

IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Scheme Based on AICTE Flexible Curriculum

Department of Computer Science & Engineering

Bachelor of Technology (B.Tech.) [Computer Science & Information Technology]

VI Semester

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical			L	T	P	
				End Sem	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work Lab Work & Sessional					
1.	BSC-CSIT601	BSC	Scientific Aptitude	70	20	10	–	–	100	3	1	–	4
2.	PCC-CSIT601	PCC	Internet of Things	70	20	10	60	40	200	2	1	2	4
3.	PCC-CSIT602	PCC	Computer Network	70	20	10	60	40	200	2	1	2	4
4.	PEC-CSIT601	PEC	Elective -II	70	20	10	–	–	100	3	–	–	3
5.	OEC-CSIT601	OEC	Open Elective-II	70	20	10	–	–	100	3	–	–	3
6.	PROJ-CSIT601	PROJ	Project-I	–	–	–	60	40	100	–	–	4	2
7.	PROJ-CSIT602	PROJ	Evaluation of Internship-I	–	–	–	60	40	100	–	–	4	2
8.	–	PROJ	Internship-II	To be completed during semester break. Its Evaluation / Credit to be added in Seventh Semester.									
Total				350	100	50	240	160	900	13	3	12	22

Electives-II	Open Electives-II
PEC-CSIT601(A) Foundation of Artificial Intelligence & Machine Learning	OEC-CSIT601(A) Entrepreneurship
PEC-CSIT601(B) Cyber Security	OEC-CSIT601(B) IPR
PEC-CSIT601(C) Natural Language Processing	OEC-CSIT601(C) Operation Research
PEC-CSIT601(D) Information Storage Management	OEC-CSIT601(D) Probability Theory & Statistics

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	1 Credit	1 Credit

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VI-Semester

BSC-CSIT601	Scientific Aptitude	3L: 1T: 0P (4hrs.)	4 credits
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Prerequisite:None

Course Objective:

This course aims to sensitize students with the gamut of skills which facilitate them to enhance their employability quotient.

Course Contents :(40 hrs)

Module 1: (10hrs.)
Number System, Percentage, Ratio and Proportion, Partnership, Profit & Loss, Simple & compound Interest.

Module 2: (10 hrs.)
Allegation & Mixture, Average, Time & Distance, Time and Work, Mensuration 2D & 3D, Permutation and Combination.

Module 3: (08 hrs.)
Probability, Co-ordinate Geometry, Inequalities, Functions, Progressions, Set Theory, Quadratic equations, Surds.

Module 4: (06hrs.)
Coding Decoding, Sitting Arrangements, Data sequence/Calendars, Direction Sense Test, Blood Relation.

Module 5: (06hrs.)
Syllogism, series, Analogy Classification, Clocks, Statements and Arguments, Puzzle Test, Cubes and dice.

Course Outcome:

1. Understand the basic concepts of quantitative ability.
2. Applying basic mathematics skills to interpret data, draw conclusions, and solve problems.
3. Developing proficiency in numerical reasoning;
4. Understand the basic concepts of logical reasoning skills.
5. Develop the puzzle solving skills.

List of Text / Reference Books:

1. R.S. Aggarwal, “Quantitative Aptitude”, S. Chand Publication, Revised Edition, 2018.
2. M. Tyra, “Magical Book on Quicker Maths”, BSC Publishing Co Pvt Ltd, 2018.
3. K. Kundan, “Magical Book Series: Data Interpretation”, BSC Publishing Co Pvt Ltd, 2012.
4. H. William Dettmer, “The Logical Thinking process”, Productivity Press (India) Ltd., 2001.
5. Aditi Agarwal, “An expert guide to problem solving: with practical examples”, Createspace Independent Pub, 2016.
6. George J Summers, “The Great Book of Puzzles & Teasers”, Jaico Publishing House, 1989.

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VI-Semester

BSC-CSIT601	Internet of things	2L: 1T: 2P (4hrs.)	4 credits
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Prerequisite: Analog & Digital Communication

Course Objective:

Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Contents :(40 hrs)

Module 1: (08 hrs.)

Introduction: Definition, Characteristics of IOT, IOT Conceptual framework, IOT Architectural view, Physical design of IOT, Logical design of IOT, Application of IOT.

