symmetrical and Asymmetrical cryptography
- Data Integrity, Authentication, Digital signatures
- Various Network Security applications, Firewall, Web Security, Email Security, Etc.

Content

Unit –I	**10 Hours**
Basic Encryption and Decryption: Terminology And Background: Encryption, Decryption and Cryptosystems, Plain Text and Cipher Text, Encryption Algorithms, Cryptanalysis. **Introduction to Ciphers**: Monoalphabetic Substitutions such as Caesar Cipher, Cryptanalysis of Monoalphabetic Ciphers, Polyablphabetic Ciphers, Perfect Substitution Cipher such as the Vernam Cipher, Stream and block Ciphers, Characteristics of Good Ciphers: Shannon Characteristics Secure Encryption Systems **Public Key (Asymmetric Key) Encryption System**: Concept and Characteristics of Public key Encryption System, Introduction to Merkle- Hellman Knapsacks, RSA Encryption in detail, Introduction to Digital signature Algorithms, The Digital Signature Standard (DSA) **Secure Secret Key (Symmetric) Systems**: The Data Encryption Standard (DES), Analyzing and Strengthening of DES, Key Escrow and Clipper, Introduction to Advance Encryption Standard (AES).	
Unit –II	**7 Hours**
Applied Cryptography, Protocols and Practice Key Management Protocols: Solving Key Distribution Problem, Diffie- Hellman Algorithm, Key Exchange with Public Key Cryptography. Public Key Infrastructure (PKI): Concept of Digital Certificate, Certificate Authorities and its roles Legal Issues: Copyrights, Patents, Trade Secrets, Computer Crime, Cryptography and the Law	
Unit –III	**10 Hours**
Operating system, Database and Program Security **Operating System Security**: Security Policies, Models of Security, Security Features of Ordinary Operating System, Security Features of Trusted Operating System **Database Security**: Security Requirements of Databases, Reliability and Integrity, Protection of Sensitive Data **Program Security**: Kinds of Malicious Code, How Viruses Attach and Gain Control, Home for Viruses, Virus Signatures, Preventing Virus Infection, Trapdoors, Convert Channels.	
Unit –IV	**8 Hours**
Network Security Network Security Issues Such as Impersonation, Message Confidentiatility, Message Integrity, Message Integrity, Code Integrity, Denial of Service, Secure Communication Mechanisms Such as IPSec, PKI based Authentication and Kebreos Authentication	

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Web Security: Solving Privacy Problems, Solving Authentication Problems, Secure Software Layer (SSL) Protocol, Secure Electronic Transaction (SET) Protocol **Secure Electronic Mail**: Privacy Enhanced Email (PEM), Pretty Good Privacy (PGP) , Public Key Cryptography Standards- PKCS # 7	
Suggested Text Books	
1.	Charles P Pfleeger, " Security in Computing"
2.	Bruce Schnnier," Applied Crytography Protocols"
3.	Lincoln d Stein. " World Wide Web security FAQ"
4.	RSA Laboratories, " Cryptographic Message Syntax standards"
5.	William Stallings, " Network Security Principles", Pearson Education
6.	William Stallings, " Cryptographic Essentials", Pearson Education

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Data Analytics

PHE-405
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The objective of this course is:

To provide foundation for data analytics and application area related to it and understand the core concepts end emerging technologies.

Pre-requisite: None

Course Outcomes: At the end of the course, students will be able to:

- To explore the fundamental concepts of data analytics
- Understand the data analysis techniques for application handling large data.
- Visualize and present the inference using various tools
- Understand various machine learning algorithms used in data analytics process.

Content

Unit –I	10 Hours
Data Analytics - Types – Phases - Quality and Quantity of data – Measurement - Exploratory data analysis - Business Intelligence. BIG DATA Big Data and Cloud technologies - Introduction to HADOOP: Big Data, Apache Hadoop, MapReduce - Data Serialization - Data Extraction - Stacking Data - Dealing with data.	
Unit –II	**7 Hours**
Data Visualization Introduction to data visualization – Data visualization options – Filters – Dashboard development tools – Creating an interactive dashboard with dc.js - summary.	
Unit –III	**10 Hours**
Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms. The Evolution of Analytic Processes, The Evolution of Analytic, Processes The Evolution of Analytic Tools and Methods. Legacy Data, Hypothesis Testing, Prediction, Software, Complexity, Business problems suited to big data analytics.	
Unit –IV	**8 Hours**
Ethics And Recent Trends Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.	

Suggested Text Books

1.	Data Warehousing in the Age of Big Data by Krish Krishnan, Morgan Kaufmann.
2.	Big Data Analytics with R and Hadoop by Vignesh Prajapati
3.	Principles of Big Data Preparing, Sharing, and Analyzing Complex Information, 1 st Edition, by J Berman, published by Morgan Kaufmann
4.	"Big Data Analytics - From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph" By David Loshin, Morgan Kaufmann
5.	Big Data Analytics Using Splunk By Peter Zadrozny , Raghu Kodali, Apress 2013
6.	Franks, Bill, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley, 1st Edition, 2012.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

–649–

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Advances in Network Technologies

PHE-406
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The objective of this course is:

- Understand the concepts of networking, layered structure and protocols thoroughly.
- Understand the role of air interface for 5G technology
- Proficient about designing a 5G networking application.
- Learn and conceptualize low delay service, broadband, security in 5G network.

Pre-requisite: None.

Course Outcomes: At the end of the course, students will be able to:

- Understand and explain the channel models of 5G and the use cases for 5G.
- Analyze use of MIMO in 5G and its techniques.
- Draw and explain 5G architecture, its components and functional criteria.
- Understand device to device (D2D) communication and standardization.
- Study the in-depth functioning of 5G radio access technologies.

