BIJUPATNAIKUNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA



Curriculum and Syllabus

B. Tech (Information Technology /Computer Science &Information Technology) from the Admission Batch

2018-19

Semester (7th)

			Seventh Semest	er			
			Theory				
SI No	Category	Course Code	Course Title	L-T-P	Credit	University Marks	Internal Evaluation
1	HS	RED7E001	Entrepreneurship Development	3-0-0	3	100	50
2	PE	RIT7D001	Internet of Things	3-0-0	3	100	50
		RIT7D002	Big Data Analytics				
		RIT7D003	Network Security				
3	PE	RIT7D004	Cloud Computing	3-0-0	3	100	50
		RIT7D005	Algorithms for Bio Informatics				
		RIT7D006	E-Commerce and ERP				
4	OE	REC5D006	Digital VLSI Design	3-0-0	3	100	50
		RIS7B001	Industrial Safety Engineering				
		REC7D002	Embedded Systems				
		REI7D003	Mechatronics				
5	OE	RIP7E002	Intellectual Property Right	200	2	100	50
5		RGT6A003	Green Technology	3-0-0	3		50
		REV5D004	Disaster Management				
c	OE	RCL7E004	Cyber Law and Ethics	3_0_0	2	100	50
0	UE	REL7D003	Smart Grid	3-0-0	3	100	30
7	MC*	RIK7F001	Essence of Indian Knowledge Tradition - II	3-0-0	0		100 (Pass Mark is 37)
			Total Cree	dit (Theory)	18		
]	Fotal Marks		600	300
			Practical	_			
1	PSI	RMP7H201	Minor Project	0-0-6	3		200
2	PSI	RSM7H202	Seminar - II	0-0-3	1		100
3	PSI	RCV7H203	Comprehensive Viva	0-0-3	1		100
			Total Credi	t (Practical)	5		
			Total Sem	ester Credit	23		
				fotal Marks			400

*Mandatory Non-Credit Courses (MC) result will be reflected with Pass (P) / Fail (F) grade. Thus, the grade obtained will not be affecting the grade point average. However, it shall appear on the grade sheet as per AICTE rule.

7 th Semester	RED7E001	Entrepreneurship	L-T-P	3 Credits
		Development	3-0-0	

Module I:

Entrepreneurship: Concept of entrepreneurship and intrapreneurship, Types of Entrepreneurs, Nature and Importance, Entrepreneurial Traits and Skills, Entrepreneurial Motivation and Achievement, Entrepreneurial Personality

Module II:

Entrepreneurial Environment, Identification of Opportunities, Converting Business Opportunities into reality. Start-ups and business incubation, Setting up a Small Enterprise. Issues relating to location, Environmental Problems and Environmental pollution Act, Industrial Policies and Regulations

Module III:

Need to know about Accounting, Working capital Management, Marketing Management, Human Resources Management, and Labour Laws. Organizational support services - Central and State Government, Incentives and Subsidies.

Module IV:

Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Governments in reviving industries.

Books:

- [1] Entrepreneurship Development and Management, Vasant Desai, HPH
- [2] Entrepreneurship Management, Bholanath Dutta, Excel Books
- [3] Entrepreneurial Development, Sangeeta Sharma, PHI
- [4] Entrepreneurship, Rajeev Roy, Oxford University Press

Digital Learning Resources:

Course Name:	Entrepreneursnip
Course Link:	https://nptel.ac.in/courses/110/106/110106141/
Course Instructor:	Prof. C Bhaktavatsala Rao, IIT Roorkee
Course Name:	Entrepreneurship Essentials
Course Link:	https://nptel.ac.in/courses/127/105/127105007/
Course Instructor:	Prof. Manoj Kumar Mondal, IIT Kharagpur

1.

(10 hours)

(10 hours)

(8 hours)

(12 hours)

7 th Semester RIT7D001	Internet of Things	L-T-P 3-0-0	3 Credits

Module-1

Introduction-Definition & Characteristics of IoT, Physical Design of IoT- Things in IoT, IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies- Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates.