Module 2: (08 hrs.)

Machine-to-machine (M2M), SDN (software defined networking) and NFV(network function virtualization) for IOT, data storage in IOT, IOT Cloud Based Services.

Module 3: (08 hrs.)

Design Principles for Web Connectivity: Web Communication Protocols for connected devices, Message Communication Protocols for connected devices, SOAP, REST, HTTP Restful and Web Sockets. Internet Connectivity Principles: Internet Connectivity, Internet based communication, IP addressing in IOT, Media Access control.

Module 4: (08 hrs.)

Sensor Technology , Participatory Sensing, Industrial IOT and Automotive IOT , Actuator, Sensor data Communication Protocols ,Radio Frequency Identification Technology, Wireless Sensor Network Technology.

Module 5: (08 hrs.)

IOT Design methodology: Specification -Requirement, process, model, service, functional & operational view.IOT Privacy and security solutions, Raspberry Pi & arduino devices. IOT Case studies: smart city streetlights control & monitoring.

Course Outcome:

1. Understand the key components that make up an IoT system.
2. Appreciate the role of big data, cloud computing and data analytics in a typical IoT system.
3. Understand where the IoT concept fits within the broader ICT industry and possible future trends.
4. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
5. Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis

List of Text / Reference Books:

1. Rajkamal, "Internet of Things", Tata McGraw Hill publication, 1st Edition, 2017.
2. Vijay Madiseti and Arshdeep Bahga, "Internet of things (A-Hand-on-Approach)" 1st Edition, Universal Press, 2014.
1. Hakima Chaouchi "The Internet of Things: Connecting Objects", Wiley publication, 1st edition, 2013.
2. Charles Bell "MySQL for the Internet of things", Apress publications, 1st edition, 2016.
3. Francis dacosta "Rethinking the Internet of things: A scalable Approach to connecting everything", 1st edition, Apress publications 2013.
4. Donald Norris "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black", McGraw Hill publication, 1st edition, 2015.

List of Experiments:

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF When '1'/'0' is received from smart phone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thing speak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thing speak cloud.
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.

13. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
14. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
15. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

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VI-Semester

PCC-CSIT602	Computer Network	2L: 1T: 2P (5 hrs.)	4 credits
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Prerequisite: Data Communication

Course Objective:

This course provides a foundation to understand computer networks using layered architectures.

Course Contents :(40 hrs)

Module 1: (06hrs.)

Introduction to computer networks: Network – Component and Categories – Topologies Reference Models: ISO/OSI Model and TCP/IP Protocol suite. Principals of physical layer: Transmission Media, Bandwidth, Multiplexing, Switching.

Module 2: (07hrs.)

Data Link Layer: Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol: Elementary & Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Protocol verification: Finite State Machine Models & Petri net models. ARP/RARP.

Module 3: (9 hrs.)

MAC Sub layer: MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted- ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), Collision Free Protocols: Basic Bit Map, Binary Count Down, Adaptive Tree Walk, Performance Measuring Metrics. IEEE Standards 802 series & their variant.

Module 4: (08hrs.)

Network Layer: Need, Services Provided, Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing. IP Addresses, Header format, Packet forwarding, Fragmentation and reassembly, ICMP, Comparative study of IPv4 & IPv6.

Module 5: (10hrs.)

Transport Layer: Design issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management. Application Layer: WWW and HTTP, FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP).

Course Outcome:

1. Describe basics of computer network, network architecture, TCP/IP protocol suite, OSI reference models & fundamentals of physical layer.
2. Classify data link protocol like flow control, error control, bit oriented protocol.
3. Paraphrase multi-channel access protocol, IEEE 802 standards & use Ethernet standards.
4. Explain routing & congestion algorithm. State IP protocol, addressing & subnet.
5. Distinguish various transport & application layer protocols.

List of Text / Reference Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks" Pearson New International Edition, 5th Edition, 2013.
2. Douglas E Comer, "Internetworking with Tcp/Ip Principles, Protocols, And Architecture- Volume I" 6th Edition, Prentice Hall of India.
3. Dimitri Bertsekas, Robert Gallager, "Data Networks", PHI Publication, Second Edition.
4. Kaveh Pahlavan, Prashant Krishnamurthy, "Networking Fundamentals", Wiley Publication. First Edition, 2009
5. Uyless Black, "Computer Networks", PHI Publication, Second Edition.
6. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill, 2011.
7. Behrouz A. Forouzan, "Data Communication and Networking", McGraw Hill, 5th Edition, 2013.
8. William Stallings, "Data and Computer Communication" 8th Edition, 2007.
9. W. Richard Stevens. "TCP/IP Illustrated, Volume 1", Addison-Wesley, United States of America.

