INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for 3rd Year B.Tech COMPUTER SCIENCE & ENGINEERING

(Admission Batch: 2018-19 Onwards)

Fifth Semester				Sixth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
				HSHM3306M/ HSHM3306	Enhancing Soft Skills and Personality	2-0-0	2
	Programme Core Subject				***Programme Core Subject***		
PCCS4306	Design and Analysis of Algorithm	3-0-0	3	PCCS4309	Operating System	3-0-0	3
PCCS4307	Computer Networks	3-0-0	3	PCCS4310	Compiler Design	3-0-0	3
PCCS4308	Microprocessor and Micro Controller	3-0-0	3	**(Any One)** PECS5304/ PECS5305/ PECS5306/	***Programme Elective II*** Machine Learning Techniques/ Soft Computing/ Cryptography and Network Security	3-0-0	3
(Any One) PECS5301/ PECS5302/ PECS5303/	***Programme Elective I*** Computer System Architecture/ Embedded System Design/ Graph Theory	3-0-0	3				
(Any One)	***Open Elective II*** Refer List of Open Electives	3-0-0	3	**(Any One)**	***Open Elective III*** Refer List of Open Electives	3-0-0	3
MCGN9305/ MCHM9306	***Mandatory Course V*** Environmental Science/ Universal Human Values	2-0-0	0	MCHM9306/ MCGN9305	***Mandatory Course VI*** Universal Human Values/ Environmental Science	2-0-0	0
Total (Theory)		**17**	**15**	**Total (Theory)**		**16**	**14**
Honours/ Minor		3-1-0	4	**Honours/ Minor**		3-1-0	4
HNCS0303 MNCS0303	Software Architecture Database Management System			HNCS0304 MNCS0304	Software Quality Management Computer Networks		
Practical/ Sessional				**Practical/ Sessional**			
PCCS7305	Design & Analysis of Algorithm Lab	0-0-3	2	PCCS7308	Operating System Lab	0-0-3	2
PCCS7306	Computer Networks Lab	0-0-3	2	PCCS7309	Compiler Design Lab	0-0-3	2
PCCS7307	Microprocessor and Micro Controller Lab	0-0-3	2	HSHM3305	Business Communication & Interview Skills	0-0-3	1
				PJCS8301	Skill Project	0-0-3	2
Total (Practical/ Sessional)		**9**	**6**	**Total (Practical/ Sessional)**		**12**	**7**
TOTAL		**26**	**21**	**TOTAL**		**28**	**21**
TOTAL SEMESTER CREDITS: 21				TOTAL SEMESTER CREDITS: 21			
TOTAL CUMULATIVE CREDITS: 104				TOTAL CUMULATIVE CREDITS: 125			

OPEN ELECTIVE SUBJECTS

OPEN ELECTIVE-II (OE-II) 5th Semester						
Sl. No.	**Subject Code**	**Subject Name**	**Contact Hours**	**Credits**	**Departments to Teach the Subject**	**Students to whom Option is Open**
1	OECH6311	Petroleum Refinery Engineering	3-0-0	3	Chemical Engg.	All branches
2	OECH6330	Green Technology	3-0-0	3	Chemical Engg, Civil Engg.	All branches
3	OECE6312	Mechanics of Solids	3-0-0	3	Civil Engg.	All branches
4	OECS6203	OOPs Using C++	3-0-0	3	CSE	CH, CS, EC, MM, PD
5	OECS6331	Cloud Computing	3-0-0	3	CSE	All branches
6	OEEE6313	Digital Signal Processing	3-0-0	3	Electrical Engg.	All branches
7	OEEC6314	Industrial Automation with PLC and SCADA	3-0-0	3	ETC Engg.	All branches
8	OEME6316	Introduction to Composite Materials	3-0-0	3	Mech. Engg.	All branches
9	OEMT6315	Nanomaterials	3-0-0	3	MME	All branches
10	OEPD6317	Powder Metallurgy	3-0-0	3	Prod. Engg.	All branches
11	OEMA6207	Numerical Methods	3-0-0	3	Mathematics	CE, EE, ME
OPEN ELECTIVE-III (OE-III) 6th Semester						
Sl. No.	**Subject Code**	**Subject Name**	**Contact Hours**	**Credits**	**Departments to Teach the Subject**	**Students to whom Option is Open**
1	OECH6318	Food Biotechnology	3-0-0	3	Chemical Engg.	All branches
2	OECH6319	Fluidization Engineering	3-0-0	3	Chemical Engg.	All branches
3	OECE6320	Structural Dynamics and Earthquake Engineering	3-0-0	3	Civil Engg.	All branches
4	OECS6321	Data Science	3-0-0	3	CSE	All branches
5	OEEE6322	Sensors and Transducers	3-0-0	3	Electrical Engg.	All branches
6	OEEC6324	Mechatronics	3-0-0	3	ETC Engg.	All branches
7	OEHM6325	Marketing Management	3-0-0	3	Humanities	All branches
8	OEMA6326	Optimization in Engineering	3-0-0	3	Mathematics	All branches
9	OEME6327	Industrial Engineering and Operation Research	3-0-0	3	Mechanical Engg.	All branches
10	OEMT6328	Biomaterials	3-0-0	3	MME	All branches
11	OEPD6329	Operation Research	3-0-0	3	Prod. Engg.	All branches

CE:	Civil Engineering	CS, CSE:	Computer Science and Engineering
EE:	Electrical Engineering	EC, ETC:	Electronics and Telecommunication Engineering
ME:	Mechanical Engineering	MT, MME:	Metallurgical and Materials Engineering
CH:	Chemical Engineering	PD, Prod.:	Production Engineering
HM:	Humanities	MA:	Mathematics

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

B.TECH SYLLABUS for COMPUTER SCIENCE & ENGINEERING

(Admission Batch: 2018-19 Onwards)

5th Semester

PCCS4306 Design and Analysis of Algorithm (3-0-0) Credit-3

Course Objectives: Student should be able to

1. Define algorithm formally and informally
2. Explain elementary and advanced data structures
3. Explain the different algorithms for solving typical problems
4. Describe the process of algorithm design and analysis
5. Explain the complexity of algorithms
6. Design recursive and non-recursive algorithms for, say, computing a Fibonacci number
7. Explain P, NP and NP-completeness.

Module-I

(10Hours)

Introduction: Role of Algorithms in Computing, Analyzing Algorithms, Designing Algorithms, Asymptotic Notation, Standard Notations and Functions. Advance data structure linear vs. nonlinear data structure. Recurrences, solution of recurrences by substitution, recursion tree and Master methods.

Module-II (10 Hours)

Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, extendible Hashing. Heap Structure: Min-Max heap, Binomial heaps, Search and Tree Structure: Binary Search Tree, AVL Tree, Priority Queue, Lower bounds for sorting.

Module-III (12Hours)

Divide and Conquer: (Quick sort, Merge sort, Strassen's algorithm for Matrix). **Dynamic Programming**: (LCS, Floyd-Warshall Algorithm, Matrix Chain Multiplication). **Greedy Algorithm**: (Single Source Shortest Path, Knapsack problem, Minimum Cost Spanning Trees (Kruskal's and Prim's algorithm) The Huffman coding algorithm). **Geometric Algorithm**: (Convex hulls, Segment Intersections, Closest Pair). **Internet and Network flow Algorithm**: (Text pattern matching (Naive and Rabin-Krap algorithm) Flow Network, cut, Ford-Fulkerson method). **Graph Algorithm**: (Breadth First search, Depth First search). **Backtracking:** – n-Queens problem Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound, **Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm.

Module-IV (8 Hours)

Polynomial Time, Polynomial-Time Verification, NP Completeness & reducibility, NP Completeness proofs, Cook's theorem, Approximation algorithm, Vertex cover algorithm, Traveling Sales man problem.

Text Book

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms",
   3rd Edition, PHI Learning Private Limited, 2012.

Reference Books

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Addison-Wesley Longman, 2011.
2. S. Sridhar, "Design and Analysis of Algorithm", OXFORD university press,2015
3. E. Horowitz, S. Sahani and Dinesh Mehta, "Fundamentals of Data Structures in C++", 2nd Ed, University Press.
4. Mark Allen Weiss, "Data Structures & Algorithm Analysis in C/C++", Pearson Edu. India.
5. Adam Drozdex, "Data Structures and algorithms in C++", Thomason learning.
6. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

PCCS4307 Computer Networks (3-0-0) Credit-3

MODULE I (10Hours)

Introduction:

Networks, Line Configurations, Network Topology, Network Types, Internetworks, Internet Architecture, Protocol and Standards, Layered Architecture, TCP/IP Model, OSI Reference Model. **Physical Layer:**Analog and Digital Signals and their Characteristics, Transmission Impairment, Data Rate Limits-NyquistFormula & Shannon Capacity, Analog and Digital Transmission and Conversions - Digital-to-Digital Conversion, Digital-to-Analog Conversion, Analog-to-Digital Conversion, Analog-to-Analog Conversion, Transmission Modes, Multiplexing - FDM, WDM, TDM, Switching, Transmission Media.

MODULE II (12Hours)

Data Link Layer:

Types of Errors, Error Detection Techniques - Parity, CRC, Check Sum, Error Correction Techniques - Hamming Code, Framing, Data Link Control - Stop-and-Wait ARQ, Go-Back-N ARQ, Selective-Repeat ARQ, Piggybacking, Multiple Access - Random Access, Controlled Access, Channelization, Elementary Data Link Protocols - HDLC, PPP, Ethernet, Wireless LANs&

Bluetooth, **Connecting Devices** - Repeater, Hubs, Bridges, Switches, Routers, Gateways, Backbone Networks, Virtual LANs, Virtual Circuit Networks - Frame Relay and ATM.

MODULE III (8Hours)

Network Layer:

Logical Addressing, IPv4 and IPv6 Addresses, Internetworking, Internet Protocols - IPv4, IPv6, Network Layer Protocols - Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP), Internet Control Message Protocol (ICMP), Internet Group Message Protocol (IGMP), Forwarding and Routing Techniques.

MODULE IV (10Hours)

Transport Layer:

Process to Process Delivery, User Datagram Protocol (UDP), Transmission Control Protocol(TCP), Congestion Control, Congestion Control Algorithms, Quality of Service (QoS), Techniques to Improve QoS. **Application Layer:** Domain Name System (DNS), Remote Logging Architecture and Protocols, E-Mail Architecture and Protocols, File Transfer, WWW and HTTP.

Text Books:

1. Behrouz A. Forouzan, "Introduction to Data Communications and Networking", Fourth Edition, 2007, McGraw-Hill Education (India), New Delhi.
2. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, 2003, PHI Learning Pvt. Ltd., / Pearson Education Inc., New Delhi.

Reference Books:

1. Natalia Olifer& Victor Olifer, "Computer Networks: Principles, Technologies and Protocols", First Edition, 2006, Wiley India Pvt. Ltd., New Delhi.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 4th Edition (2008), Pearson Education Inc., New Delhi.
3. Wayne Tomasi, "Introduction to Data Communications and Networking", First Edition, 2005, Pearson Education Inc., New Delhi

PCCS4308 Microprocessor and Microcontroller 3-0-0 Credit 3

Course Objectives: The course is designed to provide a complete knowledge on Microprocessor and Microcontrollers. Students shall be able to develop logic for creating new electronic devices using various Microprocessors and Microcontrollers. Also, by learning the Assembly language programming leads to improve advanced programming in different ports and fields.

MODULE I (10 Hours)

Microprocessor Architecture: Microprocessor and Microcomputer Architecture, Pins & Signals, Register Organization, Timing & Control Module, 8085 Instruction Timing & Execution. **Assembly Language Programming of 8085:** Instruction set of 8085, Memory & I/O Addressing, Assembly language programming, Stack & Subroutines. Interfacing EPROM & RAM Memories: 2764 & 6264, 8085 Interrupts. **8086 Microprocessor: Architectures, Pin Diagrams and Timing Diagrams:** Register Organisation, Architecture, Signal Description, Physical Memory Organisations, Bus Operation, I/O Addressing Capability, Special Processor Activities, Minimum Mode System and Timings, Maximum Mode System and Timings

MODULE II (12 Hours)

8086 Instruction Set and Assembler Directives: Machine Language Instruction Formats, Addressing Modes, Instruction Set, Assembler Directives and Operators **Assembly Language Programming with 8086: M**achine Level Programs, Machine Coding the Programs, Programming with an Assembler. **Special Architectural Features and Related Programming:** Stack, Interrupts and Interrupt Service Routines, Interrupt Cycle, Non Maskable Interrupt, Maskable Interrupt, Interrupt Programming, Passing Parameters to Procedures, Handling Programs of Size More than 64k,MACROS, Timings and Delays. **Basic Peripherals and Their Interfacing with 8086:** Semiconductor Memory Interfacing, Dynamic RAM Interfacing, Interfacing I/O Ports, PIO 8255, Modes of Operation of 8255, Interfacing Analog to Digital Data Converters, Interfacing Digital to Analog to Converters, Stepper Motor Interfacing. **Special Purpose Programmable Peripheral Devices and Their Interfacing.** Programmable Interval Timer 8253, Programmable Interrupt Controller 8259A, The Keyboard/Display Controller 8279, Programmable Communication Interface 8251USART.