Module-2

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities-Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response,

Environment-Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection, **Energy-** Smart Grids, Renewable Energy Systems, Prognostics, Retail-Inventory Management, Smart Payments, Smart Vending Machines, **Logistics**-Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics, **Agriculture**-Smart Irrigation, Green House Control, **Industry** -Machine Diagnosis & Prognosis Indoor Air Quality Monitoring, Health & Lifestyle -Health & Fitness Monitoring, Wearable Electronics

IoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

Module-3

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device & Component Integration, Application Development, Case Study on IoT System for Weather Monitoring, Motivation for Using Python

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces – Serial, SPI , I2C , Programming Raspberry Pi with Python-Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , Other IoT Devices- pcDuino, Beagle Bone Black , Cubieboard

Module-3

IoT &Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and dataintensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Books:

- 1. Internet of Things, A Hands on Approach, by ArshdeepBahga& Vijay audisetti, University Press.
- 2. The Internet of Things, by Michael Millen, Pearson

$7^{\rm th}$	RIT7D002	Bigdata Analytics	L-T-P	3
Semester			3-0-0	CREDITS

Module-1

Introduction to Big Data: Types of Digital Data-Characteristics of Data – Evolution of Big Data - Definition of Big Data - Challenges with Big Data - 3Vs of Big Data - Non Definitional traits of Big Data - Business Intelligence vs. Big Data - Data warehouse and Hadoop environment - Coexistence. Big Data Analytics: Classification of analytics - Data Science - Terminologies in Big Data - CAP Theorem - BASE Concept. NoSQL: Types of Databases – Advantages – NewSQL - SQL vs. NOSQL vs NewSQL. Introduction to Hadoop: Features – Advantages – Versions - Overview of Hadoop Eco systems - Hadoop distributions - Hadoop vs. SQL – RDBMS vs. Hadoop - Hadoop Components – Architecture – HDFS - Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting - Compression. Hadoop 2 (YARN): Architecture - Interacting with Hadoop Eco systems.

Module-2

No SQL databases: Mongo DB: Introduction – Features - Data types - Mongo DB Query language - CRUD operations – Arrays - Functions: Count – Sort – Limit – Skip – Aggregate - Map Reduce. Cursors – Indexes - Mongo Import – Mongo Export. Cassandra: Introduction – Features - Data types – CQLSH - Key spaces - CRUD operations – Collections – Counter – TTL - Alter commands - Import and Export - Querying System tables.

Module-3

Hadoop Eco systems: Hive – Architecture - data type - File format – HQL – SerDe - User defined functions - Pig: Features – Anatomy - Pig on Hadoop - Pig Philosophy - Pig Latin overview - Data types - Running pig - Execution modes of Pig - HDFS commands - Relational operators - Eval Functions - Complex data type - Piggy Bank - User defined Functions - Parameter substitution - Diagnostic operator. Jasper Report: Introduction - Connecting to Mongo DB - Connecting to Cassandra - Introduction to Machine learning: Linear Regression – Clustering - Collaborative filtering - Association rule mining - Decision tree.

Books:

- 1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
- 2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Sons, Inc., 2013.
- 3. Tom White, "Hadoop: The Definitive Guide", O'Reilly Publications, 2011.

- 4. Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.
- 5. Russell Bradberry, Eric Blow, "Practical Cassandra A developers Approach", Pearson Education, 2014.

7^{th}	RIT7D003	Network Security	L-T-P	3
Semester			3-0-0	Credits

Module I :

INTRODUCTION & NUMBER THEORY

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, 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 :

BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

Module III :

HASH FUNCTIONS AND DIGITAL SIGNATURES

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

SECURITY PRACTICE & SYSTEM SECURITY

Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

Module IV :

E-MAIL, IP & WEB SECURITY

E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keys privacyauthentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec – IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocolcomputing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

Books:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013. (UNIT I,II,III,IV).