Contents

Unit –I	**08 Hours**
Introduction to computer networks: Reference Models: The OSI Reference Model, Example Networks: The Internet, Connection-Oriented Networks (X.25, Frame Relay & ATM), Ethernet. **Network Layer**: Network Layer Design Issues: Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit & Datagram Subnets. **Internetworking**: Networks Differences, Connecting Networks, Concatenated Virtual Circuits, Connection less Internetworking, Tunneling, Fragmentation.	
Unit –II	**08Hours**
Wireless Internet Networks access: Fiber optic network access technologies (FTTH, WDM-PON and EP2P); **IP Addressing, 5G channel modeling and use cases**: Modeling requirements and scenarios, Channel model, requirements, Propagation scenarios, Relaying multi-hop and cooperative communications: Principles of relaying, fundamentals of relaying, Cognitive radio: Architecture, spectrum sensing, Software Defined Radio (SDR).	
Unit –III	**11 Hours**
Multiple-input multiple-output (MIMO) systems: Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems; Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Spatial Multiplexing; **The 5G architecture**: Introduction, NFV and SDN, Basics about RAN architecture, High-level requirements for the 5G architecture, Functional architecture and 5G flexibility, Functional split criteria, Functional split alternatives, Integration of LTE and new air interface to fulfill 5G Requirements, Enhanced Multi-RAT coordination features	
Unit –IV	**11 Hours**
Device-to-device (D2D) communications: D2D: from 4G to 5G, D2D standardization: 4G LTE D2D, D2D in 5G: research challenges, Radio resource management for mobile broadband D2D, RRM techniques for mobile broadband D2D, RRM and system design for D2D, 5G D2D RRM concept, services, National security and public safety requirements in 3GPP and METIS. **The 5G radio-access technologies**: Access design principles for multi-user communications, Orthogonal multiple-access systems, Spread spectrum multiple access systems, Capacity limits of multiple-access methods, Sparse code multiple access (SCMA), Interleave division multiple access (IDMA), Radio access for dense deployments, OFDM numerology for small-cell deployments, Radio access for V2X communication	

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BPS Mahila Vishwavidyalaya, Khanpur Kalan, Sonepat (HR.)

Suggested Text Books	
1.	Data and computer communications - Stallings, W, Pearson/Prentice Hall, 2014. ISBN: 9780133506488
2.	5G Mobile and Wireless Communications Technology by Afif Osseiran, Jose F. Monserrat, Patrick Marsch, Cambridge University press, 2nd Edition, 2011
3.	Computer networks - Tanenbaum, A.S.; Feamster, N.; Wetherall, D.J, Pearson, 2021. ISBN: 9781292374062
4.	5G NR: The Next Generation Wireless Access Technology by Erik Dahlman, Stefan Parkvall, Johan Sko'ld; Elsevier Publications, 1st Edition, 2016
5.	Fundamentals of 5G Mobile Networks by Jonathan Rodriguez, Wiley Publications, 1st Edition 2010
6.	Data Communications and Networking with TCPIP Protocol Suite, by Behrouz A. Forozoun, TMH, 6th Edition, 2022

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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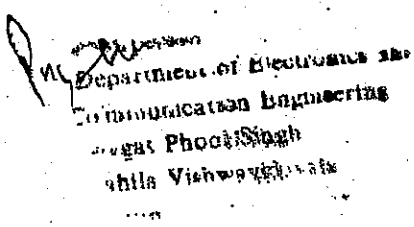
List of Courses offered by Department of Fashion Technology for Ph.D Course work

S.No	Course Code	Course Title
1	PHE-601	Evaluation of Textile Materials
2	PHE-602	Recent Developments in Apparel Technology
3	PHE-603	Textile Material & Process
4	PHE-604	Functional Textiles & Garments
5	PHE-605	Fashion Supply Chain

Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.	
UNIT- IV	
QUALITY OF SERVICE: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks. **ENERGY MANAGEMENT**: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes. WIRELESS SENSOR NETWORKS: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.	
Suggested Text Books	
1.	Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2.	Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control - Jagannathan Sarangapani, CRC Press

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.



Adhoc Wireless & Sensor Networks

PHE-511
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course objective:-

1. To understand the basics of Ad-hoc & Sensor Networks.
2. To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.
3. To understand the nature and applications of Ad-hoc and sensor networks.
4. To understand various security practices and protocols of Ad-hoc and Sensor Networks.

Course Outcomes: At the end of the course, students will demonstrate the ability:

1. To identify different issues in wireless ad hoc and sensor networks.
2. To analyze protocols developed for ad hoc and sensor networks.
3. To identify and address the security threats in ad hoc and sensor networks. Establish a Sensor network environment for different type of applications.
4. Appreciate the importance of Adhoc and sensor networks for applications like environment monitoring, habitat monitoring, health care and data acquisition systems.
5. Understanding of data transmission technologies of the Adhoc and sensor devices with focus on channel access routing and security.
6. Appreciate the need and importance of converged networks, ubiquitous environment and Internet of things in the context of Adhoc and sensor networks.

Content

UNIT- I	
Wireless LANS and PANS: Introduction, Fundamentals of WLANS, IEEE 802.11 Standard, HIPERLAN Standard, Bluetooth, Home RF. Wireless Internet: Wireless Internet, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web Over Wireless.	
UNIT-II	
AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet. MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.	
UNIT- III	
ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols. TRANSPORT LAYER AND SECURITY PROTOCOLS: Introduction, Issues in	

Chairperson
Department of Electronics & Communication Engineering
[illegible] Phool Singh

1.	Digital Signal Processing: Principals, algorithms and applications-J.G. Proakis & D.G.Monolokis, 4th ed.,PHI
2.	Discrete Time signal processing - Alan V Oppenheim & Ronald W Schaffer, PHI.
3.	DSP – A Pratical Approach – Emmanuel C.Ifeacher, Barrie. W. Jervis, 2 ed., Pearson Education.