MODULE III (8 Hours)

8051 Microcontrollers: Microcontrollers and embedded processors, Overview of the 8051 family. **8051 Hardware Connection:** Pin description of the 8051. **8051 Assembly Language Programming:** Inside the 8051, Assembly, Programming. Assembling and Running an 8051 Program, The Program Counter and ROM Space in the 80518051 data types and Directives, PSW Register, register Banks and Stack. **Jump, loop, and Call Instructions:** Loop and Jump Instructions, Call Instructions, Time Delay for Various 8051 chips. Addressing Modes, Bit Addresses for I/O and RAM.

MODULE IV (10 Hours)

Arithmetic & Logic Instructions and Programs: Arithmetic Instructions, Signed number concepts and Arithmetic Operations, Logic and Compare Instructions, Rotate Instruction and data Serialization, BCD, ASCII, and other Application Programs. **8051 Serial Port Programming in Assembly:** Basic of Serial communication, 8051 connection to RS232, 8051 Serial port Programming in Assembly, Programming the second Serial port. **Interrupts Programming in**

Assembly: 8051 Interrupts, Programming timer Interrupts, Programming external hardware Interrupts, Programming the Serial Communication interrupt, Interrupt Priority in the 8051.**Interfacing to External Memory:** Semiconductor Memory, Memory Address Decoding, Interfacing with External ROM, 8051 Data Memory space, Accessing External data Memory.

Text Books:

1. Ghosh & Sridhar,0000 to 8085–Introduction to Microprocessor for Scientists & Engineers, PHI (For Module I)
2. A.K. Roy & K.M. Bhurchandi, Advanced Microprocessor and Peripherals (Architecture, Programming & Interfacing)– TMH Publication (For Module II)
3. Mazidi & Mazidi, The 8051 Microcontroller & Embedded Systems– Pearson / PHI publication (For Module III and Module IV)

Reference Books:

1. M. Rafiqzzaman, Microprocessor – Theory & Applications. (Intel &Motorola), PHI
2. The 8086 Microprocessor: Programming & Interfacing the PC by Keneeth J. Ayela
3. Douglas V.Hall, "Microprocessors and Interfacing: Programming and Hardware", TMH
4. R.S. Gaonkar, Microprocessor architecture, programming & application with 8085, Penram International Publishing. (India) Pvt. Ltd.
5. W.A. Triebel and Avtar Singh, The 8088 and 8086 Microprocessors, Pearson Education
6. Barry B. B The Intel Microprocessor – (Architecture, Programming & Interfacing) by Pearson

PECS5301 Computer System Architecture (3-0-0) Credit-3

Course Objectives:

To understand the functions and design of various units of digital computers to store and process the information, fundamental concepts of processing units, concepts of various memory systems, input/output, Interrupts.

MODULE I [10Hrs]

Number system - Binary, decimal, octal, hexadecimal, Conversion - Binary to decimal, decimal to binary, octal to decimal, decimal to octal, octal to binary, binary to octal, hexadecimal to binary, binary to hexadecimal, hexadecimal to Decimal, decimal to hexadecimal, hexadecimal to octal, octal to hexadecimal, **Binary arithmetic** – Addition, subtraction (simple method), **Logic gates** - AND, OR, NOT, NAND, NOR, Exclusive-OR, Exclusive NOR, **Combinational circuits** - Design of Combinational Circuits – Adder / Subtracter – Encoder – Decoder – MUX / DEMUX, Flip-Flops, Counters, Registers

MODULE II [10Hrs]

Basic Computer Organization and Design: Instruction codes, computer registers, computer instructions, timing & control, instruction cycle, memory reference instructions, input-output and

interrupts, design of basic computer, design of accumulator logic. **Micro-programmed Control Unit:** Control memory, address sequencing. **Central Processing Unit**: Introduction, general register organization, stack organization, instruction formats, addressing modes.

MODULE III [10 Hrs]

Pipeline and Vector processing: Parallel Processing, pipelining, arithmetic pipeline, RISC Pipeline, Vector Processing, Array Processors. **Input-Output Organization:** Peripheral devices, input-output interface, asynchronous data transfer, modes of data transfer, priority interrupt, direct memory access, input-output processor

MODULE IV [10Hrs]

Memory organization: Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware. **Multiprocessors:** Characteristics of multiprocessor, Interconnection Structure, Inter processor Communication & Synchronization.

Text Books:

1. M. Mano, "**Computer System and Architecture**", 3rd Edition, PHI Publication.
2. W Stallings, "**Computer Organization & Architecture**", PHI Publication.

Reference Books:

1. J. P. Hayes, "**Computer Architecture and Organization**", McGraw Hill Publication.
2. Carl Hamachar, Zvonko Vranesic, SafawatZaky, "**Computer Organization**" Tata McGraw Hill Publication.
3. V. Rajaraman, T. Radhakrishnan, "**Computer Organization and Architecture**", PHI Publication.

Course Outcomes:

1. To know about number system and arithmetic operations over it.
2. To know the basics computer organization and its design.
3. Understanding pipeline and vector processing.
4. To know about the memory organization.

PECS5302 Embedded System Design 3-0-0 Credit 3

Course Outcomes:

CO1: Gain knowledge on pins present in 8085 and 8086 Microprocessor and Microcontroller.
CO2: Gain knowledge on different Addressing Modes used in 8085 and 8086.
CO3: Exercise programs relating to different ports and architecture of microcontrollers.
CO4: Create and Implement Assembly Language Programming on microprocessors.

Course Objectives:
To understand the knowledge about embedded system, devices and device drivers, design of various units of embedded devices to store and process the information, fundamental concepts of processing units, concepts of various memory systems, input/output, Interrupts. And new RTOSs

MODULE I (10 Hours)
Hardware Concepts:
Application and characteristics of embedded systems, Overview of Processors and hardware units in an embedded system, General purpose processors, Microcontrollers, ARM-based Systems on a Chip (SoC), Application-Specific Circuits (ASICs), Levels of hardware modelling, VHDL, Sensors, A/D-D/A converters, Actuators, Interfacing using UART, USB, CAN bus, SRAM and DRAM, Flash memory.

MODULE II (10 Hours)
Devices and device drivers: I/O devices, Serial peripheral interfaces, IIC, RS232C,RS422,RS485, Universal serial bus, USB Interface, USB Connector IrDA, CAN, Bluetooth, ISA,PCI, PCI -X and advance busses, Device drivers.

MODULE III (8 Hours)
ARM: ARM pipeline, Instruction Set Architecture ISA: Registers, Data Processing Instructions, Data Transfer Instructions, Multiplications instructions, Software interrupt, Conditional execution, branch instruction, Swap instruction, THUMB instructions.

MODULE IV (12 Hours)
Real-Time Operating Systems
Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix-based Real-time operating systems, POSIX-RT, A survey of contemporary Real-time operating systems, Microkernel-based systems.

Text Books:

1. "Embedded system architecture, programming and design" By Raj Kamal, TMH.
2. "Embedded System Design" by Santanu Chattopadhay, PHI
3. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware/Software Introduction, John Wiley, 2002.
4. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.

Reference Books:

Shibu KV, Introduction to Embedded Systems, TMH **8051 I/O Port Programming:** I/O Programming, I/O Bit Manipulation Programming, **8051 Addressing Modes:** Immediate and register Addressing Modes, Accessing memory using various

PECS5303 Graph Theory 3-0-0 Credit 3

Module – 1 **(11 hours)**

Introduction to Graphs: Definition of a graph, finite and infinite graphs, incidence of vertices and edges, types of graphs, sub graphs, walks, trails, paths, cycles, connectivity, components of a graph, Eulerian and Hamiltonian graphs, travelling salesman problem, vertex and edge connectivity, matrix representation of graphs, incidence and adjacency Matrices of graphs.

Module – 2 **(11 hours)**

Trees and Fundamental Circuits: Definition and properties of trees, rooted and binary trees, counting trees, spanning trees, weighted graphs, minimum spanning tree, fundamental circuit, cut set, separability, Kruskal and Prim algorithms with proofs of correctness, Dijkstra'sa algorithm, Breadth first and Depth first search trees

Module – 3 **(12 hours)**

Planar Graphs and Graph coloring: Planar graphs, Kuratowski's graphs, detection of planarity, Euler's formula for planar graphs, Euler's formula, non-planarity of K5 and K3,3, geometric and combinatorial duals of a planar graphs, coloring of graphs, chromatic numbers, Greedy algorithm, chromatic polynomial, chromatic partitioning, Four-color theorem, Five colour problem, Six colour problem. colouring with *k* colours and with no monochromatic K3.

Module – 4 **(6 hours)**

Ramsey theory and Enumerations: Introduction to Ramsey theory, Ramsey numbers, Ramsey theorem. Types of enumerations, Polya theory of enumeration and its applications.

Books

1. N Deo., “Graph Theory with Applications to Engineering and Computer Science”, Prentice Hall India 2004

Chapter 1 (1.1 to 1.5), 2, 3, 4 (4.1 to 4.5, 5 (5.1 to 5.7), 8, 10

Reference books:-

1. D. B.West, "Introduction to Graph Theory ", Prentice Hall India, Second Edition 2009
2. J. Clark and J. A. Holton, "A First Look at Graph Theory", World Scientific 1991
2. R. J.Wilson, “Introduction to Graph Theory”, Pearson Education, Fourth Edition 1996
3. G. Chartrand and P. Zhang, "Introduction to Graph Theory", Tata McGraw Hill 2007

MANDATORY COURSE

MCGN9305	Environmental Science	2-0-0	Credit-0

Unit 1: Multidisciplinary nature of environmental studies

Definition, scope and importance), Need for public awareness.

Renewable and non-renewable resources

Natural resources and associated problems, role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles.

Unit 2: Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystems:-

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Biodiversity and its conservation

- Introduction – Definition: genetic, species and ecosystem diversity.
- Bio geographical classification of India
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit 4: Environmental Pollution Cause, effects and control measures of :-
Air pollution, water pollution, soil pollution, noise pollution, nuclear hazards and solid waste Management: Causes, effects and control measures of urban and industrial wastes, Disaster management: floods, earthquake, cyclone and landslides.

Unit 5: Social Issues and the Environment
Sustainable development, water conservation, rain water harvesting, resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion.

Text Books

1. Environmental Science And Engineering by Rajesh Gopinath N. Balasubramanya, Cengage India.
2. Fundamental Concepts in Environmental Studies by Dr. D.D. Mishra S. Chand Publication.
3. Basic environmental Sciences for undergraduates by Dr. Sohini Singh, Dr. Tanu Allen and Dr. Richa K. Tyagi, Vayu education of India.

MANDATORY COURSE

MCHM9306	Universal Human Values	2-0-0	Credit-0

Objective:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To sensitize the student towards issues in society and nature.
3. To Strengthen self-reflection to know what the students 'really want to be' in their life and profession.
4. To understand harmony at all the levels of human living, applying the understanding of harmony in existence in their profession and lead an ethical life.

Module I **10 Hours**

1. Need, basic guidelines, content and process for Value Education, Self-Exploration– content and process;

2. Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities for Human Aspirations.

3. Method to fulfill the human aspirations: understanding and living in harmony at various levels.

Module II **10 Hours**

1. Human being as a co-existence of the sentient 'I' and the material 'Body', Self ('I') and 'Body' - *Sukh* and *Suvidha*

2. Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I',

3. Harmony of I with the Body: *Sanyam* and *Swasthya*; Needs of Body and Psyche: *Sanyam* and *Swasthya*

Module III **12 Hours**

1. Harmony in the Family, values in human-human relationship; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship, meaning of *Vishwas* and *Samman*

2. Harmony in the society: *Samadhan, Samridhi, Abhay, Sah*-astitva, universal harmonious order in society- family to world family, harmony in the Nature : recyclability and self-regulation in nature

3. Natural acceptance of human values, Ethical Human Conduct, and Humanistic Education,

Module IV **08 Hours**

1. Competence in Professional Ethics: professional competence for augmenting universal human order, people-friendly and eco-friendly production systems, technologies and management

2. Strategy for transition from the present state to Universal Human Order

3. Being socially and ecologically responsible engineers with mutually enriching institutions and organizations.

Text Book:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References Books:

1. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
2. A N Tripathy, 2003, Human Values, New Age International Publishers.
3. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books

Course Outcome:

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

1. Distinguish between values and skills; understand the need, basic guidelines, content and process of value education.
2. Distinguish between the Self and the Body; understand the meaning of Harmony in the Self the Co-existence of Self and Body.

3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings.
4. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment.

HONOURS

HNCS0303 Software Architecture 3-1-0 Credit 4

Objective

To provide the students with a skill-set that enables them to choose and apply a particular architectural strategy per se software system requirements

Module-I: Introduction to Software Architecture and its importance (10 Hrs)

What is Software Architecture?, Architecture Structure and Patterns, Good architecture, Importance of Software architecture, Contexts of Software architecture. **Software Quality Attributes:** Quality Classes, Understanding Quality Attributes: Usability, Availability, Interoperability, Testability, Performance, Modifiability, Security, Other Quality Attributes.

