FIFTH SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/ week	Credit	Full Marks
1.	Humanities Science - 5	HS 501	Professional Practice, Law and Ethics	2	0	0	2	2	100
2.	Program Core – 14	PC CS 511	Machine Learning	2	0	0	2	2	100
3.	Program Core – 15	PC CS 512	Introduction to IOT & Embedded Computing	3	1	0	4	4	100
4.	Program Core – 16	PC CS 503	Database Management Systems	3	0	0	3	3	100
5.	Program Core – 17	PC CS 504	Formal Language & Automata Theory	3	0	0	3	3	100
6.	Program Core – 18	PC CS 506	Computer Networks	3	0	0	3	3	100
7.	Program Core – 19	PC CS 513	IoT and Embedded Computing Lab	0	0	2	2	1	100
8.	Program Core – 20	PC CS 509	Computer Hardware & Network Lab	0	0	4	4	2	100
9.	Program Core – 21	PC CS 508	Database Management System Lab	0	0	2	2	1	100
10.	Employment Enhancement Courses - 1	EEC 510	Industry Internship - I	0	0	0	0	1	100
Total :				16	1	8	25	22	1000

Professional Practice, Law and Ethics

Course Code	HS 501
Course Title	Professional Practice, Law & Ethics
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	-
Course Category	Humanities Science (HS)
Number of classes	26 Hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Interpret laws governing engagement of labour in construction related works and other related areas.	K2
CO-2	Demonstrate an understanding of Intellectual Property Rights and Patents.	K2
CO-3	Develop ideas of the professionalism, values and ethics in a profession.	K3
CO-4	Develop a good insight into contracts and contracts management in engineering, arbitration and dispute resolution mechanisms.	K3

Course Content:

Module 1: **(6 Hours)**

Professionalism: Professional characteristics, professional education, professional development in Industry. Values and Ethics in Profession- Value system- goodness, means and ends; Ethics-ethical premises, expectation, conflicts and practices; Moral and ego, Ethics and morality Right, virtue ethics and justice, utility and justice, privacy, challenges to privacy, privacy on the Internet.
Professional Ethics–Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility,
Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

Module 2: **(10 Hours)**

Indian Contract Act, 1972 and amendments covering General principles of contracting; Valid & Voidable Contracts; Prime and Subcontracts Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Cost escalation; Delays, Suspensions & Terminations; Time Computer Science and Engineering Page 53of 129 extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation.

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration– meaning, scope and types–distinction between laws of 1940 and 1996; Arbitration agreements– essential and kinds, validity, reference and interim measures by court; Arbitration tribunal–appointment, challenge, jurisdiction

of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision.

Module 3: (5 Hours)

Role of Labour in Civil Engineering; Methods of engaging labour-on rolls, labour sub-contract, piece rate work; Industrial Disputes Act,1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act,1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act(1996) and Rules (1998); RERA Act2017, NBC 2017.

Module 4: (5 Hours)

Introduction–meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Copy Rights Act, 1957, Meaning of copyright–computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet– Remedies and procedures in India; LawrelatingtoPatentsunderPatentsAct,1970 including Concept and historical perspective of patents law in India. Process of obtaining patent– application, examination, opposition and sealing of patents. Duration of patents–law and policy considerations, Infringement and related remedies;

Text/Reference Books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. The National Building Code, BIS, 2017
3. Meena Rao(2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
4. Neelima Chandiramani (2000),The Law of Contract: An Outline ,2nd Edn. Avinash Publications Mumbai
5. Avtarsingh (2002),Law of Contract, Eastern Book Co. 7. Dutt(1994), Indian Contract Act, Eastern Law House
6. T. Ramappa (2010),Intellectual Property Rights Law in India, Asia Law House
7. Baretext (2005), Right to Information Act
8. O.P.Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
9. Ethics in Engineering- M.W.Martin & R.Schinzinger, McGraw-Hill
10. Engineering Ethics,National Institute for Engineering Ethics, USA.
11. Ethics & Mgmt and Ethos , Ghosh, VIKASH
12. Business Ethics; Concept and Cases, Velasqez, Pearson