[10 hours]

[12 hours]

[8 hours]

[10 hours]

- 2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002. (UNIT V).
- 3. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
- 4. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
- 5. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.

7^{th}	RIT7D004/	Cloud Computing	L-T-P	3
Semester	RCS6D003		3-0-0	Credits

Objectives

 \Box To understand the fundamentals of cloud computing

 \Box To understand the architecture of various cloud

□ To understand the simulation of cloud system using some state-of-the-art platforms

Module I:

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

Module II:

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 vCloud - IaaS, vCloud Express, Google AppEngine - PaaS, The Java Runtime Environment

Module III:

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:

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

Outcomes

 $\hfill\square$ Ability to develop the fundamentals of cloud computing

□ Ability to understand architecture of cloud

- $\hfill \Box$ Ability to comprehend, design, and develop cloud system using some state-of-the-art platform **Books:**
- 1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and Cloud

(10 Hours)

(10 Hours)

(10 Hours)

(10 Hours)

Computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012

- 2. Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010
- **3.** R. Buyya, C. Vecchiola and S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, Morgan Kaufmann, Elsevier, 2013.
- **4.** P. K. Pattnaik, M. R. Kabat and S. Pal, Fundamentals of Cloud Computing, Vikas Publishing House Pvt. Ltd., 2015.

Digital Learning Resources:

Course Name:	Cloud Computing
Course Link:	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
Course Instructor:	Prof. Soumya Kanti Ghosh, IIT Kharagpur
Course Name:	Cloud Computing and Distributed Systems
Course Link:	https://onlinecourses.nptel.ac.in/noc21_cs15/preview
Course Instructor:	Prof. Rajiv Misra, IIT Patna

7^{th}	RIT7D005	Algorithms for Bio	L-T-P	3
Semester		Informatics	3-0-0	Credits

Module –I

[9 HOURS]

DYNAMIC PROGRAMMING ALGORITHMS Introduction to Algorithms, DynamicProgramming, Sequence Alignment: Edit distance, LCS. PAM and BLOSUM Scoring Matrices.

Global alignments: Needleman Wunsch Algorithm, Local Alignments: Smith WatermanAlgorithm, Gap Penalties.

Module –II

GRAPH ALGORITHMS Graph Algorithms, SBH and Eulerian Paths, De-novo PeptideSequencing: Longest Paths and Space Efficient Alignment Algorithms. Fast LCS using Table

Lookup.

Module- III

PATTERN MATCHING AND CLUSTERING Exact Pattern Matching: KMP Algorithm, Keyword Trees, Aho-Corasick Algorithm. Clustering Basics: Hierarchical Clustering, Multiple Sequence Alignment: CLUSTAL, Center-based Clustering, Clustering via Cliques.

Module- IV

EVOLUTIONARY TRESS AND PHYLOGENY Evolutionary Trees and Ultrametrics, Additivedistance trees, Perfect Phylogeny Problem, Small Parsimony Problem, Nearest NeighborInterchange.

HIDDEN MARKOV MODELS, RANDOMIZED ALGORITHMS Hidden MarkovModels: Basics, Forward and Backward (Viterbi) Algorithms, Randomized algorithms and theirapplications.

Books:

- 1. Neil C. Jones and Pavel A. Pevzner, "An Introduction to Bioinformatics Algorithms", MIT Press, 2005.
- **2.** Gusfields D, "Algorithms on strings, trees and sequences: Computer Science and Computational Biology", Cambridge University Press, 1997.
- **3.** Steffen Schulze-Kremer, "Molecular Bioinformatics: Algorithms and Applications", Walter de Gruyter, 1996.

[8 HOURS]

[10 HOURS]

[12 HOURS]

- **4.** Gary Benson, Roderic Page (Eds.), "Algorithms in Bioinformatics", Springer International Edition, 2004.
- **5.** Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison. "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acid", Cambridge University Press, 1999.