Module-II (10 Hrs)

Designing the Architecture: Architecture and Requirements, Designing an architecture **Documenting the Architecture:**

Documenting Software Architectures **Architecture Patterns:** *Layering Patterns, Pipe & Filter, Blackboard, Distributed*
Systems, Reflection.

Module-III: (8Hrs)

Architecture Implementation, Testing, Reconstruction, Conformance and Evaluation Moving From Software Architecture to Software Design, **Design Patterns:** *Introduction, Creational, Structure, and Behaviour*

Module-IV: (6 Hrs)

Architecture in the Context of Cloud: Introduction to Cloud Computing, Service Models, Case Studies Software Architecture: Past, Present, and Future.

MINOR

MNCS0303	Database Management System	3-1-0	Credit-4

Module I: (10 Hours)

Introduction to database Systems, advantages of database system over traditional file system, Basic concepts & Definitions, Database users, Database Language, Database System Architecture, Schemas, Sub Schemas, & Instances, database constraints, 3-level database architecture, Data Abstraction, Data Independence, Mappings, Structure, Components & functions of DBMS, Data models.

Module II: (10 Hours)

Entity relationship model, Components of ER model, Mapping E-R model to Relational Schema. Storage Strategies**:** Detailed Storage Architecture, Storing Data, Magnetic Disk, RAID, Other Disks, Magnetic Tape, Storage Access, File & Record Organization, File Organizations & Indexes, Order Indices, B+ Tree Index Files, Hashing, Data Dictionary.

Module III: (10 Hours)

Relational Algebra (RA), Tuple Relational Calculus (TRC) and Domain Relational Calculus (DRC), Relational Query Languages: SQL and QBE. Database Design: Database development life cycle (DDLC), Automated design tools, Functional dependency and Decomposition, Join strategies, Dependency Preservation & lossless Design, Normalization, Normal forms:1NF, 2NF,3NF, and BCNF, Multi-valued Dependencies, 4NF & 5NF. Query processing and optimization: Evaluation of Relational Algebra Expressions, Query optimization, Query cost estimation.

Module IV: (10 Hours)

Transaction processing and concurrency control: Transaction concepts, properties of transaction, concurrency control, locking and Timestamp methods for concurrency control schemes. Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques. Fundamental concepts on Object-Oriented Database, Object relational database, distributed database, Parallel Database, Data warehousing & Data Mining, Big Data and NoSQL.

Text Books:

1. Database System Concepts by Sudarshan and Korth, 6th edition, McGraw-Hill Education.
2. Fundamentals of Database System by Elmasari & Navathe, Pearson Education.
3. Fundamentals of Database Management System by Gillenson, Wiley India.

References Books:

1. Database Management Systems by Ramakrishnan, McGraw-Hill Education.
2. Database management system by leon & leon, Vikas publishing House.
3. Database System: Concept, Design & Application by S.K. Singh, Pearson Education.
4. An introduction to Database System – Bipin Desai, Galgotia Publication

PRACTICAL / SESSIONAL

PCCS7305	Design and Analysis of Algorithm Lab	0-0-3	Credit-2

1. Using a stack of characters, convert an infix string to postfix string.
2. Implement insertion, deletion, searching of a BST.
3. Implement binary search and linear search in a program
4. (a) Write a program to demonstrate Masters Theorem.
   (b) Take different input instances for both the algorithm and show the running time.
5. Implement Hashing function in a program.
6. Implement a heap sort using a Max/Min heap.
7. (a)Implement a heap sort using a Binomial heap.
   (b) Write a program on Heap sort based on priority sorting.
8. (a) Write a program on Quick sort algorithm.
   (b) Write a program on merge sort algorithm.
9. Implement AVL tree in a program.
10. Implement Strassen's matrix multiplication algorithm.
11. Using dynamic programming implement LCS.
12. (a) Implement DFS/ BFS for a connected graph.
    (b) Implement Dijkstra's shortest path algorithm using BFS.
13. (a) Implement MST using Kruskal/Prim algorithm.
    (b)Write a program to implement Huffman's algorithm.
14. Write a program to find the shortest path in agiven graph using Floyd-Warshall algorithm.
15. Write aprogramto find theshortest path in agiven graph using Bellman -Ford algorithm
16. Write a program to find Optimal solution for a Knap Sack Problem using Greedy Method.
17. Write a program to implement Rabin-Krap algorithm.
18. Write a program to implement Ford-Fulkerson algorithm.
19. Find out the solution to the N-Queen problem.
20. Implement any scheme to find the optimal solution for the Travelling Sales person problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

PCCS 7306 Computer Networks Lab (0-0-3) credit-2

1. Study of network simulators like NS2, NS3.
2. Implementation (simulation) of Stop and Wait Protocol and Sliding Window Protocol.
3. Implementation (simulation) of ARP /RARP protocols.
4. Implementation (simulation) of PING and TRACEROUTE commands.
5. Write a program to implement RPC (Remote Procedure Call).
6. Implementation (simulation) of Sub-netting.
7. Applications using TCP Sockets like Echo client and echo server, chat.
8. Implementation (simulation) of TCP and UDP sockets like DNS, SNMP, file transfer.
9. Simulation of congestion control algorithms.
10. Simulation of different routing algorithms.

PCCS7307 Microprocessor & Microcontroller Lab (0-0-3) Credit-2

Experiment List

8085

1. Addition, subtraction, multiplication and division of two 8-bit numbers
2. Smallest/largest number among n numbers in a given data array, Binary to Gray code, Hexadecimal to decimal conversion

Interfacing

3. Generate square wave on all lines of 8255 with different frequencies
4. Study of stepper motor and its operations
5. Study of traffic light controller

8086

6. Addition, subtraction, multiplication and division of 16-bit numbers, 2's complement of a 16-bit number
7. Finding a particular data element in a given data array
8. To separate the odd and even numbers from a given data array

8051 Microcontroller

9. Initialize data to registers and memory using immediate, register, direct and indirect Addressing mode.
10. Addition and subtraction of 16-bit numbers

OPEN ELECTIVE-II (OE-II) 5th Semester

OECH6311	Petroleum Refinery Engineering	3L-0T-0P	3 Credits

Course objectives: The objectives of this course are

1. Indicate what crude oils consists of and how crude oils are characterized based on their physical properties.
2. Demonstrate how a petroleum refinery works and sketch a flow diagram that integrates all refining processes and the resulting refinery products.
3. Examine how each refinery process works and how physical and chemical principles are applied to achieve the objectives of each refinery process.

Module-1 **(4 weeks/12 Hours)**

Overview of Petroleum Refinery its Products and Properties

Unit I (6 Hours/ 2 weeks): Origin and formation of petroleum, reserves and deposits of the world, Indian petroleum industries, Composition and Compounds of Petroleum, Crude pre-treatment: Desalting and Dehydration, Petroleum Refinery Units.

Unit II (6 Hours/ 2 weeks): Properties of Crude oil, Test Methods for Gasoline and Diesel, Refinery Products: Gasoline and its Specification, Distillate Fuels, Residual Fuel Oils, LPG, ASTM and TBP Distillation, Octane and Cetane number.

Module-2 **(4 weeks/12 Hours)**

Refinery Processes Units

Unit III (6 Hours/ 2 weeks):Coking and Thermal Processes, Catalytic Cracking

Unit IV (6 Hours/ 2 weeks): Catalytic Hydrocracking, Hydro processing and Resid Processing.

Module-3 **(4 weeks/12 Hours)**

Refinery Processes Units

Unit V (6 Hours/ 2 weeks): Hydro treating, Catalytic Reforming and Isomerization

Unit VI (6 Hours/ 2 weeks): Alkylation and Polymerization, Visbreaking.

Module-4 **(2 weeks/6 Hours)**

Treatment of Products

Unit VII (6 Hours/ 2 weeks): Treatment of products, additives, blending of gasoline. Treatment of gasoline, kerosene, lubes and lubricating oils, waxes.

Text book :

1. Petroleum Refining: Technology and Economics', 5th ed. by J H Gary, G E Handwerk, and M J Kaiser, CRC Press.

Reference Books :

1. 'Modern Petroleum Refining Processes', 6th ed. by B K B Rao, Oxford & IBH.
2. 'Petroleum Refinery Engineering', W L Nelson, McGraw-Hill.
3. 'Handbook of Petroleum Processing', 2nd ed. by S A Treese, P R Pujado and D S J Jones, Springer.

Course Outcomes (CO):

At the end of the course, students

1. Have introductory information about petroleum and refinery.
2. Learn the history of refinery development and composition of petroleum.
3. Learn refinery products, test methods and petroleum properties.
4. Should have knowledge about the different process units involved in refinery to get the valuable products like Gasoline, Diesel etc. that can be directly use by the consumers.

OECH6330	GREEN TECHNOLOGY	3L-0T-0P	3 Credits

Objectives:

1. To present different concepts of green technologies.
2. To acquire principles of Energy efficient technologies.
3. To learn the importance of green fuels and its impact on environment.

Module-1 **(4 weeks/12 Hours)**

Unit I: Principles of green technology and engineering.

Unit II: Principles of atom and mass economy, E-factor.

Module-2 **(4 weeks/12 Hours)**

Unit III: Design of greener and safer chemicals, Solvent-free methods: Microwave, Ultraviolet, and Solar.

Unit IV: Green catalysts: ionic liquids, zeolites, photo catalyst, PEG, nano catalyst, and biocatalyst.

Module-3 **(4 weeks/12 Hours)**

Unit V: Green solvents: Supercritical fluids, fluorous phase, and non-aqueous solvents.

Unit VI: Scale-up effect, reactors, separators, Process intensification.

Module-4 **(2 weeks/6 Hours)**

Unit VII: Bio-conversion of renewable. Comparison of green fuels with conventional fossil fuels with

reference to environmental, economical and social impacts.

Reference Books:

1. Handbook of Green Chemistry, Vol. 1 to 9 by P T Anastas, Wiley VCH.
2. Green Chemistry and Engineering: A Practical Design Approach by C J González and D J C Constable, Wiley.
3. Green Chemistry and Engineering: A Pathway to Sustainability by A E Marteel Parrish and M A Abraham, Wiley.
4. Green Chemistry for Environmental Sustainability by S K Sharma and A. Mudhoo, CRC Press.
5. Green Engineering: Environmentally Conscious Design of Chemical Processes by D T Allen and D R Shonnard, PHI.

Course outcomes:

1. Enlist different concepts of green technologies in a project.
2. Understand the principles of Energy efficient technologies.
3. Recognize the benefits of green fuels with respect to sustainable development.

OECE6312	Mechanics of Solids	3-0-0	Credit-3

Module – I

Stress, St. Venant's principle, Principle of Superposition, Strain, Hooke's law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Strain energy in tension and compression, Resilience, Impact loads, stresses due to freely falling weight.

Analysis of Axially Loaded Members: Composite bars in tension and compression - temperature stresses in composite rods, Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson's ratio, Bulk Modulus, Relationship between elastic constants.

Analysis of Biaxial Stress. Plane stress, Principal stress, Principal plane, Mohr's Circle for Biaxial Stress.

Strain Deformation: Two dimensional state of strain, Mohr's circle for strain, Principal strains and principal axes of strain, strain measurements, Calculation of principal stresses from principal strains.

Module – II

Stresses in thin cylinders, thin spherical shells under internal pressure -wire winding of thin cylinders. Thick cylinders subjected to internal and external pressures, compound cylinders. Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Stresses due to combined bending and torsion, Strength of shafts in combined bending and twisting.

Module – III

Theory of Columns: Eccentric loading of a short strut, Long columns, Euler's column formula, Lateral buckling, Critical Load, Slenderness ratio. Close - coiled helical springs.

Theories of failure: Maximum principal stress theory, maximum shear stress theory, maximum strain theory, total strain energy theory, maximum distortion theory, octahedral shear stress theory graphical representation and comparison of theories of failure.

Module IV

Unsymmetrical bending: Properties of beam cross selection, slope of neutral axis, stresses and deflection in unsymmetrical bending, shear centre.

Curved Beam: Bending of beam with large initial curvature, Stress distribution in beam with rectangular, circular and trapezoidal cross section, stresses in crane hooks, ring and chain links.

Text Books/Reference Books:

1. Elements of Strength of Materials by S.P. Timoshenko and D.H. Young, Affiliated East-West Press
2. Strength of Materials by G. H. Ryder, Macmillan Press
3. Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning
4. Mechanics of Materials by Beer and Johnston, Tata McGraw Hill
5. Mechanics of Materials by R.C. Hibbeler, Pearson Education
6. Mechanics of Materials by William F. Riley, Leroy D. Sturges and Don H. Morris, Wiley Student Edition
7. Mechanics of Materials by James M. Gere, Thomson Learning
8. Engineering Mechanics of Solids by Egor P. Popov, Prentice Hall of India
9. Strength of Materials by S.S. Rattan, Tata McGraw Hill
10. Strength of Materials by R. Subramaniam, Oxford University Press
11. Advanced mechanics of solids by L.S. Srinath, McGraw Hill.
12. Advanced mechanics of materials, Kumar & Ghai, Khanna Publishers.

OECS6203	OOPs Using C++	3-0-0	Credit-3

Course Objective:

This course is aimed at mastering object oriented programming technique in software development and demonstrates these techniques in solution to different types of problems.