List of Experiments:

1. Study of Different Type of LAN & Network Equipment.
2. Study and Verification of standard Network topologies i.e. Star, Bus, Ring etc.
3. LAN installations and Configurations.
4. Write a program to implement various types of error correcting techniques.
5. Write a program to implement various types of framing methods.
6. Study of Tool Command Language (TCL).
7. Study and Installation of Standard Network Simulator: N.S-2, N.S3, OpNet, Qual Net etc.
8. Study & Installation of ONE (Opportunistic Network Environment) Simulator for High Mobility Networks.
9. Configure 802.11 WLAN.
10. Implement & simulate various types of routing algorithm.
11. Study & Simulation of MAC Protocols like Aloha, CSMA, CSMA/CD and CSMA/CA using Standard Network Simulators.
12. Study of Application layer protocols- DNS, HTTP, HTTPS, FTPS and Telnet.

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VI-Semester

Elective-II

PEC- CSIT601(A)	Foundation of Artificial Intelligence and Machine Learning	3L: 0T: 0P (3 hrs.)	3credits
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Prerequisite: Engineering Mathematics.

Course Objective:

This course provides a concise introduction to the fundamental concepts in artificial intelligence and machine learning.

Course Contents :(40 hrs)

Module 1: (10hrs.)

Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Propositional and predicate logic, monotonic and on monotonic reasoning, forward Reasoning, backwardreasoning.

Module 2: (06hrs.)

Introduction: Basic dentitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation. Linear regression, Decision trees, over fitting.

Module 3: (10 hrs.)

Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM. Neural network: Perceptron, multilayer network, back-propagation, introduction to deep neural network. Convolution neural network, flattening, sub sampling, padding, stride, convolution layer, pooling layer, loss layer, dance layer 1x1 convolution, inception network, input channels, transfer learning, one shot learning, dimension reductions, implementation of CNN like tensor flow, keras etc.

Module 4: (08 hrs.)

Ensemble learning, clustering: k-means, adaptive hierarchical clustering, and Gaussian mixture model. Application of machine learning in computer vision, speech processing, natural language processing etc, Case Study: Image Net Competition

Module 5:**(06hrs.)**

Instance based learning, Feature reduction, Collaborative filtering based recommendation. probability and Bayes learning.

Course Outcome:

1. State the overview of the Artificial intelligence.
2. Explain the types of learning, linear regression and decision tree.
3. Discuss the various classification techniques and convolution neuralnetwork.
4. Explain the Ensemble learning and clustering techniques.
5. Discuss the recommendation system and Bayeslearning.

List of Text / Reference Books:

1. Rich E and Knight K, "Artificial Intelligence", The McGraw- Hill, 3rdEdition, 2008
2. Tom Mitchell, "Machine Learning", McGraw- Hill, First Edition, 1997.
3. Ethem Alpaydin, "Introduction to Machine Learning Edition"², MIT Press, Third Edition, 2014.

Perspectives:

1. Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems.
2. AI is to enable computers to perform intellectual tasks as decision making, problem solving, perception, understanding human communication (in any language, and translate among them
3. Machine Learning is an Application of AI & gives devices the ability to learn from their experiences without doing any coding.

Recommendations:

Students pursuing a concentration in **AI & ML** must also take the following concentration Requirements and electives:

1. Deep & Reinforcement Learning
2. Robotics
3. Embedded System
4. Soft Computing
5. Computational Intelligence
6. Pattern Recognition
7. Data Visualization
8. Web & Information Retrieval
9. Data Science

Studying artificial intelligence & Machine Learning opens a world of opportunities.

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VI-Semester

Elective-II

PEC-CSIT601(B)	Cyber Security	3L: 0T: 0P (3 hrs.)	3 credits
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Prerequisite: None

Course Objective:

Analyze and resolve security issues in an organization to secure an IT infrastructure.