$7^{ ext{th}}$	RIT7D006	E-Commerce and ERP	L-T-P	3 Credits
Semester			3-0-0	

Module I

Overview of Electronic Commerce, Driving the Electronic Commerce Revolution, The Internet, Portals. Open Systems Inter Connection (OSI) Model, XML, Data Warehousing, BuildingOwnWebSite,InternetSecurity

Module II

E-Commerce and Internet, Electronic Market, Business to Business E-Commerce, Four C`s (Convergence, Collaborative Computing, Content Management and Call Center), Wireless Application Protocol (WAP), Intranet and Extranets. Data Interchange (EDI), Electronic PaymentSystems,E-Security

Module-III

Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology -Issues to consider in planning designing and implementation of cross functional integrated ERP systems. Small, medium and large enterprise vendor solutions, BPR, and best business practices - Business process Management, Functional modules.

Module IV

ERP IMPLEMENTATION: Planning Evaluation and selection of ERP systems, Implementation life cycle - ERP implementation, Methodology, Data Migration, Success and Failure factors of ERP Implementation. Extended ERP systems and ERP add-ons -CRM, SCM, Manufacturing prospective, Business analytics .

7 th Semester REC5D006	Digital VLSI Design	L-T-P 3-0-0	3 Credits

Book:

- 1. E- Commerce and Enterprise Resource Planning; CSV Murthy, HPH
- 2. Enterprise Resource Planning- Concepts and Practices ; V K Garg and N K Venkatkrishna, PHI
- 3. Enterprise Resource Planning; AlexixLeon ; TMH

MODULE-I

(08Hours)

Introduction: Historical Perspective, VLSI Design Methodologies, VLSI Design Flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Design Styles, Computer-Aided Design Technology.

Fabrication of MOSFETs: Introduction, Fabrication Processes Flow – Basic Concepts, The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full Customs Mask Layout Design.

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.

MODULE-II

MOS Inverters – Static Characteristics: Introduction, Resistive-Load Inverters, Inverters with n-Type MOSFET Load, CMOS Inverter.

MOS Inverters – Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definitions, Calculation of Delay-Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOSInverters.

Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion NMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates).

MODULE-III

Sequential MOS Logic Circuits: Introduction, Behaviour of Bistable Elements, SR Latch Circuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge Triggered Flip Flop. Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

MODULE-IV

Design for Testability: Introduction, Fault Types and Models, Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring IDDQ Test.

MODULE-V

Semiconductor Memories: Introduction, Dynamic Random-Access Memory (DRAM), Static Random Access Memory (SRAM), Non-volatile Memory, FlashMemory.

Books:

- [1] *CMOS Digital Integrated Circuits: Analysis and Design*, Sung-Mo Kang and Yusuf Leblebici, Tata McGraw-Hill Publishing Company Limited, 3rdEdn, 2003.
- [2] Principles of CMOS VLSI Design a Systems Perspective, K. Eshraghian and N.H.E. Weste, Addison Wesley,2nd Edition, 1993.
- [3] Digital Integrated Circuits– *A Design Perspective*, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, PHI, 2nd Edn.
- [4] Modern VLSI Design System *on Chip Design*, Wayne Wolf, PHI, 3rd Edn.
- [5] VLSI Design, Debaprasad Das, Oxford University Press, New Delhi, 2010
- [6] CMOS Logic Circuit Design, John P. Uyemura, Springer, 2001.
- [7] Digital Integrated Circuit Design, Ken Martin, Oxford University Press, 2000.
- [8] VLSI Design Technique for Analog and Digital Circuits, R L Geiger, TMH.