Module –I **(10 Hours)**

Introduction to OOP, OOP Concepts, Overview of C++, C++ fundamentals, Classes, Objects, Inline functions,

function Overloading, Scope Resolution Operator, Constructors ,Destructors, Static Members, Passing objects to functions, Function returning objects.

Module – II **(10 Hours)**

Arrays, Pointers, this pointer, References, Dynamic memory Allocation, functions Overloading, Default arguments, Overloading Constructors, copy constructors, Pointers to Functions, Ambiguity in function overloading.

Module –III **(10 Hours)**

Operator Overloading, Overloading of some special operators, Inheritance, Types of Inheritance, Protected members, Polymorphism, Virtual base Class, Virtual functions, Pure virtual functions, Abstract classes.

Module – IV **(8 Hours)**

Class template, Generic classes, Function template, generic functions, Exception Handling, Exception handling options, Streams, Formatted I/O, C++ File I/O, Array based I/O, Standard Template Library (STL).

Text Books

1. H. Schildt - C++ The Complete Reference, 4th Edition, Tata McGraw-Hill, New Delhi.

Reference Books

1. A. N Kanthane, Object Oriented Programming with ANSI & Turbo C++, Pearson Education, New Delhi.
2. Object Oriented Programming with C++, E. Balagurusamy, Mcgraw Hill Education
3. Object Oriented Programming in C Robert Lafore – SAMS Publishing.

Course Outcomes: Students will be able to -

1. Familiar with issues with software design.
2. Be familiar to key concepts of object oriented programming.
3. Have knowledge about C++ concepts related to good modular design.
4. Implement patterns involving realization of abstract interfaces and polymorphism.
5. Learn how to utilize Exceptions and standard template library.

OECS6331	CLOUD COMPUTING	3-0-0	Credit-3

Course Objective: This course gives students an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domain from a while now. It will provide the students basic understanding about cloud and virtualization along with it how one can migrate over it.

Module-I **10 Hrs**

Evolution of Computing Paradigms - Overview of Existing Hosting Platforms, Grid Computing, Utility Computing, Autonomic Computing, Dynamic Datacenter Alliance, Hosting/ Outsourcing, Introduction to Cloud Computing, Workload Patterns for the Cloud, "Big Data", IT as a Service, Technology Behind Cloud Computing,

Module-II **10 Hrs**

A Classification of Cloud Implementations- Amazon Web Services - IaaS, The Elastic Compute Cloud (EC2), The Simple Storage Service (S3), The Simple Queuing Services (SQS), VMware v Cloud - IaaS, v Cloud Express, Google AppEngine - PaaS, The Java Runtime Environment.

Module-III **10 Hrs**

The Python Runtime Environment- The Datastore, Development Workflow, Windows Azure Platform - PaaS, Windows Azure, SQL Azure, Windows Azure AppFabric, Salesforce.com - SaaS / PaaS, Force.com, Force Database - the persistency layer, Data Security, Microsoft Office Live - SaaS, LiveMesh.com, Google Apps - SaaS, A Comparison of Cloud Computing Platforms, Common Building Blocks.

Module-IV **8 Hrs**

Cloud Security – Infrastructure security – Data security – Identity and access management Privacy- Audit and Compliance.

Text Book:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing
2. from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012

Reference Books

1. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance", O'Reilly 2009

OEEE6313	Digital Signal Processing	3-0-0	3 Credits

Course Objectives:

To impart knowledge about the following topics:

1. Signals and systems & their mathematical representation.
2. Discrete time systems.
3. Transformation techniques & their computation.
4. Filters and their design for digital implementation.

MODULE I **(12 Hours)**

Introduction:

Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, aliasing effect.

The Z-Transform and Its Application:

Z-transform and its properties, inverse z-transforms; difference equation–Solution by z-transform, application to discrete systems-Stability analysis, frequency response–Convolution.

MODULE II **(12 Hours)**

The Discrete Fourier Transform: Its Properties and Applications:

Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, The Discrete Cosine Transform: Forward DCT, Inverse DCT, DCT as an Orthogonal Transform.

Implementation of Discrete-Time Systems:

Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures;

Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures.

MODULE III **(12Hours)**

Discrete Fourier Transform &Computation:

Discrete Fourier Transform-properties, magnitude and phase representation-Computation of DFT using FFT algorithm–DIT &DIF using radix 2 FFT–Butter fly structure.

Design of Digital Filters:

FIR & IIR filter realization–Parallel & cascade forms. FIR design: Windowing Techniques–Need and choice of windows–Linear phase characteristics. Analog filter design–Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation Warping, pre warping.

MODULE IV **(6Hours)**

Adaptive Filters:

Application of Adaptive Filters: System Identification or System Modeling, Adaptive Channel Equalization, Adaptive Line Enhancer, Adaptive Noise Cancelling; Adaptive Direct-Form FIR Filters-The LMS Algorithm: Minimum Mean Square Error Criterion, The LMS Algorithm.

Text Books:

1. Digital Signal Processing Principles, Algorithms and Applications, J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.
2. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
3. Digital Signal Processing, S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH.

Reference Books:

1. Digital Signal Processing, Manson H. Hayes, Schaum's Outlines, TMH.
2. Digital Signal Processing: A Modern Introduction, Ashok K Ambardar, Cengage Learning.
3. Modern Digital Signal Processing, Roberto Cristi, Cengage Learning.
4. Digital Signal Processing: Fundamentals and Applications, Li Tan, Jean Jiang, Academic Press, Elsevier.
5. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.
6. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
7. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
8. D. J. De Fatta, J. G. Lucas and W. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons, 1988.

Program Outcomes:

1. Ability to understand the importance of Fourier transform, digital filters.
2. Ability to acquire knowledge on Signals and systems & their mathematical representation.
3. Ability to understand and analyze the discrete time systems.
4. Ability to analyze the transformation techniques & their computation.
5. Ability to understand the types of filters and their design for digital implementation.

OEEC6314	Industrial Automation with PLC & SCADA	3-0-0	Credits 3

COURSE OBJECTIVES

1. Gain the Knowledge of various skills necessary for Industrial applications of Programmable logic controller (PLC)
2. Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC)
3. Solve the problems related to I/O module, Data Acquisition System and Communication Networks using Standard Devices.

MODULE-I (12 Hours)

Unit 1

What is A PLC, Technical Definition of PLC, What are its advantages, characteristics functions of A PLC, Chronological Evolution of PLC, Types of PLC, Unitary PLC, Modular PLC, Small PLC, Medium PLC,

Large PLC.

Unit 2

Block Diagram of PLC: Input/output (I/O) section, Processor Section, Power supply, Memory central Processing Unit: Processor Software / Executive Software, Multi asking, Languages, Ladder Language.

MODULE-II (12 Hours)

Unit 3

Bit Logic Instructions: introduction: Input and Output contact program symbols, Numbering system of inputs and outputs, Program format.

Unit 4

Introduction to logic: Equivalent Ladder diagram of AND gate, Equivalent ladder diagram of or Gate, equivalents Ladder Diagram of NOT gate, equivalent ladder diagram of XOR gate, equivalent ladder diagram of NAND gate, equivalent ladder diagram of NOR gate, equivalent ladder diagram to demonstrate De Morgan theorem. Ladder design. Examples: Training Stopping, Multiplexer, DE multiplexers

MODULE-III (12 Hours)

Unit 5

PLC Timers and Counters: On Delay and OFF delay timers, Timer-on Delay, Timer off delay, Retentive and non-retentive timers. Format of a timer instruction. PLC Counter: Operation of PLC Counter, Counter Parameters, Counters Instructions Overview Count up (CTU) Count down (CTD).

Unit 6

PLC input output (I/O) modules and power supply: Introduction: Classification of I/O, I/O system overview, practical I/O system and its mapping addressing local and expansion I/O, input-output systems, direct I/O, parallel I/O systems serial I/O systems.

MODULE-IV (8 Hours)

Unit 7

SCADA Systems

Introduction, definition and history of Supervisory Control and Data Acquisition, typical SCADA System Architecture, Communication Requirements, Desirable properties of SCADA system, Features, advantages, disadvantages and applications of SCADA. SCADA Architecture (First generation-Monolithic, Second Generation-Distributed, Third generation-Networked Architecture), SCADA systems in operation and control of interconnected power system, Power System Automation, Petroleum Refining Process, Water Purification System.

Text Books:

1. Madhu Chhanda Mitra,S.S Gupta, "PLC and Industrial automation",Pernram International pub. (Indian) Pvt. Ltd., 2011.

Reference Books:

1. Ronald L Krutz, "Securing SCADA System", Wiley Publication, 2012.
2. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd edition, 2006.

Course Outcomes:

1. Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC).
2. Compute the extent and nature of electronic circuitry in Programmable logic controller (PLC) and SCADA including monitoring and control circuits for Communication and Interfacing.

OEME6316	Introduction to Composite Materials	3-0-0	Credit-3

Course objective:

1. Introduce students to the concepts of modern composite materials.
2. Equip them with knowledge on how to fabricate and carry out standard mechanical test on composites.
3. To make student understand the basic stress and strain relations in composite materials.

Module I **(10hours)**

Introduction: Classification and characteristics of composite materials, mechanical behaviour of composites, constituents, Reinforcements, Matrices, Fillers, Additives, Applications and advantages of composites. Processing – Pultrusion; Filament winding; Prepreg technology; Injection & compression moulding; Bag moulding; Resin transfer moulding.

Module II **(12hours)**

Macromechanics of a Lamina: Stress strain relations of anisotropic materials - Engineering constants for orthotropic materials, Stress strain relations for specially orthotropic lamina. Transformation relationships for a lamina of arbitrary fibre orientation.

Module III **(12hours)**

Micromechanics of a Lamina: Rule of mixture; Volume & mass fractions; Density & void content. Evaluation of the nine mechanical and four hygrothermal constants: four elastic moduli(Strength of Materials Approach), five strength parameters, two coefficients of thermal expansion and two coefficients of moisture expansion of a unidirectional lamina from the individual properties of the fiber and the matrix**.**

Module IV **(10hours)**

Analysis: Classical lamination theory; Stress analysis of composite laminates; Failure predictions – Maximum stress theory; Maximum strain theory; Tsai-Hill theory; Modes of failure of composites; First ply failure; Partial ply failure; Total ply failure.

Text Books:

1. Mechanics of Composite Materials, R.M. Jones, Mc. Graw Hill Book Co.
2. Mechanics of Composite Materials, A. K. Kaw, CRC Press.
3. Mechanics of composite materials & structures, M Mukhopadhay, Universities Press.

COURSE OUTCOME

1. (Knowledge based) identify and explain the types of composite materials and their characteristic features;
2. Understand the differences in the strengthening mechanism of composite and its corresponding effect on performance and application;
3. Understand and explain the methods employed in composite fabrication;
4. Appreciate the theoretical basis of the experimental techniques utilized for failure mode of composites.
5. (Skills) develop expertise on the applicable engineering design of composite;
6. Learn simple micromechanics and failure modes of composites.

OEMT6315	Nanomaterials	3-0-0	Credits 3

Objectives of the Course:

To recognize the differences between nanomaterials and conventional materials and to become familiar with a wide range of nanomaterials, their synthesis, characterization, properties and applications.

Module 1: **(12 Hours)**

Introduction: Types of nanomaterials, emergence of nanotechnology, bottom-up and top-down approaches, challenges in nanotechnology. Nanoparticles: synthesis of metallic nanoparticles, semiconductor nanoparticles, oxide nanoparticles (sol-gel processing); vapour phase reactions, solid phase segregation. Nanowires: Synthesis of nanowires by evaporation – condensation growth, VLS or SLS growth, high energy ball milling, cryo rolling, and equal channel angular extrusion, template based synthesis, electrospinning, types of lithography. Thin Films: fundamentals of film growth, PVD, CVD and ALD.

Module-II **(12 Hours)**

Specific nano materials and their applications: Carbon nanostructures (Nanotubes, nanohorns, graphene, buckyballs etc.), Semiconducting nanomaterials – Quantum confinement, Quantum wells, quantum wires and quantum dots. Magnetic nanomaterials – super paramagnetism Ferroelectric, nano ceramics Super plasticity Nanocomposites and their types.

Module III: **(12 Hours)**

Thermodynamics of nanomaterials, Mechanical property aspects of nanomaterials, inverse Hall-Petch relationship, nano indentation, electrical properties of nanomaterials, optical properties of nanomaterials, magnetic properties of nanomaterials, Characterization techniques from the perspective of nanomaterials: BET, XRD, SEM, TEM, AFM, EDS, WDS, LEED, XPS etc.

Module IV: **(06 Hours)**

Application of nanomaterials such as medicine, energy, environment, information and communication technology.

Suggested text books:

1. Rishal Singh, S.M. Gupta, Introduction to nanotechnology, Oxford university press, (2016).
2. Dieter Vollath._ Nanomaterials: An Introduction to Synthesis, Properties and Applications, Second Edition. Published 2013 by Wiley-VCH Verlag GmbH & Co. KGaA.

Suggested reference books:

1. Charles Poole and Frank Owens, Introduction to Nanomaterials, Wiley 2007
2. Cao G., Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Imperial College Press
3. Gagotsi Y., Nanomaterails Handbook, (Ed.), Taylor and Francis.
4. Edlstein and Cammarate, Nano Materials Synthesis, Properties and Applications.
5. Bandyopadyay A.K., Nano Materials, New age Publications.
6. Pradeep T., Nano - The Essentials, TMH.
7. Koch,C. Nanostructured Materials: Processing, Properties and applications, William Andrew Publishing.