Course Contents :(40 hrs)

Module 1:

(06hrs.)

Introduction of Cyber Crime, Challenges of cyber crime, Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Internet Time Theft, Salami attack/Salami Technique.

Module 2:

(8 hrs.)

Web jacking, Online Frauds, Software Piracy, Computer Network Intrusions, Password Sniffing, Identity Theft, cyber terrorism, Virtual Crime, Perception of cyber criminals: hackers, insurgents and extremist group etc. Web servers were hacking, session hijacking.

Module 3:

(10 hrs.)

Cyber Crime and Criminal justice: Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cheating, Defamation, Harassment and E-mail Abuse, Other IT Act Offences, Monetary Penalties, jurisdiction and Cyber Crimes, Nature of Criminality, Strategies to tackle Cyber Crime and Trends.

Module 4:

(10 hrs.)

The Indian Evidence Act of 1872 v. Information Technology Act, 2000: Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and Probative Value of E-Evidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving Electronic Messages.

Module 5:

(06hrs.)

Tools and Methods in Cybercrime: Proxy Servers and Anonymizers, Password Cracking, Key

loggers and Spyware, virus and worms, Trojan Horses, Backdoors, DoS and DDoS Attacks , Buffer and Overflow, Attack on Wireless Networks, Phishing : Method of Phishing, Phishing Techniques. Introduction to KALILinux.

Course Outcome:

1. Define and explain the concepts of cyber crime and its classification.
2. Delineate the components online frauds, intrusions, virtual crimes and hacking.
3. Knowledge of different acts in cybersecurity
4. List the various parts of IT act related to electronic records.
5. Knowledge of different Cyber Security tools.

List of Text / Reference Books:

1. Jonathan Clough, "Principles of Cyber crime", Cambridge University Press, 2nd Edition, 2015.
2. John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Charles River Media, 2nd Edition, 2005.
3. Vivek Sood "Cyber Law Simplified", TMH, 2001.
4. Nina Godbole, Sunit Belapure, "Cyber Security", Wiley-India
5. William Hutchinson, Mathew Warren, "Information Warfare: Corporate attack and defense in digital world", Elsevier, Reed International and Professional Publishing Ltd, 2001
6. Harish Chander, "Cyber Laws and IT Protection", Prentice Hall India Learning Private Limited, 2012

Perspectives:

1. Computer security, cyber security or any other related terminology is the protection of computers from any harm or damage, either physical or otherwise, by unauthorized users.
2. Cyber Security is a very broad term but is based on three fundamental concepts known as "The CIA Triad". It consists of Confidentiality, Integrity, and Availability.
3. Cyber Security study programmers teach you how to protect computer operating systems, networks, and data from cyber attacks.
4. Confidentiality, honesty, and availability are three basic security principles that are essential for information on the internet.

Recommendations:

Students pursuing a concentration in **Cyber Security** must also take the following concentration Requirements and electives:

Cyber Security are more popular than ever. Living in the digital age means hackers and cyber terrorists have endless opportunities to exploit individuals, government institutions, and even Large companies

1. Project-I
2. Project-II
3. Project-III
4. Mobile Application Development

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VI-Semester

Elective-II

PEC-CSIT601(C)	Natural Language Processing	3L: 0T: 0P (3 hrs.)	3 credits
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Prerequisite: Engineering Mathematics, Theory of Computation

Course Objective:

To gain the knowledge for developing advanced technology of computer systems like speech recognition and machine translation.

Course Contents :(40 hrs)

Module 1:

(06 hrs.)

Introduction to Natural Language Understanding- Levels of language analysis-Syntax, Semantics, Pragmatics, Applications, Ambiguity, Morphology, Parsing with Finite State Transducers, Regular Expressions, Stemmer, Spellingerrors.

Module2:

(10hrs.)

Computational Phonology: speech sound, phonetic transcription, text to speech, Pronunciation Variations, Bayesian Method to spelling and pronunciations, Minimum Edit Distance, Weighted Automata,N-grams.

Module3:

(10 hrs.)

HMM and speech recognition, Viterbi algorithm, Acoustic processing of speech, Feature Extraction, Speech Synthesis; Part-of-Speech Tagging: rule based, stochastic, transformation based.

Module4:

(08 hrs.)