Digital Learning Resources:

Course Name:	VLSI Design
Course Link:	https://nptel.ac.in/courses/117/101/117101058/
Course Instructor:	Prof. A.N. Chandorkar, IIT Bombay
Course Name:	Digital VLSI Testing
Course Link:	https://nptel.ac.in/courses/117/105/117105137/
Course Instructor:	Prof. S, Chattopadhyay, IIT Kharagpur

Course Name:	VLSI Technology
Course Link:	https://nptel.ac.in/courses/117/106/117106093/
Course Instructor:	Dr. Nandita Dasgupta, IIT Madras

7th Semester

7^{th}	RIS7B001	Industrial Safety	L-T-P	2Credita
Semester		Engineering	3-0-0	Screuits

Module-I:

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Module-II

Fundamentals of maintenance engineering: Definition and aim of maintenanceengineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Module-III:(7 hours)

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Module-IV:

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in

(7 hours)

(7 hours)

(7 hours)

machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module-V:

(8 hours)

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repaircomplexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.

- 2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
- 3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
- 4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

7^{th}	REC7D002	Embedded Systems	L-T-P	3
Semester			3-0-0	CREDITS

Module-I

Hardware Concepts Embedded System: Application and characteristics of embedded systems, Overview of Processors and hardware units in embedded system, embedded software in a system, Examples of Embedded system.

ARM:ARM pipeline, Instruction Set Architecture ISA: Registers, Data Processing Instructions, Data Transfer Instructions, Multiplication's instructions, Software interrupt, Conditional execution, branch instruction, Swap instruction, THUMB instructions.

Module-II

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

(8hrs)

(12 hrs)

(9 hrs)

Real Time Operating System (RTOS): 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)

Module –IV

Modelling Techniques: Software and programming concept: Processor selection for an embedded system, State chart, SDL, Petri-Nets, Unified Modeling Language (UML). Hardware software codesign. Hardware and software partitioning: K-L partitioning, Partitioning using genetic algorithm,

Module –V

Low power embedded system design: Dynamic power dissipation, Static power dissipation, Power reduction techniques, system level power management. Software design for low power devices.

Books:

- [1] "Embedded system architecture, programming and design" By Raj Kamal, TMH.
- [2] "Embedded System Design" by SantanuChattopadhay, PHI
- [3] Frank Vahid and Tony Givargis, Embedded Systems Design A unified Hardware /Software Introduction, John Wiley, 2002.
- [4] "Hardware software co-design of Embedded systems" By Ralf Niemann, Kulwer Academic.
- [5] "Embedded real time system programming" By Sriram V Iyer, Pankaj Gupta, TMH.

Digital Learning Resources:

Course Name:	Embedded Systems
Course Link:	https://nptel.ac.in/courses/108/102/108102045/
Course Instructor:	Prof. Santanu Chaudhary, IIT Delhi
Course Name:	Embedded Systems
Course Link:	https://nptel.ac.in/courses/108/105/108105057/
Course Instructor:	Prof. Amit Patra et al, IIT Kharagpur
Course Name:	Embedded Systems Design
Course Link:	https://nptel.ac.in/courses/106/105/106105159/
Course Instructor:	Prof. Anupam Basu, IIT Kharagpur

7th Semester

(8 hrs)

(8 hrs)

7th Semester

7 th	REI7D003	Mechatronics	L-T-P	3
Semester			3-0-0	CREDITS

MODULE-I

(10Hours)

Evolution of Mechatronics, components of mechatronic system, types of mechatronic products, Signal theory, signal analysis and processing, Laplace transformation, Z-transformation modulation and de-modulation. Electrical components and electronic device –Resister, inductor and capacitor, reactance and impedance. Basic electronics devices junction diodes, Bipolar transistors

MODULE-II (08Hours)

Basic Digital Technology: Digital number system, Binary number system, Hexadecimal number system, Binary addition, Boolean Algebra, Logic function, Universal GATES, FLIP-FLOP, Registers counters. System modelling: Frequency response, Mechanical system, electrical system, Thermal system, Fluid system

MODULE-III (10Hours)

Actuators- Electric motors; D.C. Motors, Stepper motor, Hydraulic actuators, Pneumatic actuators Transducer and Sensors: Principles, difference between transducer and sensors, transducer types – photo emissive, photo conductive, photovoltaic, thermistors, Thermocouple, Inductive, capacitive, Peizoelectric, Hall effect transducers, Ionization transducer, Encoders- Incremental encoder, Optical encoder, Bimetallic strip, Strain gauge, load cell. 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. Microprocessor ad Microcontroller: Microprocessor based Digital control, registers, Program counter, Intel -8085 microprocessor