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

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Guru Gobind Singh
Indraprastha Vishwavidyalaya
Delhi

Advanced Digital Signal Processing

PHE-510
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course objective:-

1. To study about discrete time systems and to learn about FFT algorithms.
2. To study the design techniques for FIR and IIR digital filters
3. To study the finite word length effects in signal processing
4. To study the properties of random signal, Multirate digital signal processing and about QMF filters

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. To have a deep understanding on basics of digital signal processing which can be applied to communication systems.
2. To design the Multirate Filters
3. Know the analysis of discrete time signals
4. To study the modern digital signal processing algorithms and applications.
5. Have an in-depth knowledge of use of digital systems in real time applications

Content

UNIT- I
Review of DFT, FFT, IIR Filters, FIR Filters, Multirate Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion, Applications of Multirate Signal Processing
UNIT-II
Non-Parametric methods of Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman & Tukey methods, Comparison of all Non-Parametric methods
UNIT- III
Parametric Methods of Power Spectrum Estimation: Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Waker & Burg Methods, MA & ARMA models for power spectrum estimation.
UNIT- IV
Linear Prediction : Forward and Backward Linear Prediction – Forward Linear Prediction, Backward Linear Prediction, Optimum reflection coefficients for the Lattice Forward and Backward Predictors. Solution of the Normal Equations: Levinson Durbin Algorithm, Schur Algorithm. Properties of Linear Prediction Filters, Finite Word Length Effects: Analysis of finite word length effects in Fixed-point DSP systems – Fixed, Floating Point Arithmetic
Suggested Text Books

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Mahila Vishwavidyalaya

C

TDM Bus- Space and Time Division Switching Combinations- Public Switched Telephone Network, Packet Switching- Datagram Approach- Virtual Circuit Approach- Circuit Switched Connection Versus Virtual Circuit Connection, Message Switching. Multiplexing: Time Division Multiplexing (TDM), Synchronous Time Division Multiplexing, Digital Hierarchy, Statistical Time Division Multiplexing. Multiple Access: Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Detection (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization- Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), - Code - Division Multiple Access (CDMA).

Suggested Text Books

1.	Data Communication and Computer Networking - B. A.Forouzan, 3rd ed., 2008, TMH.
2.	Advanced Electronic Communication Systems - W. Tomasi, 5 ed., 2008, PEI.
3	Data Communications and Computer Networks – Prakash C. Gupta, 2006, PHI.
4.	Data and Computer Communications - William Stallings, 8th ed., 2007, PHI.
5.	Data Communication and Tele Processing Systems – T. Housely, 2nd Edition, 2008, BSP.
6.	Data Communications and Computer Networks- Brijendra Singh, 2nd ed., 2005, PHI.

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

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Mahila Vishwavidyalaya

Advanced Data Communications

PHE-509
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course objective:-

1. To learn different types of digital modulation techniques.
2. To learn the basic concepts of data communication.
3. To learn the various error detection and correction codes and different types of protocols.
4. To learn the different types of switching and multiplexing techniques.
5. To learn the various multiple access techniques.
6. To develop an understanding of complete data communication and networking

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand different modulation schemes and concepts of data communication.
2. Understand various error detection and correction schemes, network topologies and protocols.
3. Understand various types of switching, multiplexing and access techniques.

Content

UNIT- I
Digital Modulation: Introduction, Information Capacity Bits, Bit Rate, Baud, and M-ARY Coding, ASK, FSK, PSK, QAM, BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.
UNIT-II
Basic Concepts of Data Communications, Interfaces and Modems: Data Communication- Components, Networks, Distributed Processing, Network Criteria- Applications, Protocols and Standards, Standards Organizations- Regulatory Agencies, Line Configuration- Point-to-point- Multipoint, Topology- Mesh- Star- Tree- Bus- Ring- Hybrid Topologies, Transmission Modes- Simplex- Half duplex- Full Duplex, Categories of Networks- LAN, MAN, WAN and Internetworking, Digital Data Transmission- Parallel and Serial, DTE- DCE Interface- Data Terminal Equipment, Data Circuit- Terminating Equipment, Standards EIA 232 Interface, Other Interface Standards, Modems- Transmission Rates.
UNIT- III
Error Detection and Correction: Types of Errors- Single- Bit Error, CRC (Cyclic Redundancy Check)- Performance, Checksum, Error Correction- Single-Bit Error Correction, Hamming Code. Data link Control: Stop and Wait, Sliding Window Protocols. Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocol- Binary Synchronous Communication (BSC) - BSC Frames- Data Transparency, Bit Oriented Protocols – HDLC, Link Access Protocols.
UNIT- IV
Switching: Circuit Switching- Space Division Switches- Time Division Switches-

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Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

Department of Electronics &
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Mahila Vishwavidyalaya

CMOS Analog & Mixed Signal Design

PHE-508
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course objective:-

1. To cover the fundamentals and mathematical models in digital image and video processing.
2. To develop time and frequency domain techniques for image enhancement.
3. To expose the students to current technologies and issues in image and video processing.
4. To develop image and video processing applications in practice.

Pre requisites: Signals and Systems, Digital Signal Processing

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image and video compression.