Syntax Processing: Parsing with CFG, CKY parsing and the Earley parser, Probabilistic parsing; Semantic Processing: Meaning representation, First Order Predicate Calculus. Lexical Semantics: Internal structure of words, thematic roles, Primitive decomposition, WordNet.

Module5:

(06 hrs.)

Word sense disambiguation; Information Retrieval: Vector space model, Improving user queries; Pragmatic Processing: Discourse; Natural Language Generation, Machine Translation.

Course Outcome:

1. To tag a given text with basic Language features
2. To design an innovative application using NLP components
3. To implement a rule based system to tackle morphology/syntax of a language
4. To design a tag set to be used for statistical processing for real-time applications
5. To compare and contrast the use of different statistical approaches for different types of NLP applications.

List of Text / Reference Books:

1. D. Jurafsky and J.H. Martin, "Speech and Language Processing; Processing", Prentice Hall, 2000.
2. C. Manning and H. Schütze, "Foundations of Statistical Natural Language Processing", MIT Press
3. James Allen. "Natural Language Understanding", Addison Wesley, 1994.
4. Richard M Reese, "Natural Language Processing with Java", O'Reilly Media, 2015.
5. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008

Perspectives:

1. Natural language processing (NLP) is a branch of artificial intelligence that helps computers understand, interpret and manipulate human language.
2. NLP (Natural Language Processing) Concerned with building computational tools that do useful things with language.
3. NLP includes text-to-speech or speech-to-text conversion; machine translation from one language to another; categorizing, indexing, and summarizing written documents; and identifying mood and Opinions within text- and voice-based data.

Recommendations:

Students pursuing a concentration in **Natural Language Processing** must also take the following concentration requirements and electives:

1. Computational Intelligence
2. Pattern Recognition
3. Web & Information Retrieval
4. Semantic Web & Ontology's.

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VI-Semester

Elective-II

PEC-CSIT601(D)	Information Storage & Management	3L: 0T: 0P (3 hrs.)	3 credits
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Prerequisite: None

CourseObjective:

To introduce solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

Course Contents :(40 hrs)

Module 1: (06hrs.)

Introduction to Storage Technology: Data proliferation, evolution of various storage technologies, Overview of storage infrastructure components, Information Lifecycle Management, Data categorization.

Module 2: (12hrs.)

Storage Systems Architecture: Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, RAID levels & parity algorithms, hot sparing, Front end to host storage provisioning, mapping and operation.

Module 3: (06hrs.)

Introduction to Networked Storage: JBOD, DAS, NAS, SAN & CAS evolution and comparison. Applications, Elements, connectivity, standards, management, security and limitations of DAS, NAS, CAS & SAN.

Module 4: (06hrs.)

Hybrid Storage solutions; Virtualization: Memory, network, server, storage & appliances. Data center concepts & requirements, Backup & Disaster Recovery: Principles Managing & Monitoring: Industry management standards (SNMP, SMI-S, CIM), standard framework applications, Key management metrics (Thresholds, availability, capacity, security, performance).

Module 5:

(10hrs.)

Information storage on cloud :Concept of Cloud, Cloud Computing, storage on Cloud, Cloud Vocabulary, Architectural Framework, Cloud benefits, Cloud computing Evolution, Applications & services on cloud, Cloud service providers and Models, Essential characteristics of cloud computing, Cloud Security and integration.

Course Outcome:

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

- 1.To Understand the Concept of Information Storage and Data centre Environment.
- 2.To understand about Data Protection.
- 3.To Understand Fiber ChannelSAN.
- 4.To describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities.
- 5.To Understand Cloud Computing.

List of Text / Reference Books:

1. G. Somasundaram & Alok Shrivastava (EMC Education Services) editors, “Information Storage and Management: Storing, Managing, and Protecting Digital Information”,Wiley India,2009.
2. Ulf Troppens, Wolfgang Mueller-Friedt, Rainer Erkens, Rainer Wolafka, Nils Haustein, “Storage Network explained : Basic and application of fiber channels, SAN, NAS, iSESI, INFINIBAND and FCOE”, WileyIndia.
3. John W. Rittinghouse and James F. Ransome, “Cloud Computing:Implementation, Management and Security”, CRC Press, Taylor Frances Pub.1stEdition,2017
4. Nick Antonopoulos, Lee Gillam, “Cloud Computing : Principles, System &Application”, Springer.
5. Anthony T. Velete, Toby J.Velk, and Robert Eltenpeter, “Cloud Computing: A practical Approach”, McGraw-Hill Education (India) PvtLimited,2009
6. Dr. Kumar Saurabh , “Cloud Computing : Insight into New Era I”, Wiley India Pvt. Limited, 2011.