Books:

- [1] A Text Books of Mechatronics, R.K.Rajput, S.Chand& company
- [2] Mechatronics, N.G. P.C Mahalik, Tata McGraw Hill
- [3] Mechatronics, D.G. Alciator, M.B. Histand, Tata McGraw Hill
- [4] Mechatronics, A.Smaili& F Mrad, Oxford University Press
- [5] Mechatronics, K.P.ramchandran, G,K Vijay Raghavan, M. S Balachandran
- [6] Mechatronics An Intigrated approach, Clarence W de Sliva, CRC Press

Digital Learning Resources:

Course Name:	Mechatronics
Course Link:	https://nptel.ac.in/courses/112/107/112107298/
Course Instructor:	Prof. Pushparaj Mani Pathak, IIT Roorkee

7th Semester

7^{th}	RIP7E002	Intellectual Property Right	L-T-P	3
Semester			3-0-0	CREDITS

MODULE-I

Introduction: Intellectual property: meaning, nature and significance, need for intellectual property Right (IPR), IPR in India – Genesis and development, IPR in abroad, Examples: -Biotechnology Research and Intellectual Property Rights Management. What is a patent, what can be protected by a patent, why should I apply for a patent? Patent Law, Patentability requirements, non-Patentable subject matters, Layout of the Patents. Procedure for domestic and international filing of applications, Restoration, Surrender and Revocations of Patents, Rights of Patentee and Working of Patent, Licensing and Enforcing Intellectual Property.

MODULE-II

Copyrights: Copyright: meaning, scope; What is covered by copyright? How long does copyright last? Why protects copyright? Related rights, Rights covered by copyright. Ownership: Duration, Division, Transfer and Termination of Transfers.

MODULE-III (10Hours)

Infringement and Remedies: Literal and non-literal infringement, Role of claims, Doctrines on infringement: Equivalent doctrine, Pith and Marrow doctrine, Comparative test. Defences: Gillette Defence, General grounds, Patents granted with conditions, Parallel import. Remedies: Civil, Administrative.

MODULE-IV (08Hours)

State Law: Trade Secret, Contract, Misappropriation, Right of Publicity Trademarks, Trade Secret -Overview, Requirements, Misappropriation of Trade Secret, Departing Employees, Remedies, Criminal Liability, Misappropriation, Clickwrap Agreements, Idea Submissions; Right of Publicity, Federal Pre-emption, Review.

Books:

- [1] W. R. Cornish and D. Llewellyn, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Rights, Sweet & Maxwell.
- [2] Lionel Bently and Brad Sherman, Intellectual Property Law, Oxford University Press.
- [3] P. Narayanan, Intellectual Property Law, Eastern Law House
- [4] B. L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing Co.
- [5] V. K. Ahuja, Law Relating to Intellectual Property Rights, LexisNexis
- [6] AjitParulekar and Sarita D'Souza, Indian Patents Law Legal & Business Implications;Macmillan India ltd, 2006

(12Hours)

(10Hours)

[7] P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

Reference:

- [1] The Copyright Act, 1957
- [2] The Patent Act, 1970
- [3] The Trade Marks Act, 1999
- [4] The Designs Act, 2000
- [5] The Geographical Indication of Goods Act, 1999
- [6] The Protection of Plant Varieties and Farmers' Rights Act, 2001
- [7] The Semiconductor Integrated Circuits Layout Design Act, 2000

Digital Learning Resources:

Course Name:	Intellectual Property
Course Link:	https://nptel.ac.in/courses/109/106/109106137/
Course Instructor:	Prof. Feroze Ali, IIT Madras

7^{th}	RGT6A003	Green Technology	L-T-P	3
Semester			3-0-0	CREDITS

Module I:

(12 Hrs)

Global Warming and its effect: - Introduction and physical definition of global warming, the New Carbon Problem: Accumulation, Long Half-Life, Heating Potential, Carbon Emission Factors, Carbon Absorption in Nature, The Global Emission Situation and its effect in India, The Kyoto and Other Protocols and its view in India, Effect of climate change and its impact.