Content

UNIT-I	
Current Sources & Sinks: The cascade connection, sensitivity and temperature analysis, transient response, layout of simple Current Mirror, matching in MOSFET mirrors, other Current Sources/Sinks. Voltage dividers, current source self-biasing, band gap voltage references, Beta-Multiplier Referenced Self-biasing.	
UNIT-II	
Amplifiers: Gate Drain connected loads, Current Source Loads, Noise and Distortion, Class AB Amplifier. Feedback Amplifiers: Feedback Equation, properties of negative feedback and amplifier design, feedback topologies, amplifiers employing the four types of feedback, Stability.	
UNIT- III	
Differential Amplifiers: The Source Coupled pair, the Source Cross-Coupled pair, cascode loads, Wide-Swing Differential Amplifiers, Operational Amplifiers: Basic CMOS Op-Amp Design, Operational Trans conductance Amplifiers, Differential Output Op-Amp.	
UNIT- IV	
Non-Linear & Dynamic Analog Circuits: Basic CMOS Comparator Design, Adaptive Biasing, Analog Multipliers, MOSFET Switch, Switched Capacitor circuits: Switched Capacitor Integrator, dynamic circuits. Data Converter Architectures: Data Converter Fundamentals, DAC & ADC specifications, Mixed Signal Layout issues, DAC architectures, ADC architectures	

Suggested Text Books	
1.	CMOS Circuit Design, Layout and Simulation - Baker, Li, Boyce, 1st ed., TMH
2.	Analog Integrated Circuit Design – David A.Johns, Ken Martin, 1997, John-Wiley & Sons.
3.	Design of Analog CMOS Circuits – B. Razavi, MGH, 2003, TMH
4.	Analog MOS ICs for Signal Processing – R.Gregorian, Gabor. C. Temes, John Wiley & Sons.

660 —

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Mahila Vishwavidyalaya

Suggested Text Books	
1.	Digital Image Processing – Gonzaleze and Woods, 3rd ed., Pearson
2.	Video processing and communication – Yao Wang, Joem Ostermann and Ya–quin Zhang. 1st Ed., PH Int.
3.	Digital Video Processing – M. Tekalp, Prentice Hall International

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

Department of Electronics and Communication Engineering

Image & Video Processing

PHE-507
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective:-

1. To cover the fundamentals and mathematical models in digital image and video processing.
2. To develop time and frequency domain techniques for image enhancement.
3. To expose the students to current technologies and issues in image and video processing.
4. To develop image and video processing applications in practice.

Pre requisites: Signals and Systems, Digital Signal Processing

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image and video compression.

Content

Unit –I
Basic steps of Image Processing System Sampling and Quantization of an image – Basic relationship between pixels Image Transforms: 2 D- Discrete Fourier Transform, Discrete Cosine Transform (DCT), Wavelet Transforms: Continuous Wavelet Transform, Discrete Wavelet Transforms.
Unit –II
Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering. Image Segmentation Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region Based segmentation.
Unit –III
Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, JPEG Standards. Basic steps of Video Processing Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.
Unit –IV
Optical flow, General Methodologies, Pixel Based Motion Esimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

— 162 —

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Bhagat Phool Singh Mahila Vishwavidyalaya

Optimization & Heuristic Search Techniques

PHE-506
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The objective of this course is:

1. To learn about optimization problem and basic optimization issues.
2. To understand the concept of linear programming.
3. To understand various heuristic optimization techniques

Course Outcomes: At the end of the course, students will be able:

1. To know the concept of optimization problem and its issues.
2. To acquire the knowledge of heuristic optimization techniques.

Content

Unit –I	
INTRODUCTION: Historical Development, Engineering application of Optimization, Formulation of design problems as mathematical programming problems, classification of optimization problems.	
Unit –II	
LINEAR PROGRAMMING: Graphical method, Simplex method, Revised simplex method, Duality in linear programming (LP), Sensitivity analysis, other algorithms for solving LP problems, Transportation, assignment and other applications.	
Unit –III	
NON LINEAR PROGRAMMING: Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and indirect methods, Optimization with calculus, Khun-Tucker conditions.	
Unit –IV	
DYNAMIC PROGRAMMING: Introduction, Sequential optimization, computational procedure, curse of dimensionality. **HEURISTIC OPTIMIZATION TECHNIQUES**: Meta heuristic search methods: Genetic Algorithm based optimization, Simulated Annealing Techniques, Swarm Intelligent Algorithms, PSO, etc.	
Suggested Text Books	
1.	S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International (P) Ltd., New Delhi, 2000.
2.	K. Deb, "Optimization for Engineering Design - Algorithms and Examples", PrenticeHall ofIndia Pvt. Ltd., New Delhi, 1995.
3.	H.A. Taha, "Operations Research: An Introduction", 5th Edition, Macmillan, New York, 1992. • G. Hadley, "Linear programming", Narosa Publishing House, New Delhi, 1990.
4.	Modern Heuristic Optimization Techniques" by Kwang Y. Lee, Mohamed A. El-Sharkawi, 2008

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

Professor
Department of Electronics and Communication Engineering
Thapar Institute of Engineering & Technology
Patiala-147004

1.	Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
2.	Optical Fiber Communications – Gerd Keiser, 3 ed., 2000, McGraw Hill.
3.	Optical Fiber Communications: Principles and Practice – John.M.Senior, 2 ed., 2000, PE.
4.	Fiber Optics Communication – Harold Kolimbris, 2 ed., 2004, PEI
5.	Optical Networks: Third Generation Transport Systems – Uyless Black, 2 ed., 2009, PEI
6.	Optical Fiber Communications – Govind Agarwal, 2 ed., 2004, TMH
7.	Optical Fiber Communications and Its Applications – S.C.Gupta, 2004, PHI

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

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Department of Electronics and Communication Engineering
Sardar Phool Singh

Optical Communications Technology

PHE-505
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objectives:

1. To understand the basics of optics including light propagation and reflection.
2. To understand the different optical sources and detectors.
3. To explore the optical amplifiers for amplifying the signal

Pre-requisite: Electronics Devices and Circuits

Course Outcome: After studying this course, students will be able to:

1. Acquire the deep understanding of optical communication system.
2. Familiarize with various optical components and devices.