Perspectives:

1. Information storage is a central pillar of information technology. A large amount of digital information is created every moment by individuals and organizations.
2. Information needs to be stored, protected, optimized, and managed in classic, virtualized, rapidly evolving cloud environments.
- 3.Information storage technology plays in the availability, performance, integration, and optimization of the entire IT infrastructure.
4. Information storage has developed into a highly sophisticated technology, providing a variety of solutions for storing, managing, connecting, protecting, securing, sharing, and optimizing digital information.

Recommendations:

Data storage and management experts discuss what steps you need to take to properly manage and store data. Students pursuing a concentration in Information Storage Management must also take the following concentration requirements and electives:

1. Mobile Application Development
2. Block Chain Technology
3. Cloud Computing
4. Data Mining & Warehousing

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VI-Semester

Open Elective-II

OEC-CSIT601(A)	Entrepreneurship	3L:0T:0P (3hrs)	3 Credits
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Prerequisite(s): NA

Courseoutcomes:

1. To inculcate entrepreneurship skills to students.
2. To aware about industry structure and how to start up a company.
3. To aware about types of Enterprises.
4. To understand E-commerce practices.
5. To understand and practice Digital Marketing.

Course Objectives:

- To develop conceptual understanding of the concept of Entrepreneurship
- To learn the government's policy.
- To Learn about types of Enterprises
- To Learn about E-commerce and its Technological Aspects
- To Learn about Digital Marketing

Course Content:

Module 1

(08Hrs)

Entrepreneurship: Definition, requirements to be an entrepreneur, entrepreneur and entrepreneur, entrepreneur and manager, growth of entrepreneurship in India, women entrepreneurship, rural and urban entrepreneurship

Module 2

(10Hrs)

Entrepreneurial Motivation

Motivating factors, motivation theories-Maslow's Need Hierarchy Theory, McClelland's Acquired Need Theory, government's policy actions towards entrepreneurial motivation, entrepreneurship development programme.

Module 3

(10Hrs)

Types of Enterprises and Ownership Structure: Small scale, medium scale and large scale enterprises, role of small enterprises in economic development; proprietorship, partnership, Ltd. companies and co-operatives: their formation, capital structure and source of finance

Module 4

(12Hrs)

E-commerce and its Technological Aspects: Overview of developments in Information Technology and Defining E-Commerce: The scope of E commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E Commerce Architecture.

Module5

(10Hrs)

Introduction to Digital Marketing: Evolution of Digital Marketing from traditional to modern era, Role of Internet, Search Engine Advertising, Display marketing, Social Media Marketing

Text Books:

1. Koontz & O' Donnel, Essentials of Management, Tata McGraw Hill, New Delhi, 2009
2. Peter F Drucker, The Practice of Management, McGraw Hill, New York, 1960
3. Peter F. Drucker, Innovation and Development, McGraw Hill, New York, 2000.

Reference Books:

1. Mohanty SK; Fundamental of Entrepreneurship; PHI, 2005.
2. Davis & Olson; Management Information System; TMH, 1985.

Perspective:

Entrepreneurship education cultivates innovative talents, which are an important driving force for future development. At present, innovation-driven development strategies place new demands on entrepreneurship education

Recommendation:

Entrepreneurship is not just about start-ups. It is a problem-solving frame of mind that requires technical expertise, a business sense, an ability to anticipate the future, and an appreciation of social context

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 technology]**

VI-Semester

Open Elective-II

OEC-CSIT601(B)	Intellectual Property Rights	3L:0T:0P (3hrs)	3 Credits
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Prerequisite(s): NA

Course Objective:

- To be familiar with the concept of intellectual property.
- To be familiar with Purpose and function of trademarks
- To be familiar with Fundamental of copy right law
- To clear idea of the trade Secrete
- To be familiar with latest development in the field of intellectual property.