Course Outcomes

After completing this course, the student should be able to:

1. Indicate the differences between nanomaterials and conventional materials
2. Indicate how specific synthesis techniques can result in nanomaterials
3. Give examples of specific nanomaterials and explain the scientific reasons for the properties displayed by them
4. Describe how specific characterization techniques can be used to analyze nanomaterials

OEPD6317	POWDER METALLURGY	3L-0T-0P	3 Credits

Course Objective

The course is a specialized course of the metallic materials area. The scope is to provide the necessary knowledge on the metallic part production by metal powders. It covers subjects such as metal powder characterization, metal powder production methods, and powder metallurgy processing steps.

Module I **[12]**

Introduction Historical and modern developments in Powder Metallurgy. Advantages, limitations and applications of Powder Metallurgy. Basic Steps for Powder Metallurgy. Characteristics of metal powder Chemical composition, Particle size, shape and size distribution, Characteristics of powder mass such as

apparent density, tap density, flow rate, friction index. Properties of green compacts and sintered compacts

Module II **[10]**

Powder Characterization Powder conditioning, fundamentals of powder compaction, density distribution in green compacts, compressibility, green Strength, pyro phorocity and toxicity.

Module III **[10]**

Powder Compaction Methods Basic aspects, types of compaction presses, compaction tooling and role of lubricants, Single and double die compaction, isostatic pressing, Hot pressing. Powder Forming Powder rolling, powder forging, powder extrusion and explosive forming technique

Module IV **[10]**

Sintering Definition, stages, effect of variables, sintering atmospheres and furnaces, Mechanism, liquid-phase sintering, Secondary operations. Sintered Products Study of sintered bearings, cutting tools, metallic filters, friction and antifriction parts and electrical contact materials. Defects in Powder metallurgy processed materials and their processing to minimize defects: Friction stir processing etc.

Text Books:

1. Introduction to Powder Metallurgy, A. K. Sinha, Dhanpatrai Publication.
2. Powder Metallurgy: Science, Technology, and Materials, Anish Upadhyaya, Gopal Shankar Upadhyaya, CRC Press
3. Powder Metallurgy, ASM Handbook, Vol-VII.

Reference Books:

1. Powder Metallurgy: Science, Technology and Applications, P. C. Angelo, R. Subramanian
2. Powder Metallurgy, W.D. Jones
3. Principles of Powder Metallurgy, T. Shukerman
4. Handbook of Powder Metallurgy :- H.H. Hausner

Course Outcomes:

Upon successful completion of the course, student will able to:

1. Acquire the knowledge of Powder Metallurgy History, Applications and its importance.
2. Measure the various powder characteristics like apparent density; tap density, flow rate, friction index.
3. Acquainted the knowledge of metal powder production methods.
4. Aware about the powder characterization techniques.
5. Understand the basic methods of Powder compaction for green compact.

OEMA6207	Numerical Methods	3-0-0	Credit-3

Module –I **(12 Hours)**

Number system, Floating point arithmetic, Errors, truncation error, Bisection method, Scant method, Regula-Falsi Method, Newton-Raphson method, Muller method, Rate of Convergence,

Lagranges's interpolation, Newton divided difference interpolation, Newton's forward and backward interpolation, Piecewise and Spline interpolation.

Module -II : **(12 Hours)**

Numerical integration: Romberg integration, Gaussian Quadrature (2-point, 3-point), Newton- Cotes rules.

Numerical solution to ordinary differential equations: Taylor's series methods, Euler method, modified Euler method Runge - Kutta methods, predictor- corrector method, multistep methods.

Module -III: **(8 Hours)**

Matrix eigen value problem, power method, Rayleigh Quotient, shifted power method, inverse power method, QR method.

Module IV: **(8 Hours)**

Parabolic Partial Differential Equation: Explicit Method, Implicit method, Crank-Nicolson method. Hyperbolic Partial Differential Equation: Explicit Method, Implicit method. Elliptic Partial Differential Equation: Finite-difference method.

Text Books

1. Jain M.k, Iyengar S.R.K & Jain R.K, Numerical methods for Scientific and Engineering Computation, 6th Edition,New Age International(P) Ltd.
2. Atkinson Kendall E, An introduction to Numerical Analysis, 2nd Edition, John Wiley & Sons

Reference Books

1. Fusset L.V, Applied numerical Analysis Using MATLAB,2nd Edition, PEARSON
2. Chapra Steven C & Canale Raymond P., Numerical methods for Engineers, 7th Edition, McGraw Hill Education.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

B.TECH SYLLABUS for COMPUTER SCIENCE &ENGINEERING

(Admission Batch: 2018-19 Onwards)

6th Semester

HSHM3306	Enhancing Soft Skills and Personality	2-0-0	Credit-2

Course Objective

The course aims to cause an enhanced awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfillment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. The focus of this course is on interpersonal and management skills.

Module I **10 Hours**

- Highlights of Developing Soft Skills and Personality Course-1-24
- Highlights of Developing Soft Skills and Personality Course-25-48
- Definitions and Types of Mindset
- Learning Mindsets
- Secrets of Developing Growth Mindsets
- Importance of Time and Understanding Perceptions of Time
- Using Time Efficiently
- Understanding Procrastination
- Overcoming Procrastination
- Don't Say "Yes" to Make Others Happy!

Module II: **10 Hours**

- Types of People
- How to Say "No"
- Controlling Anger
- Gaining Power from Positive Thinking-1
- Gaining Power from Positive Thinking-2
- What Makes Others Dislike You?
- What Makes Others Like You?-1
- What Makes Others Like You?-2
- Being Attractive-1
- Being Attractive-2

Module III **10 Hours**

- Common Errors-1
- Common Errors-2
- Common Errors-3
- Common Errors-4
- Common Errors-5
- Humour in Communication
- Humour in the Workplace
- Function of Humour in the Workplace
- Money and Personality
- Managing Money

Module IV **10 Hours**

- Health and Personality
- Managing Health-1: Importance of Exercise
- Managing Health-2: Diet and Sleep
- Love and Personality
- Managing Love
- Ethics and Etiquette
- Business Etiquette
- Managing Mind and Memory
- Improving Memory
- Care for Environment
- Highlights of the Course

Books for Reference:

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: Harper Collins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.

PCCS4309 Operating System 3-0-0 Credit-3

Course Objectives:

The objective of the course is to **u**nderstand fundamental operating system terminologies like processes, threads, files, semaphores, IPC , shared memory regions, etc., to understand how the operating system abstractions can be used in the development of application programs, or to build higher level abstractions. Understand the principles of concurrency and synchronization, resource management techniques.

MODULE I (10 Hours)

Introduction to OS: Definition, Evolution and Types of Operating System, user's view & System view of Operating system, Hardware protection: Dual mode operation, I/O protection, Memory Protection, CPU protection. System components of operating system, operating system services, Understanding System calls with examples.

MODULE II (10 Hours)

Process Management: Process Identification & its state, PCB, Process Scheduling: scheduling criteria, different types of scheduler: long term, short term, medium term, Types of scheduling: Pre-emptive, Non-pre-emptive, FCFS,SJF, SRTF, Round Robin, Priory scheduling, multilevel queue scheduling, multilevel feedback queue scheduling, Real time scheduling, context switching, Process creation, Inter Process Communication. Process Synchronization: Cooperating process, Critical Section problem and solution for two processes and multiple process. Semaphore. Classical synchronization Problems: Producer-Consumer, Reader-Writer, Dining philosopher. Deadlock: Necessary condition, RAG, methods to handle deadlock: Prevention, detection and avoidance algorithms, Recovery from deadlock. Introduction to Threading.

MODULE III (10 Hours)

Memory Management: Address binding, Logical-vs-physical address space, Swapping, Contiguous memory allocation, Fragmentation, Non-contiguous memory allocation: paging, segmentation, H/W support for Paging & Segmentation, Protection and sharing in paging & segmentation .Virtual Memory: demand paging, Page replacement policy: FIFO, LRU, Optimal, Belady's anomaly, allocation of frames, thrashing

MODULE IV (10 Hours)

File Management: File attribute, File operations, file access method, File protection, File system structure, directory implementation, Allocation methods. Disk Management: Disk Structure, Disk scheduling.

Text Books: Operating System Concepts-Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley

PCCS4310	Compiler Design	3-0-0	Credits 3

Course Objectives:

1. The objectives of this course are to explore the principles, algorithms and data structures involved in the design and construction of compilers.
2. To introduce the major concept areas of language translation and compiler design.
3. To enrich the knowledge in various phases of compiler.
4. To extend the knowledge of various parsing techniques such as LL and LR parsers.

Prerequisites: Knowledge of data structures, regular expressions, finite automata and context free grammar.

MODULE-I (Chapters: 1, 2, 3 and 4) (12 Hours)

Introduction to Compilers: Compilers and translators, the phases of a compiler, brief overview of all the phases of compiler, compiler writing tools, cousins of compiler, the Lexical and Syntactic structure of a language. **A simple one pass compilers:** Overview, Syntax definition, parse tree, parsing (overview of top down and bottom up parsing) and syntax directed translation. **Lexical Analysis**: The role of the lexical analyzer, Input buffering, specification of tokens and recognition of tokens, regular expressions finite automata. **Syntax Analysis:** The role of Parser, Context free grammars, ambiguity and its elimination, elimination of left, recursion, left factoring, Top-down parsing, bottom-up parsing, Operator-precedence parsing, LR Parsers (The Canonical Collection of LR (0) items, Constructing SLR, Canonical LR, and LALR parsing tables).

MODULE-II (Chapters: 5, 6 and 7) (10 Hours)

Syntax Directed Translation: Syntax directed definitions, construction of syntax tree, bottom-up evolution of S-attributed definitions, L-attributed definition, top-down translation, bottom-up evaluation of inherited attributed, recursive evaluators.

Type Checking: Type systems (Static and dynamic), type expression, Type Checking, Type Equivalence, Type Conversion. **Run time Environments:** Storage organization, storage allocation, symbol tables, structure of Symbol Table, Simple Symbol Table (Linear Table, Ordered List, Tree, Hash Table), dynamic storage allocation techniques.

MODULE-III (Chapters: 8 and 9) (8 Hours)

Intermediate Code Generation: Intermediate Language, Intermediate representation Technique, Three-address code, quadruples and triples, Translation of assignment statements, Boolean expressions, Control Flow, Case Statement, and Function, Back Patching and procedure call. Issues in the design of code generation, target machine, run time storage management, Register Allocation and assignment, DAG representation, peephole optimization, Code generation using dynamic programming,

MODULE-IV (Chapter: 10) (8 Hours)

Code Optimization: Need of code optimization, Optimization of Basic Blocks, Loops in flow graph, global data flow analysis, Optimizing transformation (Compile time evaluation, common sub-expression elimination, Variable Propagation, Code Movement Optimization, Strength Reduction, Dead code optimization, Loop Optimization), Local Optimization, Global Optimization, Computing Global data flow equation, Setting up data flow Equations, Iterative Data Flow Analysis. **Error Detection and Recovery:** Errors, Lexical- Phase errors, Syntactic- Phase errors, Semantic errors, Error handling routines.

Text Book:

1. Compilers: Principles, Techniques, and Tools, Authors: Alfred V. Aho, Ravi Sethi and Jeffery D. Ullman (Pearson Education)

Reference Books:

1. Compiler Design by Santanu Chattopadhyay, PHI
2. The Theory and Practice of Compiler Writing: Jean-Paul Tremblay and Paul G. Sorenson (BS Publications)
3. Compiler Design: O G Kakde, University Science press
4. Advanced Compiler Design and Implementation, Steven Muchnic, Elsevier Publications

PECS5304 Machine Learning Techniques 3-0-0 3

MODULE-I (8 Hours)

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

.

MODULE-II (8 Hours)

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

.

MODULE-III (8 Hours)

Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM. Neural network: Perceptron, multilayer network, back propagation, introduction to deep neural network.

MODULE-IV (8 Hours)

Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning. Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model

BOOKS:

1. Machine Learning. Tom Mitchell. First Edition, McGraw-Hill, 1997.
2. Introduction to Machine Learning Edition 2, by Ethem Alpaydin

PECS5305 SOFT COMPUTING 3-0-0 Credit-3

MODULE-1 **[8hrs]**

Introduction to Soft computing, Introduction to Fuzzy logic, Neural network and Evolutionary Computing,

MODULE-2(Fuzzy Logic)

Basic Fuzzy logic Theory, Crisp and fuzzy sets, Fuzzy membership functions, operation on fuzzy sets, fuzzy relations, Fuzzy propositions, Fuzzy implification. Fuzzy inferences, Zadehs compositional rule of inference, De-fuzzyfication Techniques: fuzzy logic controller, mamdani and Takagi and sugeno architecture.

MODULE-3 (Neural Network)

Introduction To ANN, Single layer networks, perceptron; Activation function; Adaline-its training and capabilities, weights learning, Multilayer perceptrons; error back propagation; Generalized delta rule; Radial basis function networks and least square training algorithm, kohenen self organizing map and learning vector quantization networks; Recurrent neural network; simulated annealing neural network; ANFIS.