Content

Unit –I
Signal propagation in Optical Fibers Geometrical Optics approach and Wave Theory approach, Loss and Bandwidth, Chromatic Dispersion, Non Linear effects- Stimulated Brillouin and Stimulated Raman Scattering, Propagation in a Non-Linear Medium, Self Phase Modulation and Cross Phase Modulation, Four Wave Mixing, Principle of Solitons.
Unit –II
Fiber Optic Components for Communication & Networking Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters, High Channel Count Multiplexer Architectures, Optical Amplifiers, Direct and External Modulation Transmitters, Pump Sources for Amplifiers, Optical Switches and Wavelength Converters.
Unit –III
Modulation and Demodulation Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duobinary, Single Side Band and Multilevel Schemes, Ideal and Practical receivers for Demodulation, Bit Error Rates, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.
Unit –IV
Transmission System Engineering System Model, Power Penalty in Transmitter and Receiver, Optical Amplifiers, Crosstalk and Reduction of Crosstalk, Cascaded Filters, Dispersion Limitations and Compensation Techniques. n Fiber Non-linearities and System Design Considerations Limitation in High Speed and WDM Systems due to Non-linearities in Fibers, Wavelength Stabilization against Temperature Variations, Overall System Design considerations – Fiber Dispersion, Modulation, Non-Linear Effects, Wavelengths, All Optical Networks.
Suggested Text Books

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Sant Baba Bhool Singh
Mahila Vishwavidyalaya

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

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Department of Electronics and
Communication Engineering

PHE-504
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objectives:

1. To learn digital CMOS logic design.
2. To nurture students with CMOS circuit designs.
3. To realize importance of testability in logic circuit design.
4. To overview SOC issues and understand PLD architectures with advanced features.

Course Outcome: After studying this course students will be able to:

1. Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.
2. Understand chip level issues and need of testability
3. Design analog & digital CMOS circuits for specified application

Content

Unit –I	
Review of Microelectronics and Introduction to MOS Technologies: MOS, CMOS, BiCMOS Technology, Trends And Projections. Basic Electrical Properties of MOS, CMOS & BiCMOS Circuits: Ids-Vds relationships, Threshold Voltage Vt, Gm, Gds and o, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.	
Unit –II	**10 Hours**
LAYOUT DESIGN AND TOOLS: Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools. LOGIC GATES & LAYOUTS: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.	
Unit –III	**10 Hours**
COMBINATIONAL LOGIC NETWORKS: Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing.	
Unit –IV	**10 Hours**
SEQUENTIAL SYSTEMS: Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing. FLOOR PLANNING & ARCHITECTURE DESIGN: Floor planning methods, off-chip connections, High-level synthesis, Architecture for low power, SOCs and Embedded CPUs, Architecture testing.	
Suggested Text Books	
1.	Essentials of VLSI Circuits and Systems, K. Eshraghian Eshraghian. D, A.Pucknell, 2005, PHI.
2.	Modern VLSI Design - Wayne Wolf, 3rd ed., 1997, Pearson Education.
3.	Principals of CMOS VLSI Design – N.H.E Weste, K.Eshraghian, 2nd ed., Adisson Wesley.

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Bhagat Phool Singh Mahila Vishwavidyalaya

	and Applications, Mc - Graw Hill, Inc. 1996.
6.	N.K.Sinha and Madan M Gupta, Soft computing & Intelligent Systems - Theory & Applications, Indian Edition, Elsevier, 2007.
7.	John Yen and Reza Langari, Fuzzy logic Intelligence, Control, and Information, Pearson Education, Indian Edition, 2003.
8.	Witold Pedrycz, Fuzzy Control and Fuzzy Systms, Overseas Press, Indian Edition, 2008.

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

Chairperson
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Guru Phool Singh
Khalsa Vishwavidyalaya
Jhanjeer

Intelligent Techniques

PHE-503
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The objective of this course is:

1. To learn about basic concepts of AI.
2. To understand the concepts of ANN and various learning algorithms
3. To learn about the concepts of fuzzy logic and fuzzy logic tool box in MATLAB.

Course Outcomes: At the end of the course, students will be able to:

1. To acquire the knowledge of AI
2. To learn about ANN, fuzzy logic and its tool box in MATLAB.

Content

Unit –I	
Introduction: Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.	
Unit –II	
Artificial Neural Networks: Concept of artificial neural networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller. Case studies using Matlab- Neural Network toolbox.	
Unit –III	
Fuzzy Logic System: Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system. Case studies using Matlab fuzzy-logic toolbox	
Unit –IV	
GENETIC ALGORITHM: Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems.	
Suggested Text Books	
1.	Oscar Castillo,Patricia Melin, Soft Computing For Hybrid Intelligent Systems,Wiltold Pedrycz,2008
2.	Madan M.Gupta, Naresh K Sinha, "Soft computing and intelligent systems: Theory and applications,2000.
3.	J.Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
4.	M.T.Hagan, H. B. Demuth and M. Beale, Neural Network Design, Indian reprint, 2008.
5.	N.K. Bose and P.Liang, Neural Network Fundamentals with Graphs, Algorithms

3.	Logic Design Theory – N. N. Biswas
4.	Switching and Finite Automata Theory – Z. Kohavi
5.	Digital Design – Morris Mano
6.	Digital Circuits and Logic Design – Samuel C. Lee

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

Chairperson
Department of Electronics &
Communication Engineering
Bhagat Phool Singh
Mahila Vishwavidyalaya
Khanpur K

Digital System Design

PHE-502
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective:
1. To implement digital logic circuits on FPGA
2. To synthesize complex digital circuits at several levels
3. To simulate and debug digital systems described in VHDL
4. To learn the Hardware Description Language