Planning for the Future to reduce global warming: - Steps taken to Control Carbon Emissions universally, Use of Promotional and Punitive Mechanisms for Reducing Carbon in Atmosphere, The General Approach in Planning for the Future, Developing Countrywide Adaptive Measures for Safety of Local People, Developing Mitigative Measures for Global Reduction of Carbon, India's National Action Plan on Climate Change (NAPCC) till date, National Mission for a Green India, The MRV Debate.

Module II:

Opportunities in Control of Carbon Emissions and Accumulation:- Essential Steps for Control of Carbon Emissions and Accumulation, Procedure to develop own Priorities and Business Opportunities in India for control of carbon emissions and accumulation, Needs a Mix of Green and Traditional Power Sources in India, A Logical Approach for Carbon Reduction, Need in India — More Forests, Less Deforestation and payment rates procedure for controlling carbon emissions and its Promotional Mechanisms at India. Green Technologies for Energy Production: - Various Technologies Available for Energy Production, Cost Comparison of a Few Typical Systems for Power Generation, Sources of Energy Production Already in Use, Alternative Methods Ready for Use, Green Technologies Needing some Prior R&D Work.

Module III:

Green Technologies for Personal and Citywide Application: - Measures to be taken for Green city, Carbon Emission Reduction at Personal Level, Carbon Emission Reduction at Local Authority and

(10 Hrs)

(8 Hrs)

Citywide Level, Carbon Emissions from Imports. Green Technologies for Specific Applications:-Promotion of 'Green' Buildings, Guidelines, The Energy Conservation Building Code (ECBC), Green Hotels and Hospitals, Green Technologies for Transport, Green Roads, Ports and Harbours, Industries, Carbon, Carbon Emissions from a Few Selected Industries in India, The Changing Scenario in Cities, Need for Wider Application to Town Planning and Area Re-Development Projects, 'Green' Infrastructure for Municipal Services, Bringing up Indian Villages, Green Services for Crematoria, Spreading Message to all Stakeholders.

Module IV:

(**10 Hrs**)

Some High-tech Measures for Reducing Carbon Emissions: - Use of Solar Power with Satellite-Based Systems, Use of Carbon Capture and Storage (Sequestration), Microorganisms, A Quick SWOT Analysis.Recommended Plan of Action: - India's National Action Plan Take Us to a Low-Carbon Path, The Missions Help Develop Awareness, few case studies on Projects undertakenby Various Countries, Adaptive Measures Essential for Indian People to Cope with Climate Change

Books

[1] Green Technologies, Soli J. Arceivala, McGraw Hill Education [2] Green Technologies and Environmental Sustainability edited by Ritu Singh, Sanjeev Kumar

Digital Learning Resources:

Course Name: Sustainable Materials and Green Buildings Course Link:https://nptel.ac.in/courses/105/102/105102195/ Course Instructor:Dr. B. Bhattacharjee, IIT Delhi

7^{th}	REV5D004	Disaster Management	L-T-P	3
Semester			3-0-0	CREDITS

Module I

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional) Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment -Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk -Vulnerabilities to flood and earthquake hazards

Module II

Disaster Management Mechanism: Concepts of risk management and crisis managements -Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

Module III

Capacity Building: Capacity Building: Concept - Structural and Non-structural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

Module IV

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

(12 Hours)

(6 Hours)

(6 Hours)

(12 Hours)

7th.Semester

7 th Semester	RCL7E004	Cyber Law and Ethics	L-T-P 3-0-0	3 Credits
			3-0-0	

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans

Books:

- [1] Manual on Disaster Management, National Disaster Management, Agency Govt of India.
- [2] Disaster Management by Mrinalini Pandey Wiley 2014.
- [3] Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015
- [4] Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015
- [5] Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
- [6] National Disaster Management Plan, Ministry of Home affairs, Government of India http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf

Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

Module-II: Information Technology Act

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

Module-III: Cyber Law and Related Legislation

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

Module-IV: Electronic Business and Legal Issues

Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models-B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

Module-V: Cyber Ethics

The Importance of Cyber Law, Significance of Cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Books:

- 1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, Dominant Publisher
- 2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
- 3. Information Security policy & Implementation Issues, NIIT, PHI
- 4. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
- 5. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,
- 6. Cyber Law, JonthanRosenoer, Springer, New York, (1997).

7th.Semester

7 th Semester REL7D003	Smart Grid	L-T-P 3-0-0	3 Credits
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Module-I:

Evolution of Electric Power Grid, introduction to smart Grid, Concept, definitions, architecture and functions of Smart Grid. Need of Smart Grid. Difference between conventional & smart grid. Opportunities & Challenges of Smart Grid, Introduction to Smart Meters, Real Time Pricing, Smart Appliances. Automatic Meter Reading (AMR). Outage Management System (OMS). Home & Building Automation, Substation Automation, Feeder Automation, Smart Sensors, Geographic Information System (GIS). Intelligent Electronic Devices (IED) & their application for Monitoring & Protection.

Module-II:

Phasor Measurement Units (PMU), Wide Area Measurement System (WAMS), Wide-Area based Protection and Control Micro-grid concepts, need and application, Issues of Interconnection. Protection & control systems for micro-grid. Storage systems including Battery, SMES, Pumped Hydro. Compressed Air Energy Storage.

Module-III:

Variable speed wind generators, fuel-cells, micro-turbines. Integration of renewables and issues involved, Advantages and disadvantages of Distributed Generation. Power Quality & EMC in smart Grid. Power Quality issues of Grid connected Renewable Energy Sources. Power Quality Conditioners for micro-grid. Web based Power Quality monitoring, Power Quality Audit.

Books:

- Ali Keyhani, "Design of Smart power grid renewable energy systems", Wiley [1] IEEE,2011
- [2] Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRCPress, 2009.
- Stuart Borlase, "Smart Grid: Infrastructure, Technology and solutions " CRC Press [3]
- [4] Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.
- Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving [5] Sustainability: 1", Artech House Publishers July 2011
- MladenKezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George [6] Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer

Digital Learning Resources:

Course Name:	Introduction to Smart Grid
Course Link:	https://nptel.ac.in/courses/108/107/108107113/
Course Instructor:	Prof. N.P. Padhy and Prof. Premalata Jena, IIT Roorkee

(10 hours)

(10 hours)

(10 hours)

7th Semester

$7^{\rm th}$	RIK7F001	Essence of Indian	L-T-P	3
Semester		Knowledge Tradition - II	3-0-0	CREDITS

Course Objectives:

- 1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- 2. To make the students understand the traditional knowledge and analyse it and apply it to their day to day life

Course Outcomes :

At the end of the Course, Student will be able to:

- 1. Identify the concept of Traditional knowledge and its importance.
- 2. Explain the need and importance of protecting traditional knowledge.
- 3. Illustrate the various enactments related to the protection of traditional knowledge.
- 4. Interpret the concepts of Intellectual property to protect the traditional knowledge.
- 5. Explain the importance of Traditional knowledge in Agriculture and Medicine.

Module-1:

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

Module-2:

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Module-3:

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

Module-4:

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

Module-5:

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

Books:

- 1. Traditional Knowledge System in India, by Amit Jha, 2009.
- 2. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
- 3. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino.

Digital Learning Resources:

Course Name:	Ayurvedic Inheritance of India
Course Link:	https://nptel.ac.in/courses/121/106/121106003/
Course Instructor:	Dr M. S. Valiathan, IIT, Madras

https://www.youtube.com/watch?v=LZP1StpYEPM