MODULE-4(Genetic Algorithm)

Concept of GA,GA operators: Encoding, GA operators: Selection-I,GA Operators: Selection-II,GA Operators: Crossover-I,GA Operators :Crossover-II,GA Operators: Mutation. Basic evolutionary Programming concept Application, Hybrid evolutionary algorithm.

TEXT BOOK

1. J.S.R Jang, C.T. Sun and E. Mizutani, ”Neuro-fuzzy and soft computing”. PHI Pvt. Ltd.

REFERENCE BOOKS

1. F.O. Karry and C de silva, “soft computing and intelligent system Design-Theory, Tools and Application”, Pearson Education.
2. V. Keeman, “Learning and soft computing”, Pearson education India.

PECS5306 Cryptography and Network Security 3-0-0 Credit 3

Course Objectives:

The course is designed to understand the importance of information security, cryptography theories, Algorithms and systems. Students shall be able to understand different approaches and Techniques to build protection mechanisms in order to secure computer networks.

MODULE I (12 Hours)

Security Concepts:

Introduction, The need for security, Security approaches, Principles of security, the OSI security architecture ,Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. **Classical Encryption techniques:** Symmetric cipher model, Algorithm types &Modes, substitution techniques, transposition techniques, steganography. **Finite Fields and Number Theory:** Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

MODULE II (8 Hours)

Symmetric key Ciphers: Block Cipher principles, Data Encryption Standard(DES), Advanced Encryption Standard (AES), Blowfish, RC5, IDEA. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange

MODULE III (10 Hours)

Message Integrity and Authentication: Message Digests, Modification Detection Code(MDC) and Message Authentication Code(MAC), Cryptographic Hash Functions Digital Signatures-Process, Services Techniques, Security analysis and applications. **Entity Authentication:** Passwords, Challenge-response, Zero-Knowledge, Biometrics. **Key Management:** Symmetric-key Distribution, Kerberos, Public key Distribution

MODULE IV (10 Hours)

Application Layer Security: E-mail Security, PGP, S/MIME. **Transport Layer Security:** Secure Socket Layer (SSL) and Transport Layer Security(TLS) Protocols. **Network Layer Security:** IP Security (IPSec)

Text Books:

1. B. A. Forouzan, D. Mukhopadhyay, "Cryptography and Network Security", 2nd edition, 2010, McGraw-Hill Publication, New Delhi.(Module 1: Chapters 1-2,4,9, Module 2: Chapters 3,5-8,10, Module 3: Chapters 11-15, Module 4: Chapters 16-18).

2. William Stallings, "Cryptography and Network Security", 6thEditionMarch 2013, Pearson Education.

Reference Books:

1. Atul Kahate, "Cryptography and Network Security", Third Edition, McGraw-Hill Publication.
2. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India,

MANDATORY COURSE

MCGN9305	Environmental Science	2-0-0	Credit-0

Unit 1: Multidisciplinary nature of environmental studies
Definition, scope and importance), Need for public awareness.
Renewable and non-renewable resources
Natural resources and associated problems, role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles.

Unit 2: Ecosystems
Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystems:-

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Biodiversity and its conservation

- Introduction – Definition: genetic, species and ecosystem diversity.
- Bio geographical classification of India
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit 4: Environmental Pollution Cause, effects and control measures of :-
Air pollution, water pollution, soil pollution, noise pollution, nuclear hazards and solid waste Management:

Causes, effects and control measures of urban and industrial wastes, Disaster management: floods, earthquake, cyclone and landslides.

Unit 5: Social Issues and the Environment

Sustainable development, water conservation, rain water harvesting, resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion.

Text Books

1. Environmental Science And Engineering by Rajesh Gopinath N. Balasubramanya, Cengage India.
2. Fundamental Concepts in Environmental Studies by Dr. D.D. Mishra S. Chand Publication.
3. Basic environmental Sciences for undergraduates by Dr. Sohini Singh, Dr. Tanu Allen and Dr. Richa K. Tyagi, Vayu education of India.

MANDATORY COURSE

MCHM9306	Universal Human Values	2-0-0	Credit-0

Objective:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To sensitize the student towards issues in society and nature.
3. To Strengthen self-reflection to know what the students 'really want to be' in their life and profession.
4. To understand harmony at all the levels of human living, applying the understanding of harmony in existence in their profession and lead an ethical life.

Module I **10 Hours**

1. Need, basic guidelines, content and process for Value Education, Self-Exploration– content and process;

2. Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities for Human Aspirations.

3. Method to fulfill the human aspirations: understanding and living in harmony at various levels.

Module II **10 Hours**

1. Human being as a co-existence of the sentient 'I' and the material 'Body', Self ('I') and 'Body' - *Sukh* and *Suvidha*

2. Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I',

3. Harmony of I with the Body: *Sanyam* and *Swasthya*; Needs of Body and Psyche: *Sanyam* and *Swasthya*

Module III **12 Hours**

1. Harmony in the Family, values in human-human relationship; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship, meaning of *Vishwas* and *Samman*

2. Harmony in the society: *Samadhan, Samridhi, Abhay, Sah*-astitva, universal harmonious order in society- family to world family, harmony in the Nature : recyclability and self-regulation in nature

3. Natural acceptance of human values, Ethical Human Conduct, and Humanistic Education,

Module IV **08 Hours**

1. Competence in Professional Ethics: professional competence for augmenting universal human order, people-friendly and eco-friendly production systems, technologies and management

2. Strategy for transition from the present state to Universal Human Order

3. Being socially and ecologically responsible engineers with mutually enriching institutions and organizations.

Text Book:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References Books:

1. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
2. A N Tripathy, 2003, Human Values, New Age International Publishers.
3. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books

Course Outcome:

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

1. Distinguish between values and skills; understand the need, basic guidelines, content and process of value education.
2. Distinguish between the Self and the Body; understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings.
4. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a

harmonious environment.

HONOURS

HNCS0304 SOFTWARE QUALITY MANAGEMENT 3-1-0 Credit-4

Course Objectives:

1. Software quality models
2. Quality measurement and metrics
3. Quality plan, implementation and documentation
4. Quality tools including CASE tools
5. Quality control and reliability of quality process
6. Quality management system models
7. Complexity metrics and Customer Satisfaction
8. International quality standards – ISO, CMM

Module-I [10Hrs]

INTRODUCTION TO SOFTWARE QUALITY: Software Quality – Hierarchical models of Boehm and McCall – Quality measurement – Metrics measurement and analysis – Gilb's approach – GQM Model. SOFTWARE QUALITY ASSURANCE: Quality tasks – SQA plan – Teams – Characteristics – Implementation – Documentation – Reviews and Audits.

Module-II [8Hrs]

QUALITY CONTROL AND RELIABILITY: Tools for Quality – Ishikawa's basic tools – CASE tools – Defect prevention and removal – Reliability models – Rayleigh model – Reliability growth models for quality assessment.

Module-III [8Hrs]

QUALITY MANAGEMENT SYSTEM: Elements of QMS – Rayleigh model framework – Reliability Growth models for QMS – Complexity metrics and models – Customer satisfaction analysis.

Module-IV [8Hrs]

QUALITY STANDARDS: Need for standards – ISO 9000 Series – ISO 9000-3 for software development – CMM and CMMI – Six Sigma concepts.

TEXT BOOKS:

1. Allan C. Gillies, "Software Quality: Theory and Management", Thomson Learning, 2003.

2. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education (Singapore) Pte Ltd., 2002.

REFERENCE BOOKS:

1. Norman E. Fenton and Shari Lawrence Pfleeger, "Software Metrics" Thomson, 2003
2. Mordechai Ben – Menachem and Garry S.Marliss, "Software Quality", Thomson Asia Pte Ltd, 2003.
3. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI", Pearson Education (Singapore) Pte Ltd, 2003.
4. ISO 9000-3 "Notes for the application of the ISO 9001 Standard to software development".

MINOR

MNCS 0304 Computer Networks (3-1-0) Credit-4

MODULE I (10Hours)

Introduction:

Networks, Line Configurations, Network Topology, Network Types, Internetworks, Internet Architecture, Protocol and Standards, Layered Architecture, TCP/IP Model, OSI Reference Model.

Physical Layer:

Analog and Digital Signals and their Characteristics, Transmission Impairment, Data Rate Limits- Nyquist Formula& Shannon Capacity, Analog and Digital Transmission and Conversions - Digital-to-Digital Conversion, Digital-to-Analog Conversion, Analog-to-Digital Conversion, Analog-to-Analog Conversion, Transmission Modes, Multiplexing - FDM, WDM, TDM, Switching, Transmission Media.

MODULE II (12Hours)

Data Link Layer:

Types of Errors, Error Detection Techniques - Parity, CRC, Check Sum, Error Correction Techniques - Hamming Code, Framing, Data Link Control - Stop-and-Wait ARQ, Go-Back-N ARQ, Selective-Repeat ARQ, Piggybacking, Multiple Access - Random Access, Controlled Access, Channelization, Elementary Data Link Protocols - HDLC, PPP, Ethernet, Wireless LANs& Bluetooth, Connecting Devices - Repeater, Hubs, Bridges, Switches, Routers, Gateways, Backbone Networks, Virtual LANs, Virtual Circuit Networks - Frame Relay and ATM.

MODULE III (8Hours)

Network Layer:

Logical Addressing, IPv4 and IPv6 Addresses, Internetworking, Internet Protocols - IPv4, IPv6, Network Layer Protocols - Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP), Internet Control Message Protocol (ICMP), Internet Group Message Protocol (IGMP), Forwarding and Routing Techniques.

MODULE IV (10Hours)

Transport Layer:

Process to Process Delivery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Congestion Control, Congestion Control Algorithms, Quality of Service (QoS), Techniques to Improve QoS.

Application Layer:

Domain Name System (DNS), Remote Logging Architecture and Protocols, E-Mail Architecture and Protocols, File Transfer, WWW and HTTP.

Text Books:

1. Behrouz A. Forouzan, "Introduction to Data Communications and Networking", Fourth Edition, 2007, McGraw-Hill Education (India), New Delhi.
2. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, 2003, PHI Learning Pvt. Ltd., / Pearson Education Inc., New Delhi.

Reference Books:

1. Natalia Olifer & Victor Olifer, "Computer Networks: Principles, Technologies and Protocols", First Edition, 2006, Wiley India Pvt. Ltd., New Delhi.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 4th Edition (2008), Pearson Education Inc., New Delhi.
3. Wayne Tomasi, "Introduction to Data Communications and Networking", First Edition, 2005, Pearson Education Inc., New Delhi.

PRACTICAL / SESSIONAL

PCCS7308 Operating System Lab (0-0-3) Credit-2

1. Basic UNIX Commands.
2. Linux Administrative commands.
3. UNIX Shell Programming.
4. Programs on process creation and synchronization, inter process communication including shared memory e.g. Dinning Philosopher Problem, Reader Writer Problem.
5. Programs on UNIX System calls.
6. Simulation of CPU Scheduling Algorithms.
7. Simulation of Banker's Algorithm for Deadlock Avoidance and Prevention.
8. Program for FIFO, LRU, and Optimal page replacement algorithms.

PCCS7309 Compiler Design Lab 0-0-3 Credit 2

List of Experiments:

1. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines.
2. Write a C program to identify whether a given line is a comment or not.
3. Write a C program to recognize strings under 'a*', 'a*b+', 'abb'
4. Write a C program to test whether a given identifier is valid or not
5. Write a C program to simulate lexical analyzer for validating operators.
6. Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
7. Construction of DFA from NFA.
8. Implementation of SHIFT REDUCE PARSING ALGORITHM.
9. Implementation of OPERATOR PRECEDENCE PARSER.
10. Implementation of RECURSIVE DESCENT PARSER.
11. Implementation of CODE OPTIMIZATION TECHNIQUES.
12. Implementation of CODE GENERATOR.

HSHM3305	Business Communication & Interview Skills	0-0-3	Credit-1

COURSE OBJECTIVES

1. To develop communicative competence in prospective engineers.
2. To train them to participate in Group Discussion, presentation & face interview
3. To understand team dynamic & effectiveness.
4. To learn leadership qualities and practice them.
5. To develop basic personality traits.

Detailed Syllabus

Emphasis will have to be given to practice sessions in the class room by the learners

Module –I (08 Hours)

1. Soft Skills: An introduction-Definition and Significance of Soft Skills; Importance and Measurement of Soft Skill Development, Role of effective communication in professional life.
2. Self-Discovery: Discovering the Self; Beliefs, Values, Attitude, Virtue,
3. Being Creative: Out of the box thinking, Lateral Thinking and its use.