Module 1 (08 Hrs)

Introduction to Intellectual Property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Module 2 (08 Hrs)

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

Module 3 (10 Hrs)

Law Of Copyrights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Module 4 (08 Hrs)

Trade-Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

Module 5 (08 Hrs)

New Development In Intellectual Property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets

law.

Course Outcome:

After completion of the course student will be able to:

1. Understand the concept of intellectual property.
2. Understand what is trademark and its importance.
3. Understand the law of copyright.
4. Understand how trade secrets help in competitive market
5. Understand the latest trends in intellectual property.

Text Books & References:

1. Intellectual property right, Deborah.E.Bouchoux, Cengagelearning.
2. Intellectual property right –Unleashing the knowledge economy, Prabuddha Ganguli, Tata McGraw Hill Publishing company Ltd.

Perspective:

The subject of IPR includes patents (granted to inventions that are new, non-obvious, and useful, for a period of 20 years) designs, trademarks, Copyright etc. Students possess an understanding on IPR so that they can add more value when they join industries because they can apply these concepts in day to day scenarios protecting the assets of both the organization and as well as their customers.

Recommendation:

Each industry should evolve its own IPR policies, management style, strategies, and so on depending on its area of specialty. Pharmaceutical industry currently has an evolving IPR strategy requiring a better focus and approach in the coming era.

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VI-Semester

Open Elective-II

OEC-CSIT601(C)	Operation Research	3L:0T:0P (3hrs)	3Credits
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Pre requisite(s): M-II, M-III

Course Objective:

1. To be familiar with all the OR Techniques and optimization methods.
2. To be familiar with various inventory control techniques.
3. To be familiar with waiting line models and Competitive strategy.
4. To clear idea of the decision making and meta-heuristic algorithm.
5. To understand project network analysis.

Course Content:

Module 1 (12 Hrs)

Linear system and distribution models: Mathematical formulation of linear systems by LP, solution of LP for two variables, Simplex method, special cases of LP- transportation and assignment model and their graphical solution, Vogels Approximation Method (VAM) or penalty method, cell evaluation degeneracy.

Module 2 (10 Hrs)

Inventory Models: Necessity of inventory in process and safety stock, problem of excess inventory and cycle time, JIT/ Lean Mfg; basics of inventory models with deterministic demand, Classical EOQ Model, ABC, VED and other analysis based on shelf life, movement, size, MRP technique and calculations, lot sizing in MRP, linking MRP with JIT; evolution of MRP to ERP to SCM and e-business.

Module 3 (10 Hrs)

Waiting Line Models: Introduction, Input process, service mechanism, Queue discipline, single server (M/M/1), average length and average time calculations, optimum service rate; basic multiple server models (M/M/s)

Competitive strategy: concept and terminology, assumptions, pure and mixed strategies, two person zero sum games, saddle point, dominance, graphical, algebraic and LP methods for solving game theory problems.

Module 4

(10 Hrs)

Decision Analysis: Decision under certainty, risk Probability and uncertainty, Hurwitz criterion AHP assigning weight and consistency test of AHP. **Metaheuristics:** definition of heuristic and metaheuristic algorithms.

Module 5

(10 Hrs)

Network Analysis: Project Planning, Scheduling and Controlling; Project management; Network Techniques and its role in project management, Network logics, Fulkerson's Law, Merits and Demerits of AON Diagrams; Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Determination of critical path, Float/Slack.

Course Outcome:

After completion of the course student will be able to:

1. Understand the concept of optimization and its application.
2. Understand the concept of various inventory control techniques used in industries.
3. Understand the concept of Queuing and Game Theory.
4. Understand the idea of the decision making and application of meta-heuristic algorithm
5. Implement project management concepts, tools and techniques in order to achieve project success

Text Books :

1. Hillier FS and Liberman GJ; Introduction to Operations Research concept and cases; TMH , 8th Ed. 2008.
2. Heera and Gupta, Operation Research, S Chand Pub. reprint with corrections ,2017
3. Sharma JK; Operations Research; Macmillan 3rd Ed. 2006.
4. Heera and Gupta ,Problems in Operations Research Principles and Solutions, S Chand Pub, 4th Ed. 2015.