Pre-requisite: Digital Electronics

Course Outcome: After completion of the course, student will be able to:
1. Apply Boolean algebra in reduction, expansion, factoring
2. Synthesize and analyze digital circuits through VHDL
3. Create complex digital circuits at several levels of abstractions
4. Understand and analyse logic on FPGA

Content

UNIT- I	
Designing with Read only memories – Programmable Logic Arrays – Programmable Array logic– Sequential Programmable Logic Devices – Design with FPGA's– Using a One-hot state assignment, State transition table- State assignment for FPGA's - Problem of Initial state assignment for One –Hot encoding - State Machine charts – Derivation of SM Charts – Realization of SM charts – Design Examples –Serial adder with Accumulator - Binary Multiplier – Signed Binary number multiplier (2's Complement multiplier) – Binary Divider – Control logic for Sequence detector – Realization with Multiplexer – PLA – PAL.	
UNIT-II	
Logic Fault model – Fault detection & Redundancy- Fault equivalence and fault location – Fault dominance – Single stuck at fault model – Multiple stuck at fault models –Bridging fault model Fault diagnosis of combinational circuits by conventional methods – Path sensitization techniques, Boolean Difference method – Kohavi algorithm – Test algorithms – D algorithm, PODEM, Random testing, Transition count testing, Signature analysis and test bridging faults.	
UNIT- III	
Circuit Test Approach, Transition Check Approach - State identification and fault detection experiment, Machine identification, Design of fault detection experiment. PLA Minimization and Testing PLA Minimization – PLA folding, Fault model in PLA, Test generation and Testable PLA Design.	
UNIT- IV	
The Finite state Model – Capabilities and limitations of FSM – State equivalence and machine minimization – Simplification of incompletely specified machines. Fundamental mode model – Flow table – State reduction – Minimal closed covers – Races, Cycles and Hazards.	
Suggested Text Books	
1.	Fundamentals of Logic Design – Charles H. Roth
2.	Digital Systems Testing and Testable Design – Miron Abramovici

Chairperson
Department of Electronics & Communication Engineering
Guru Gobind Singh Indraprastha University
Sector 16C, Dwarka, Delhi

Suggested Text Books	
1.	Chetan Singh Solanki., Solar Photovoltaic: Fundamentals, Technologies and Application, PHI Learning Pvt., Ltd.; 2009.
2.	Jha A.R., Solar Cell Technology and Applications, CRC Press, 2010.
3.	John R. Balfour, Michael L. Shaw, Sharlave Jarosek., Introduction to Photovoltaics, Jones & Bartlett Publishers, Burlington, 2011.
4.	Luque A. L. and Andreev V.M., Concentrator Photovoltaic, Springer, 2007.
5.	Partain L.D., Fraas L.M., Solar Cells and Their Applications, 2nd edition. Wiley, 2010.
6.	S.P. Sukhatme, J.K.Nayak., Solar Energy, Tata McGraw Hill, New Delhi, 2010.

Note: There will be nine questions in total from all four units. Question number one is compulsory and set from all four units. Students have to attempt five questions in all selecting at least one question from each four units.

Chairperson
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Maliya Vishwavidyalaya

672

Solar Photovoltaic System and Technology

PHE-501
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The basic objective of this course is to:

1. Understand the fundamentals of solar energy conversion and familiarize with solar geometry.
2. Design PV system and analysis of its performance.
3. Familiarize with solar energy policies.

Course Outcomes: At the end of the course, students will be able to:

1. Understand the properties of solar energy resource, PV system operation and component specifications
2. Compute circuit parameters, solar cell/array performance parameters
3. Understand PV installations, government policies and costing
4. Design of PV systems for domestic, commercial and industrial applications.

Content

UNIT- I
Photovoltaic effect-Principle of direct solar energy conversion into electricity in a solar cell. Semiconductor properties, energy levels, basic equations. Solar cell, p-n junction, structure. PV Module, PV Array. Equivalent Circuit Model of Solar cell, Modeling and Simulation of solar cell, module and array, I-V characteristics of a PV module, maximum power point, cell efficiency, fill factor, effect of irradiation and temperature.
UNIT-II
Commercial solar cells – Production process of single crystalline silicon cells, multi crystalline silicon cells, amorphous silicon, cadmium telluride, copper indium gallium di selenide cells. Design of solar PV systems and cost estimation. Case study of design of solar PV lantern, stand alone PV system – Home lighting and other appliances, solar water pumping systems
UNIT- III
Classification – Central Power Station System, Distributed PV System, Stand alone PV system, grid Interactive PV System, small system for consumer applications, hybrid solar PV system, concentrator solar photovoltaic. System components – PV arrays, inverters, batteries, charge controls, net power meters. PV array installation, operation, costs, reliability.
UNIT- IV
Building-integrated photovoltaic units, grid-interacting central power stations, stand-alone devices for distributed power supply in remote and rural areas, solar cars, aircraft, space solar power satellites. Socio-economic and environmental merits of photovoltaic systems, Issues and barriers in implementing Solar PV system. Application of Solar Photovoltaic system in digital India, Government Initiatives and polices.

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Guru Jambheshwar University of Science & Technology
Hisar-125001

Department of Electronics and Communication Engineering

*List of Department Specific Domain Core Course

Sr. No.	Course Code	Course Title
1	PHE-501	Solar Photovoltaic System And Technology
2	PHE-502	Digital System Design
3	PHE-503	Intelligent Techniques
4	PHE-504	VLSI Technology And Design
5	PHE-505	Optical Communications Technology
6	PHE-506	Optimization & Heuristic Search Techniques
7	PHE-507	Image & Video Processing
8	PHE-508	CMOS Analog & Mixed Signal Design
9	PHE-509	Advanced Data Communications
10	PHE-510	Advanced Digital Signal Processing
11	PHE-511	Adhoc Wireless & Sensor Networks

Professor
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Evaluation of Textile Material

PHE-601
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objectives:

The course is designed to make the students:

- To understand in depth concepts of fibre, yarn, fabric and apparel testing and instruments.
- To acquire the knowledge about mechanism of working and designing of instruments.
- To understand sampling techniques and statistical applications in textile testing.
- To learn and understand evaluation of specially designed functional textiles.
- To understand the concept of low stress mechanical properties and fabric comfort analysis.