Module-II (12 hours)

1. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking.
2. Teamwork and Leadership Skills: Concept of Teams; Building effective teams; being a team player, Concept of Leadership and developing Leadership skills
3. Group Discussion: Importance, Planning, Elements and Skills. GD as part of a selection process: Evaluation and Analysis

Module-III (12 hours)

1. Interview Skills: Interviewee-in-depth perspectives, Types of Interview- In Campus / Onsite/ Telephonic, Before, During and After the Interview. Tips for Success.
2. Presentation Skills: Types, Content, Audience Analysis, Essential Tips-Before, During and After, Overcoming Nervousness/ reducing stage fright, visualization strategies, on camera techniques.
3. Preparing Curriculum Vitae, Resume, Bio-data, Job Application

Module-IV (08 hours)

1. Stress/ Time Management: Definition, Nature, types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress. Effective utilization of Time as a resource, Managing Time
2. Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Types of Leadership behavior; Assertiveness Skills.
3. Emotional Intelligence: Meaning, Features, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

Reference Books:

1. Managing Soft Skills for Personality Development-edited by B.N. Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills-S.P. Dhanavel, Orient Blackswan India, 2012.
3. Personality Development and Soft Skills by Barun Mitra OUP
4. Communication Skills second edition Kumar Lata OUP
5. Crash Course in Personal Development- Brian Clegg Kogan Page Publication
6. Lateral Thinking by Edward De Bono Penguin Books

COURSE OUTCOMES

By the end of course, students shall be able to:

1. Understand the significance and essence of a wide range of soft skills. Learn how to apply soft skills in a wide range of routine social and professional settings.
2. Learn how to employ soft skills to improve interpersonal relationships. Learn how to use soft skills to enhance employability and ensure workplace and career success.
3. Participate in different types of Group Discussions/ Activities effectively, presenting a topic and face interviews with confidence.

OPEN ELECTIVE-III (OE-III) 6th Semester

OECH6318	Food Biotechnology	3L-0T-0P	3 Credits

Objective of the course: To study the aspects of production, composition and design of food products.

Module-I **(12 Hours/4 Weeks)**

Unit – 1 (6 Hours/2 Weeks) Food quality and Production technology: Analysis of food, major ingredients present in different product, Food additives: colour, flavour, vitamins, Single cell protein, mushroom.

Unit – 2 (6 Hours/2 Weeks) Fermentative production of food, Pickling and alcoholic beverages, genetically manipulated crops-based food, oriental foods, probiotics and prebiotics in food products.

Module-II **(12 Hours/4 Weeks)**

Unit – 3 (6 Hours/2 Weeks) Technology for improved process: Enzyme in bakery, fermented cereal products, Enzymes in fat/oil industries, Protease in cheese making, enzymes in beverage production.

Unit – 4 (6 Hours/2 Weeks) Utilization of food waste for production of value-added products, enzymes in sugar syrup, genetically modified food.

Module-III **(12 Hours/4 Weeks)**

Unit – 5 (6 Hours/2 Weeks) Food spoilage and control: Spoilage of food, Microbiology of water, meat, milk, vegetables, microbial safety of food products.

Unit – 6 (6 Hours/2 Weeks) Chemical safety of food products, heavy metal, fungal toxins, pesticide and herbicide contamination, Food preservatives and additives, Post-harvest technology for food preservation.

Module-IV **(6 Hours/2 Weeks)**

Unit – 7(6 Hours/2 Weeks) Canning, dehydration, ultrafiltration, sterilization, irradiation.

Text Books

1. Modern Food Microbiology, 7th ed. by J M Jay, M J Loessner, and DA Golden, Springer.
2. Food Microbiology, 5th ed. by W C Frazier and D C Westhoff, McGraw-Hill.
3. Prescott & Dunn's Industrial Microbiology by G Reed, CBS.
4. Technology of Food Preservation, 4th ed. by N W Desrosier and J N Desrosier, Avi Publishing Co Inc.
5. Introduction to Food Engineering, 5th ed. by R P Singh and D R Heldman, Academic Press.

Course Outcomes:

At the end of the course, the student should be able to

1. Understand the process used to enhance the production, nutritional value, safety and taste of food.
2. Know about the modern biotechnological techniques applied to food science.

3. Know about improving crops so that they need fewer pesticides.
4. Design product & functionality, understand food innovation and marketing.
5. Gain knowledge about the rapid detection techniques of foodborne pathogens and chemical senses.
6. Know about the requirements for careers in the dynamic food sector as well as for research and development.

OECH6319	Fluidization Engineering	3L-0T-0P	3 Credits

Course objectives: The objectives of this course are to introduce

1. Basics of fluidization and various industrial application of fluidization;
2. Various fluidization regime, classification of particles;
3. Describe the staging of fluidized bed reactor.

Module-1 **(4 weeks/12 Hours)**

Basics of fluidization, types, behaviour, and parameters

Unit I (6 Hours/2 weeks): Introduction to fluidization, types of fluidization, gross behavior of fluidized beds, minimum fluidization velocity.

Unit II (6 Hours/2 weeks): Pressure drops in fluidized beds, bed voidage, transport disengaging height, viscosity and fluidity of beds, bubble behavior, bed expansion, distributor design.

Module-2 **(4 weeks/12 Hours)**

Mathematical treatment and calculations

Unit III (6 Hours/2 weeks): Simple mathematical treatment, Solid transport: flow and fluidized solids, solids transfer, terminal velocity, particle entrainment and elutriation.

Unit IV (6 Hours/2 weeks): Simple calculations relating to solid transport.

Module-3 **(4 weeks/12 Hours)**

Heat and mass transfer in fluidized beds

Unit V (6 Hours/2 weeks): Heat and mass transfer in fluidized beds: Heat transfer mechanism, principles of gas-solid and bed surface transfer, heat transfer to liquid fluidized systems.

Unit VI (6 Hours/2 weeks): Generalized correlation for fluidized bed mass transfer and its limitations.

Module-4 **(2 weeks/6 Hours)**

Semi-fluidization and fluidized bed reactors

Unit VII (6 Hours/2 weeks): Semi-fluidization: principles, estimation of various bed parameters, Industrial applications; Design of fluidized bed reactors: Concept of RTD, basic design principles for fluidized bed.

Text books :

1. 'Fluidization Engineering', 2nd ed. by D Kunii and O Levenspiel, Butterworth Heinemann.

Reference Books :

1. 'Fluidization' by M Leva, McGraw-Hill.
2. 'Fluidization' by J F Davidson and D Harrison, Academic Press.

Course Outcomes (CO):

At the end of the course, students would be able to understand about

1. Concept of fluidization
2. Applications of fluidization
3. Semi-fluidization
4. Fluidized bed reactors

OECE6320	Structural Dynamics and Earthquake Engineering	(3-0-0)	Credit-03

Module I

Elements of Earthquake origin & Propagation: Elements of Seismology, Earthquakes, Structure of the Earth, History of the Earth, Earthquake Mechanism, Propagation of Seismic Waves, Earthquake Phenomena, Earthquake Measurements, Definitions of magnitude, intensity, epicentre etc; Plate tectonics, seismographs, liquefaction, Types, effects and controlling factors

Module II

Theory of Vibration Effects: Dynamic Loads. D'Alembert's Principle and inertia forces, Stiffness and flexibility of elastic structures, Theory of Vibrations, Free vibrations of single and multiple degree freedom systems, computations of dynamic response to time dependent forces, mass and stiffness matrices, natural frequencies, Plate Tectonics Theory.

Module III

Earthquake Resistant Design: Principles of Earthquake Resistant Design, Response spectrum theory. Time – Acceleration method, Application of response spectrum theory to seismic design of structures.

Module IV

Earthquake Damages: Earthquake Damages to Various Civil Engineering Structures, Case Histories Earthquake, Earthquake response of structures, Soft storey collapse, Slender structures, unsymmetrical structures. Methods of disaster prevention: Earthquake resistant building Regulations, specification, guidelines for construction – Materials selection.

Reference Books

1. A K. Chopra (2003), Dynamics of Structures-Theory and Applications to Earthquake Engineering,

Second Edition, Prentice-Hall India Pvt Ltd.
2. Pauley & Priestly (1995), Seismic design of reinforced concrete and masonry buildings, John Wiley & Sons.
3. Stratta. J.L. (2000), Manual of Seismic Design, Prentice-Hall India Pvt Ltd.
4. Kramer. S.L. (2000), Geotechnical Earthquake Engineering, Prentice-Hall India Pvt Ltd.
5. Agarwal & Shrinkhardo (2006), Earthquake Resistant design of structures, Prentice-Hall India.

OECS6321	Data Science	3-0-0	Credit-03

Prerequisite:
Brief knowledge in programming in C, C++ with great interest in quantitative/statistical analysis and a student having degree in BTech in any branch of Engineering, MCA, M.Tech, MS having occasionally programming knowledge may enrol for this subject. As this is just an introductory to data science techniques even a simple graduate student may take this course.

Module I: **10 Hrs.**
Benefits and uses of data science and big data, Data Science steps, Facets of data, Structured data, Unstructured data, Natural language , Machine-generated data, Graph-based or network data, Audio, image, and video, Streaming data, The data science process, Setting the research goal, Retrieving data, Data preparation, Data exploration, Data modelling or model building, Presentation and automation, The big data ecosystem and data science, Distributed file systems, Distributed programming framework, Data integration framework, Python Environment set-up, Jupyter overview, Python Numpy, Python Pandas, Python Matplotlib.

Module II: **8 Hrs.**
An introduction to R, Data structures in R, Data visualization with R, Data analysis with R, Data science using MS-excel, Important statistical concepts used in data science, Difference between population and sample, Types of variables, Measures of central tendency, Measures of variability, Coefficient of variance, Skewness and Kurtosis, Normal distribution, Test hypotheses, Central limit theorem, Confidence interval, F-test, T-test, Chi-square test, Type I and II errors, Student's T distribution.

Module III: **10 Hrs.**
Regression, ANOVA,R square, Correlation and causation, Exploratory data analysis, Data visualization, Missing value analysis, The correction matrix, Outlier detection analysis, Supervised machine learning, Python Scikit tool, Neural networks, Support vector machine, Logistic and linear regression, Decision tree classifier, Tableau, Working with Tableau, Deep diving with data and connection, Creating charts, Mapping data in Tableau, Dashboards and stories.

Module IV: **10 Hrs.**
Machine learning on cloud, ML on cloud platform, ML on AWS, ML on Microsoft Azure, Understanding NoSQL databases and why they're used today, Identifying the differences between NoSQL and relational

databases, Defining the ACID principle and how it relates to the NoSQL BASE principle, Learning why the CAP theorem is important for multi-node database setup, Applying the data science process to a project with the NoSQL database Elastic search, The rise of graph data bases, graph mining, test mining and analysis, Natural Language Toolkit(NLTK),Data visualization to the end user, Dashboard development tools.

Text Books:

There is no text book for the course. A teacher may use lecture notes and videos, read research papers and Web Pages, which will be freely available on internet websites.

Reference Books:

1. Introducing Data Science BIG DATA, MACHINE LEARNING, AND MORE, USING PYTHON TOOLS by DAVY CIELEN ARNO, D. B. MEYSMAN and MOHAMED ALI, MANNING SHELTER ISLAND
2. Introduction to Probability – By Joseph K. Blitzstein and Jessica Hwang
3. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition, by Hadley Wickham
4. Python Data Science Handbook, Jake Vander Plas, *O'reilly*
5. Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, Aurélien Géron (Author),O'reilly

OEEE6322	Sensors and Transducers	3-0-0	3 Credits

Module -I **[12 Hours]**

Elements of a general measurement system; Static Characteristics: systematic characteristics, statistical characteristics, calibration; Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, and dynamic error in measurement systems. **(Bentley: Chapters 1-4)**

Techniques for dynamic compensation, Loading Effects and Two-port Networks
(Bentley: Sections 4.4 and 5.1-5.2)

Module-II **[12 Hours]**

Sensing elements: Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages. Capacitive sensing elements: variable separation, area and dielectric;

Inductive sensing elements: variable reluctance and LVDT displacement sensors; Electromagnetic sensing elements: velocity sensors. **(Bentley: Sections 8.1 to 8.6)**

RVDT, Hall Effect sensors **(Bentley: Sections 8.3 and 8.10)**

Piezoelectric sensing elements, Piezo-resistive sensing elements.
(Bentley: Sections 8.7 and 8.8)

Module-III **[12 Hours]**

Signal Conditioning Elements: Deflection bridges: design of resistive and reactive bridges, push-pull configuration for improvement of linearity and sensitivity.

Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation
(Bentley: Sections 9.1 to 9.3; Ghosh: Sections 15.1 and 15.2)

Current transmitters, Oscillators and resonators **(Bentley: Sections 9.4 and 9.5)**

Module-IV **[6 Hours]**

Thermoelectric sensing elements: laws, thermocouple characteristics, installation problems, cold junction compensation.

IC temperature sensor Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.
(Ghosh: Section 10.3 to 10.4)

Text Books:

1. Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi, 2007.
2. Introduction to Measurement and Instrumentation- A.K. Ghosh (3/e), PHI Learning, New Delhi, 2009.

Reference Books:

1. Measurement Systems Application and Design- E.O. Doeblin (4/e), McGraw-Hill, International, NY.
2. Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY, 2003.
3. Industrial Instrumentation- T.R. Padmanabhan, Springer, London, 2000.

OEEC6324	Mechatronics	3-0-0	Credits 3

COURSE OBJECTIVES

1. Understand key elements of Mechatronics system, its block diagram representation.
2. Understand principles of sensors, transducers, encoders and actuators and its characteristics.

3. Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial applications.
4. Understand the system modelling and analysis in time domain and frequency domain.