Reference Books:

1. Taha H; Operations research; PHI, 10th Ed.2019.
2. Jain, pandey & shrivastava; Quantitative techniques for management, New Age publishers.2019
3. Srinivasan G; Quantitative Models In Operations and SCM; PHI Learning, 2017
4. Sen RP; Operations Research-Algorithms and Applications; PHI Learning, 2009
5. Bronson R ;Theory and problems of OR; Schaum Series; TMH, 2016.

Perspective:

Operations Research is interdisciplinary field, intermixing theories and methodologies from mathematics, management science, computer science, operations management, economics, engineering, decision support, soft computing and many more.

Recommendation:

Operations research and computers interact in many scientific fields of vital importance to our society. These include, among others, transportation, economics, investment strategy, inventory control, logistics. Computers & Operations Research (COR) provides an forum for the application of computers

and operations research techniques to problems in these and related fields.

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VI-Semester

Open Elective-II

OEC-CSIT601(D)	Probability Theory & Statistics	3L:1T:0P (3hrs)	4 Credits
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Course Objective: To understand the basic concept of probability, LPP, Index number and perform the data analysis with suitable forecasting in research and project phases.

Module-1: Probability (9 Hours)

Probability, Types of probability, Random variable, Probability function, Sampling: purpose and principle of sampling, Methods of sampling, Size of sample, Merits and limitations of sampling, Sampling distribution, Conditional probability, Baye's theorem.

Module-2: Correlation and Regression Analysis (9 Hours)

Correlation analysis: Significance, Correlation & Causation, Types of correlation, Methods of studying correlation, Multiple correlation, Regression analysis: Difference between correlation and regression, Bivariate linear regression model, Regression lines, Equations, Coefficients.

Module-3: Hypothesis Testing (8 Hours)

Concept of hypothesis, Types of error in testing, Level of significance, Null and alternative hypothesis, Special tests of significance: The Chi (χ^2) test, The Z-Score test, The T-test, Test for proportion.

Module-4: Linear Programming (9 Hours)

Linear programming: General linear programming problem (LPP), Standard and canonical form of LPP, Formulation of LPP, Graphical solution, Simplex method, Artificial variable techniques: Two phase method, Big-M method, Duality: definition of the dual problem, Dual simplex method.

Module-5: Index Numbers, Forecasting and Time Series Analysis (10 Hours)

Index numbers: Use of index numbers, Unweighted index numbers, Weighted index numbers, Quantity index numbers, Volume index numbers, Time reversal test, Factor reversal test, Forecasting: Introduction, Steps in forecasting, Methods of forecasting, Time series analysis: Components of time series, Straight line trends, Non-linear trend.

Course Outcomes:

- CO1: Apply fundamental concepts of probability to Computer Science & Engineering problem.
- CO2: Apply and explain the Correlation & Regression to Computer Science & Engineering project.
- CO3: Apply the various test of significance to structure engineering decision-making problems.
- CO4: Apply various linear programming methods to Computer Science & Engineering.

CO5: Apply and analyze the index numbers, forecasting analysis and time series analysis on suitable classified data.

Textbooks/References:

1. Connor, L R and Morreu, A J H, Statistics in Theory and Practice, Pitman, London, 1964.
2. Wannacott and Wannacott, Introductory Statistics, John Wiley & Sons, New York, 5th Edition, 1990.
3. Willams, Ken (ed), Statistics and Urban Planning, Charles Knight & Co. Ltd, London, 1975.
4. Yamane, Taro, Statistics – An Introductory Analysis, Harper, New York, 1973.
5. D. C. Montgomery and G. C. Runjer, Applied Statistics & Probability for Engineers, Wiley Publication, 6th Edition, 2014.
5. A. Ravindran, D. T. Phillips and James J. Solberg, Operations Research- Principles and Practice, John Wiley & Sons, 2nd Edition 2007.
6. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 10th Edition, 2019.
7. F.S. Hillier, G.J. Lieberman, Introduction to Operations Research- Concepts and Cases, Tata McGraw Hill, 10th Edition, 2017.
8. C. Chatfield, The Analysis of Time Series - An Introduction, Chapman and Hall, 7th edition 2019.
9. Peter J. Brockwell and Richard A. Davis, Introduction to Time Series and Forecasting, Springer, 3rd Edition 2016.
10. S. Ross, A first course in probability, Pearson education India, 6th edit