UNIT- I
Introduction to textile testing; Sampling and basic statistics: Selection of samples for testing; Random and biased samples; Different types of sampling of textile materials; Testing methods: Measurement of length, fineness and crimp of fibres; Determination of maturity, moisture content of cotton, Measurement of twist, linear density and hairiness of yarn, Yarn numbering and conversion system,
UNIT- II
Tensile testing of fabrics; Tearing, bursting and abrasion resistance tests for fabrics; Pilling and Snagging resistance of fabrics; Crease and wrinkle behavior;fabric drape and handle, Wicking& Wetting properties, Water repellency, water proofness
UNIT- III
Fabric comfort; Air and water-vapour transmission through fabrics; Thermal resistance of fabrics;Fastness characteristics of textiles (light, washing, perspiration, sublimation, chlorine etc.) and their evaluation, Computer colour matching
UNIT- IV
Flame resistance, Limited Oxygen Index of Fabrics, Overview of low stress mechanical properties, FAST, Kawabata Evaluation System,

Course Outcomes:

After completion of the course, students will be able to:

- Relate the importance of concepts, techniques and analysis in research areas.
- Perform proper sampling techniques and procedures for testing and in research.
- Evaluate the influence of fibre, yarn and fabric properties on apparel quality/functionality.

675

- Use analytical skills to assess performance and to develop insight into developing innovative quality product.

Books Recommended:

1. Physical Testing of Textiles, Wood head Publishing Ltd, Cambridge, 2002. Saville B P
2. Testing and Quality Management, Ed. V. K. Kothari, IAFL Publications, New Delhi, 1999, V. K. Kothari.
3. Principles of Textile Testing", CBS Publishers and Distributors, New Delhi, 1999, Booth J E.
4. Textile Testing, SSM Institute of Textile Technology, Angappan P &Gopalakrishnan, R,Komarapalayam, 2002.
5. Apparel quality Control, V.K. Mehta
6. Basu A, "Textile Testing", SITRA Coimbatore, 2002.

Note: There will be nine questions in theory paper in total from all four units of syllabus. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Recent Developments in Apparel Technology

PHE-602
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objectives:

The course is designed to make the students understand about:

- Innovation and advancement in stitching technology
- Various kinds of machines and their utility and their developments.
- Automation and applications of programmable machines in garment industries.
- Ergonomic concepts and applications

UNIT- I
Detailed study of different seam and stitches used in Apparel Industries. Latest Innovation in seams, stitches, sewing thread, needles. Role of marker, planning in increasing the efficiency of garment production, latest cutting room tools and technologies.
UNIT- II
Understanding the need and use of various construction types for sewing machinery in regards to quality and performance improvement and ease to operate, Advancement in sewing Machinery: Directive for operating special purpose sewing machinery. Various bed types of machine and their applications in manufacturing processes: Flat Bed, large area Raised Bed, DNLS m/c, Over Lock m/c, Flat Lock m/c, Multi thread Chain Stitch m/c, Blind stitch machine and their developments.
UNIT- III
Various types of feed mechanisms, their suitability for different fabrics and construction of components and their contribution towards quality and productivity. Application of programmable machines in garment industries. Developments and automation in garment manufacturing machines and industries.
UNIT- IV
Scientific approach in sewing techniques. Ergonomic concepts and application in the sewing room, Introduction of time targets and quality aspects, Practical approach to achieve targets, Understanding of different shaped sewing lines in actual garments, Material Handling, Postural Techniques, Work Study, Working Time Arrangement, Shift Work, Motion Economy.

Course Outcomes:

After completion of the course, students will be able to:

- Gain insight of innovations and advancements in stitching technology

- Develop understanding and functionality of various kinds of machines and their utility.
- Get exposure about automation and applications of programmable machines in garment industries.
- Apply Ergonomic concepts and applications in time studies.

Suggested Text Books & References:

1. The Technology of Clothing Manufacture, Harold Carr, Barbara Latham
2. Introduction to Clothing Manufacture, Gerry Cooklin
3. Knitted Clothing Technology, Bracken burry

Note: There will be nine questions in theory paper in total from all four units of syllabus. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Course Outcome:

After completion of the course, students will be able to:

- Understand deep insight of fibre, yarn and fabric formation and key concepts of technology involved.
- Develop understanding of use of various kinds of machines and their utility in their research areas.
- Apply technical knowledge in developing new products as per the required functionality and performance.