MODULE-I (12 Hours)

Unit 1

Fundamental of Mechatronics: Definition and concepts of Mechatronics, Conventional system vs. mechatronic system, Evolution of Mechatronics.

Unit 2

Hardware components for Mechatronics. Need and Role of Mechatronics in Design, Manufacturing and Factory Automation.

MODULE-II (12 Hours)

Unit 3

Sensors:

An introduction to sensors. Principle of operation, Difference between transducer and sensors. Sensor types- Transducer signal conditioning sensor, velocity and motion sensor, force sensor, fluid pressure sensor, liquid flow sensor, liquid level sensor, temperature sensor.

Unit 4

Transducers:

Introduction to transducers. Transducer types – photo emissive transducer, photo conductive transducer, photovoltaic transducer, thermistors, thermocouple, inductive transducer, capacitive transducer, piezoelectric transducer, hall effect transducers, ionization transducer, Use of sensor and transducer for specific purpose in mechatronics.

MODULE-III (12 Hours)

Unit 5

Actuators and encoders:

Electric motors: D.C. Motors, Stepper motor. Hydraulic actuators, Pneumatic actuators. Principle of operation of encoders, Types of encoders- incremental encoder, optical encoder, bimetallic strip encoder, strain gauge encoder, load cell encoder.

Unit 6

Programmable Logic Controller:

Basic Structure- Programming: Ladder diagram Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls, data handling, Analog input / output , PLC Selection &Application.

MODULE-IV (8 Hours)

Unit 7

MEMS and Microsystems:
Overview of MEMS and Microsystems. Micromachining techniques: silicon as a material for micromachining, photolithography, thin film deposition, doping, wet and dry etching, surface and bulk micromachining, wafer bonding, packaging.

Microsystems modelling and Design:
Mechanics of deformable bodies. Energy method. Estimation of stiffness and damping for different microstructures. Modelling of electromechanical system, it's analysis in time domain and frequency domain, pull-in voltage. Applications of MEMS.

Text Books:

1. Mahalik N.P, "Mechatronics: Principles, Concepts and applications", Tata McGraw Hill, 3rd edition (Indian), 2012.
2. Appu Kuttan, "Introduction to Mechatronics", Oxford University, 2007.

Reference Books:

1. RK Rajput, "A Textbook of Mechatronics", S. Chand Publishing, 1st Edition, 2007.
2. Ananthasuresh & Gopalkrishnan, "Micro and Smart Systems", Wiley India, 2012
3. A. Smaili& F Mrad, "Applied Mechatronics", Oxford University Press, 1st Edition 2007.
4. S. D. Senturia, "Microsystem Design", Springer, 1st edition 2nd reprint 2004

Course Outcomes:

1. To model, analyze, and control engineering systems.
2. Identify sensors, transducers, and actuators to monitor and control the behaviour of a process or product.
3. Develop PLC programs for a given task.
4. Evaluate the performance of mechatronics systems.

OEHM6325	MARKETING MANAGEMENT	3-0-0	Credit-3

Course Objectives

1. To understand the concepts of marketing management
2. To learn about marketing process for different types of products and services
3. To understand the tools used by marketing managers in decision situations
4. To understand the marketing environment

Course Content

UNIT 1: Basic Concepts of Marketing

Definition, Concept of Exchange-Needs & Wants, Marketing Concept, Process ,Marketing environment, Elements of macro and micro environment, Competition analysis, Factors contributing to competition, Porters five forces model, identifying and analyzing competitors, Marketing planning process, Market research and information system, Research process, consumer behavior, factors influencing consumer behavior.

UNIT 2: Market segmentation, targeting and positioning

Definition, Bases of segmenting consumer and industrial market, Target market strategies, Market positioning, Market demand forecasting :forecasting tools, short term tools, Moving average and exponential smoothing methods, Long term forecasting tools- time series analysis, Econometric method, Qualitative methods– Buying intention survey, sales force opinion, Delphi techniques, Product planning-Product planning and new product planning process.

UNIT 3: Price decision

Objectives and factors influencing price, Pricing methods and strategies, Integrated marketing communication (IMC), Concept of IMC, The marketing communication process, Promotion mix, Elements of promotion mix, Channel of distribution: types of intermediaries, functions of distribution channels, channel levels, physical distribution, supply chain management (basic only)

Text Books

1. Kotler, P., Keller, K. L., Koshy, A., & Jha, M. (2012), Marketing Management A South Asian Perspective, 14th Edition, Pearson Education, New Delhi.
2. Ramaswamy, V. S., & Namakumari, S. (2017), Marketing Management: Indian Context with Global Perspective, McGraw hill.

Reference Books

1. Kotler, Philip. Marketing Management, Millennium Edition. Intl ed. US: Prentice Hall, 2002.ISBN: 8120316096.
2. Principles of Marketing, Kotler and Armstrong, Pearson, 12th edition., 2008, ISBN: 978-81- 317-1547-5

Course Outcomes

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

CO 1. Demonstrate strong conceptual knowledge in the functional area of marketingmanagement.
CO 2. Demonstrate effective understanding of relevant functional areas of marketing management and its application.
CO 3. Demonstrate analytical skills in identification and resolution of problems pertaining to marketing management

OEMA6326	Optimization in Engineering	3-0-0	Credit-3

Module-I. **(12 Hours)**

Idea of Engineering optimization problems, Classification of optimization algorithms, modeling of problems and principle of modeling. Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming.

Module-II. **(12 Hours)**

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method. Assignment problems: Hungarian method for solution of Assignment Problems Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems.

Module-III. **(13 Hours)**

Non-linear programming: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method. Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming.

Module-IV. **(8 Hours)**

Queuing models: General characteristics, M/M/1 model, Limited queue capacity, multiple server, Finite sources, Queue discipline. Introduction to Genetic Algorithm.

Text Books:

1. A. Ravindran, D. T. Philips, J. Solberg, Operations Research- Principle and Practice, Second edition, Wiley India Pvt. Ltd.
2. Prabhakar Pai, Operation Research, Oxford University Press.
3. H.A. Taha, A.M. Natarajan, P. Balasubramanie, A. Tamilarasi Operations Research, Pearson Education, Eighth Edition.

Reference Books:

1. Stephen G. Nash, A. Sofer Linear and Non-linear Optimization, McGraw Hill, 2nd Edition.
2. A. Ravindran, K.M. Ragsdell, G.V. Reklaitis, Engineering Optimization, Wiley India Pvt. Ltd, Second edition.
3. F.S. Hiller, G.J. Lieberman, Operations Research, Tata McGraw Hill, Eighth Edition. .

OEME6327	Industrial Engineering and Operation Research	3-0-0	Credit-3

Product Design and Development: Principles of good product design, tolerance design; quality and cost considerations; product life cycle; standardization, simplification, diversification, value engineering and analysis, concurrent engineering; comparison of production alternatives.

Work System Design: Taylor's scientific management, Gilbreths's contributions; productivity – concepts and measurements; method study, micro-motion study, principles of motion economy; work measurement –time study, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration.

Facility Design: Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.

Operation Research: Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models; network flow models, constrained optimization and Lagrange multipliers; Markovian queuing models; dynamic programming; simulation – manufacturing applications. Engineering Economy and Costing: Elementary cost accounting and methods of depreciation; break-even analysis, techniques for evaluation of capital investments, financial statements, time-cost trade-off, resource levelling. Production control: Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality; aggregate production planning; master production scheduling; MRP and MRP-II; routing, scheduling and priority dispatching; Push and pull production systems, concept of JIT manufacturing system; Logistics, distribution, and supply chain management;
Inventory – functions, costs, classifications, deterministic inventory models, quantity discount; perpetual and periodic inventory control systems.
Project management – PERT and CPM.

Text Book:

1. Production & operations management, K. Aswathappa, K.S. Bhat, Himalaya Publishing House, edition 2012.
2. R. Paneerselvam, Production operations Management
3. Operations Research, D.S.Hira, Gupta, S Chand Publisher
4. Industrial Engineering & Management, O P Khanna, Dhanpat Rai & Sons
5. WORK STUDY & amp; TIME STUDY,ILO

OEMT6328	Biomaterials	3-0-0	Credits 3

Objectives of the Course:

1. To introduce the student to the range of biomaterials and the science and engineering of biomaterials.
2. To understand constraints associated with the use of biomaterials

Module 1: **(12 Hours)**

Introduction to basic concepts of Materials Science, Salient properties of important material classes Property requirement of biomaterials, Concept of biocompatibility, Structure and properties of biological cells & tissues, Cell fate processes (cell migration, cell differentiation, cell apoptosis, cell division), Cell signaling processes, Cell-material interactions and foreign body response

Module 2: **(12 Hours)**

Bone tissue–structure, bone tissue-property, assessment of biocompatibility of biomaterials, in vitro biochemical assays (cellular adhesion, cellular viability using MTT, osteogenic differentiation- ALP assay; Biomineralisation - Osteocalcin assay), In vivo testing and histocompatibility assessment, Genotoxicity assessment,

Module 3: **(12 Hours)**

Important biometallic alloys: Ti-based, stainless steels, Co-Cr-Mo alloys Bioinert, Bioactive and Bioresorbable ceramics**,** Processing and properties of different hydroxyapatite (HA)-based biocomposites, Synthesis of biocompatible coatings on structural implant materials, Fabrication of porous scaffold materials using electrospinning and 3D printing, Microstructure and properties of glass-ceramics; biodegradable polymers, Processing and Properties of some Polymer-based Biocomposites,

Module 4: **(06 Hours)**

Design concept of developing new materials for bio-implant applications

Suggested Text Books:

1. Introduction to Biomaterials: Basic Theory with Engineering Applications; C.L Agrawal, J.L. Ong, Mark R Appleford, Gopinath Mani, Canbridge University Press, 2013

Suggested Reference Books:

1. Biological Performance of Materials: Fundamentals of Biocompatibility (Third Edition, Revised and Expanded); Author: Jonathan Black; Publisher - Marcel Dekker, 1999
2. Biomaterials Science and Biocompatibility; Authors: Frederick H. Silver and David L. Christiansen; Publisher: Springer-Verlag New York, 1999
3. Biomaterials Science: An Introduction to Materials in Medicine; Editors: Buddy D. Ratner, Allan S. Hoffman, Fredrick J. Schoen and Jack E. Lemons; Publisher: Elsevier Inc., 2004
4. Molecular Biology of the Cell; Fourth edition; Authors: Bruce Alberts, Alexander Johnson, Julian Lewis, Keith Roberts and Peter Walter; Publisher: Taylor & Francis, New York, 2002

5. B. Basu, D. Katti and Ashok Kumar; Advanced Biomaterials: Fundamentals, Processing and Applications; John Wiley & Sons, Inc., USA, September, 2009.

Course Outcomes:

After completing the course, the student will be able to:

1. Explain the types of Biomaterials and their relative advantages and disadvantages
2. Indicate the constraints placed on the use of materials in biological environments
3. Explain the characterization of materials from the perspective of application as a
4. Biomaterial

OEPD6329	OPERATION RESEARCH	3L-0T-0P	3 Credits

Course Objective

Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively; knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry; skills in the use of Operations Research approaches and computer tools in solving real problems in industry; Mathematical models for analysis of real problems in Operations Research. Identify and develop operational research models from the verbal description of the real system.

Module I **[12]**

Introduction: Definition, Characteristics and phases, Applications of OR. Linear Programming: Problem Formulation, Graphical solution, Simplex method - Artificial variables technique (i.e. Big M method only) - Duality principle, simple problems on dual formulation only, sensitivity analysis.

Module II **[10]**

Transportation Model: Formulation, IBFS-North West Corner method, LCEM, VAM, Unbalanced transportation problem, Optimality test by MODI method.

Assignment Model - Formulation - Optimal solution by Hungarian method – Unbalanced Assignment problem- Restricted case.

Module III **[10]**

Queuing Models: Introduction – Kendall's Lee notation- single channel with infinite population, Multichannel with infinite population

Networking Model: PERT, CPM

Module IV **[08]**

Theory of Games: Introduction-classification of games- 2 person zero sum games- Assumptions -solution of games with saddle points - Rectangular games without saddle points, dominance principle - 2 X 2 games by

Algebraic method, m X 2 & 2 X n games by graphical method.

Text Books:

1. Operation Research by Panarsalvam
2. Operation Research by Kalavathy

Reference Books:

1. Hiller & Libermann, "Introduction to Operations Research", 8th ed., Tata McGraw Hill, 2010.
2. D.S. Hira and R.K. Gupta, "Operations Research", 5th ed., S.Chand & Co., 2008.
3. Taha, "Introduction to Operations Research." 8th ed., PHI Publications, 2008.
4. S.D. Sharma, "Operations Research", 8th ed., Kedarnath Publishers, 2007.

Course Outcomes:

Upon successful completion of the course, student will able to:

1. Recognize the importance and value of Operations Research and mathematical modelling in solving practical problems in industry.
2. Formulate a managerial decision problem into a mathematical model;
3. Understand Operations Research models and apply them to real-life problems;
4. Use computer tools to solve a mathematical model for a practical problem.
5. Cognitive skills (thinking and analysis)
6. Be able to build and solve Transportation Models and Assignment Models.
7. Be able to understand the characteristics of different types of decision.