Suggested Text Books & References:

1. Gohl E P G and Vilensky LD, "Textile Science", CBS Publishers, Delhi, 1983.
2. Cook Gordon J, "Hand Book of textile fibre", Vol. I and II, Woodhead Fibre Science Series, UK, 1984.
3. Gupta V B and Kothari V K, "Manufactured Fibre Technology", 1st Ed., Chapman and Hall, London, 1997.
4. Kothari V K Ed. "Textile Fibers: Developments and Innovations, IAFL Publications, New Delhi, 2000.
5. Salhotra K R, "Spinning of Man Made Fibres and Blends on Cotton Spinning System",The Textile Association, Mumbai, 1989
6. Bernard P. Corbman, "Textile Fibres to Fabric" McGrawhill Publications, 6th Edition 1983
7. Penny Walsh, " The yarn book", A & C black publisher
8. Eric Oxtoby, "Spun Yarn Technology"
9. Gokarneshan N., Fabric structure and design, New Age Publishers
10. Adanur Sabit, Handbook of weaving; Technomic Publishing Company, Inc, U.S.A
11. Lord P.R.& Mohamed M.H., Weaving: Conversion of Yarn to Fabric, Watford : Merrow,
12. Marks & Robinson, "Principles of Weaving"
13. Chakarverty J N, "Fundamental and practices in colouration of textiles", Woodhead Publishing India Pvt Ltd, 2008
14. ShenaiVA, "Technology of Bleaching & Mercerising", Sevak Pub., Mumbai.
15. Shenai V A,"Technology of Dyeing", Sevak Pub., Mumbai.
16. Trotman E R, "Dyeing and Chemical Technology of Textile Fibres", B.I. Publications Pvt. Ltd.
17. Hall David M, Chemical testing of textiles: a laboratory manual, Dept of Textile Engineering, AuburnUniversity, 1981

Note: There will be nine questions in theory paper in total from all four units of syllabus. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

679

Functional Textiles and Garments

PHE-604
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objectives:

The students will be able to:

- Gain understanding about properties and uses of speciality fibres
- Know about various functional garments, their requirements and applications.
- Have understanding about principle and mechanisms of smart garments.
- Gain adequate knowledge about medical textile, sportswear, defence textiles etc

UNIT- I
Functional Garments and their application, Classifications of functional garments, Properties and uses of speciality fibres like Nomex, Kevlar, Glass fibres used in functional garments. Breathable textiles and garments: Introduction, Priniciple, classification and use. Moisture management in fabrics. Sports Textile: requirement, Different fibre used, their application in sports.
UNIT- II
Protective clothing: Different types of protective clothing, General requiremnt of protective clothing. Overview and application of Cut resistant fabric, Chemical protective clothing (CPC), Ballistic protective clothing – different fibres and fabrics, Foul weather clothing, Phase change material and its uses.
UNIT- III
Antimicrobial clothing and Medical Clothing, their importance and applications, Thermal protective clothing (Fire retardant fabrics): combustion mechanism, fire governing parameters, requirements, construction, various affecting flame retardancy, performance evaluation. Smart and intelligent textiles-Passive and Active functionality, Smart Electronic clothing – requirements, processing of conductive yarn, application in defense, Multifunctional textiles with incorporated electronics for integrated communications.
UNIT- IV
Environmentally sensitive textiles – overview of photochromic, thermochromic, (Chameleonic), etc fabrics and their applications to textiles. Nanotechnology in apparels – introduction and definition of nanotechnology, Applications of High performance fibres in Functional Textiles.

Course Outcomes:

After completion of the course, students will be able to:

- Apply their knowledge of high performance fibre properties in smart textiles.
- Evaluate the influence of fibre and yarn parameters on Functional garments.

- Develop skills to design and develop functional clothing for various end use applications like sports wear, protective clothing, medical textiles etc.

References:

1. Textile in sport, Edited by R. Shishoo, Woodhead Publisher.
2. Wearable electronics and photonics, Edited by X M Tao, woodhead Publisher.
3. Welington Sears Handbook of Industrial textiles, S Adanur, Woodhead publisher.
4. Handbook of Technical Textiles, edited by A RHorrocks and S C Anand, UK.
5. Nanofibres and nanotechnology in textiles, Edited by P Brown and K stevens, Woodhead Publisher.
6. Nanofunctional Textiles and their application, Edited by Y Li, woodhead Publisher.
7. Smart textiles for medical and healthcare, Edited by L Van langenhove, Woodhead publisher.

Note: There will be nine questions in theory paper in total from all four units of syllabus. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

-681-

Fashion Supply Chain

PHE-605
L T P
4 0 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objectives:

The course is designed to make the students understand about:

- To Familiarize with the concepts of Supply chain
- Latest techniques and processes in increasing Supply chain efficiency
- Innovations in planning and managing the inventories of Supply chains
- Innovations in Reverse Supply chain process

UNIT- I
Supply Chain, Supply Chain Concepts: flow of materials, Wastes in the pipeline, flow of Information, Supply Chain Drivers, Supply chain Management: Concept, frame work and need for study
UNIT- II
Planning ; Managing Inventories in a Supply Chain: Safety Inventory, Benchmarking The supply chain Quick Response, Vendor Managed Inventory(VMI), Postponement, Just in Time; QR Logistics, Introduction to Apparel / Textile Supply Chain, Distribution; Procurement and various Procurement Channels in Supply Chain.
UNIT- III
Reverse supply chain (RSC), difference with forward supply chain, cost considerations Involved, industries participation, factors leading to application of concept of RSC in Specific industries and its restricted application, benefits, cost effectiveness of RSC.
UNIT- IV
Supply chain in apparels, Introduction to sampling, Understanding quality procedures in Sampling and sample development, different stages of samples and their requirements From Proto to Shipment sample Proto, fit, Size set, Pre production, TOP, Sealer, Important Industry Inputs.

Course Outcomes:

After completion of the course, students will be able to:

- Gain insight of innovations and advancements in supply chain Management.
- Develop understanding of inventory planning and Management.
- Get exposure about automation and applications of Reverse supply chain process
- Learn and implement different techniques of Supply Chain leading to overall process

682

Suggested Text Books & References:

1. Logistics & supply Chain Management: Strategies for Reducing Cost and Improving service –Martin Christopher
2. Supply Chain Management: Strategy, Planning and Operation - Sunil Chopra.
3. Partnership Sourcing: An Integrated Supply Chain Management Approach - Douglas Macbeth

Note: There will be nine questions in theory paper in total from all four units of syllabus. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

683