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Machine Learning

Course Code	PC CS 511
Course Title	Machine Learning
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	Data Mining, AI
Course Category	Program Core
Number of classes	24 Hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Explain the concepts of computational intelligence like machine learning	K2
CO-2	Apply machine learning techniques to address the real time problems in different areas.	K3
CO-3	Illustrate the Ensemble methods and its usage in machine learning application	K3
CO-4	Apply Reinforcement learning techniques to respective problems.	K3

Course Content:

Module 1: (6 Hours)

Introduction: Machine learning, Terminologies in machine learning, Types of machine learning: supervised, unsupervised, semi-supervised learning. Review of probability. Decision Trees, Clustering- K-means/Kernel K-means, Dimensionality Reduction-PCA and kernel PCA, Matrix Factorization and Matrix Completion

Module 2: (6 Hours)

Discriminative Model: Least Square Regression, Gradient Descent Algorithm, Univariate and Multivariate Linear Regression, Prediction Model, probabilistic interpretation, Regularization, Logistic regression, multi class classification, Support Vector Machines- Large margin classifiers, Nonlinear SVM, kernel functions, SMO algorithm.

Module 3: (6 Hours)

Generative models: k-Nearest Neighbour Classification, Bayesian concept learning, Likelihood, Posterior predictive distribution, beta-binomial model, Naive Bayes classifiers, classifying documents using bag of words. Bayesian Statistics and Frequentist statistics. Directed graphical models (Bayes nets), Conditional independence, Inference.

Module 4: **(6 Hours)**

Advanced ML Models: Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests) Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference. Recent trends in various learning techniques of machine learning and classification methods.

References / Suggested Learning Resources:

1. E. Alpaydin, "Introduction to Machine Learning", PHI, 2005.
2. Tom Mitchell, "Machine Learning", McGraw Hill,1997
3. KevinP Murphy,"Machine Learning, a probabilistic perspective", The MIT Press Cambridge, Massachusetts, 2012.
4. Alex Smola and SVN. Viswanathan, "Introduction to Machine Learning", Cambridge University Press, 2008.
5. Introduction to Machine Learning(link is external) |Nils J. Nilsson, Stanford University

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Introduction to IOT & Embedded Computing

Course Title:	Introduction To IOT & Embedded Computing
Course Code	PC CS 512
Number of credits	4 (L:3,T:1,P:0)
Prerequisites	Microcontrollers
Course Category	Program Core
Total no of lecture periods	40 Hours

Course Outcome:

On completion of the syllabus, the students will be able to: -

CO Number	CO Description	K-level
CO-1	Illustrate the concept of Embedded systems and RTOS.	K2
CO-2	Understand to the concept of ARM-7.	K2
CO-3	Explain the Basic idea of IoT, Sensing, Actuation, Networking, Communication Protocols, Sensor Networks.	K2
CO-4	Experiment with Arduino, raspberry picoting for IoT implementation.	K3

Course Content:

Module 1: (13 Hours)

Introduction to Embedded systems: Introduction to embedded systems. Features of embedded systems. Characteristics of Embedded Systems. Classification of embedded systems. Examples of embedded systems. Architecture of embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC. Real time systems, examples of real time systems. Types of real-timesystems. Introduction to RTOS, difference between RTOS and General-purpose OS. Need for RTOS inembedded systems. Kernel and its functions. Case study on automatic washing machine and electronic micro-oven.

Module 2: (10 Hours)

Introduction toARM-7: ARM 7 Architecture, ARM Development tools, Instruction set: Data processing, Data transfer, Control flow. Addressing modes, Memory organization. Writing simple assembly language programs, Pipelining, Brief introduction to exception sand interrupts handling. Overview and features of LPC2478.Case study on embedded system: Washing machine, Microwave oven etc.

Module 3: (09 Hours)

Introduction to IoT: Introduction to IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks. Machine-to-Machine Communications, Inter-operability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Module 4: (10 Hours)

Inter-operability of IoT Introduction to Python programming, Introduction to Raspberry Pi, and Implementation of IoT with Raspberry Pi. Introduction to SDN, SDN for IoT. Introduction to cloud computing, fog computing. IoT Case Study: Agriculture, Healthcare, Activity Monitoring, smart home, smart city, smart grid**.**

References/Suggested learning resources:

1. K.J.Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications",Penram Intl, 1996.
2. J.W.Valvano,"EmbeddedMicrocomputerSystem:RealTimeInterfacing",Brooks/Cole,2 000.
3. Real Time Operating System-Rajib Mall
4. Introduction to embedded systems, Shibu K.V., McGraw Hill
5. ARM System on chip Architecture, Steve Furber, Pearson, edition second
6. Embedded systems an integrated approach, LayaB.Das, Pearson, Third impression,2013
7. ARM system developer ‟Sguide, Andrew N.Sloss, DominicSymes, ChrisWright, MorganKaufmann Publishers.
8. Embedded system design A Unified hardware/software Introduction, Frank Vahid, Tony Givargis, Wiely
9. "The Internet of Things: Enabling Technologies, Platforms, and UseCases", by PethuruRajand Anupama C.Raman (CRCPress)
10. "Internet of Things: A Hands-on Approach", by Arshdeep Bahgaand VijayMadisetti (Universities Press)

SUGGESTED SOFTWARE/ LEARNING WEBSITES:

1. https://www.arduino.cc/reference/en/
2. https://learn.adafruit.com/category/learn-arduino

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Database Management Systems

Course Code	PC CS 503
Course Title	Database Management Systems
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Database Management Systems
Course Category	Program Core
Number of classes	36 Hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Illustrate relational algebra expressions for a given query and optimize the developed expressions..	K2
CO-2	Develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.	K2
CO-3	Design the databases using E-R method for a given specification of the requirement and normalize them.	K2
CO-4	Construct the SQL queries in Open source and commercial DBMS -MYSQL, ORACLE for a given specification and optimize its execution using Query optimization algorithms	K3
CO-5	Implement the isolation property, including locking, time stamping based on concurrency control and serializability of scheduling	K4

Course Content:

Module 1: Introduction (8 Hours)

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Module 2: Relational Model (12 Hours)

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms

Module 3: Transaction Processing **(8 Hours)**

Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic, Concurrency Control schemes,

Database recovery: Failure Classification, Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions, Advance Recovery systems, Remote Backup.

Module 4: Database Security **(8 Hours)**

Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Advanced Topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and Data mining.

References / Suggested Learning Resources:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

4. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

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Formal Language & Automata Theory

Course Code	PC CS 504
Course Title	Formal Language & Automata Theory
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	NIL
Course Category	Program Core(PC)
Number of classes	38 Hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Construct a formal notation for strings, languages and machines and design finite automata to accept a set of strings of a language	K3
CO-2	Identify whether the given language is regular or not	K4
CO-3	Analyze context free grammars to generate strings of context free language.	K4
CO-4	Classify computability and non-computability and Decidability and undecidability.	K4

Course Content:

Module 1: (10 Hours)

Regular Language and Finite Automata Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata,propertiesofregularlanguages,pumpinglemmaforregularlanguages,minimizationof finite automata)

Module 2: (10 Hours)

Context Free Language and Pushdown Automata: Context-free languages and pushdown automata: Context- free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.

Module 3: (10 Hours)

Context Sensitive language and Turing Machines: Context-sensitive languages: Context-sensitive grammars(CSG) and languages, linear bounded automata and equivalence with CSG. Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators

Module 4: (08 Hours)

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rices theorem, undecidable problems about languages.

References / Suggested Learning Resources:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.
6. Dr. R.B.Patel, Theory of Computation, Khanna Publishing House

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Computer Networks

Course Code	PC CS 506
Course Title	Computer Networks
Number of Credits	03 (L: 3, T: 0, P: 0)
Prerequisites	Nil
Course Category	Program Core
Number of classes	38 Hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Interpret the different building blocks of communication network and its architecture.	K2
CO-2	Illustrate the suitable Application layer protocols for specific applications and its respective security mechanisms	K2
CO-3	Design subnetting and analyze the performance of network layer.	K3
CO-4	Analyze the error and flow control mechanisms in data link layer.	K4
CO-5	Examine various routing protocols	K4

Course Content:

Module 1: (9 Hours)

Data Communications and Networking: A Communications Model – Data Communications - Evolution of network, Requirements, Applications, Network Topology (Line configuration, Data Flow), Protocols and Standards, Network Models (OSI,TCP/IP) Switched Communications Networks – Circuit Switching – Packet Switching – Comparison of Circuit Switching and Packet Switching – Implementing Network Software, Networking Parameters (Transmission Impairment, Data Rate and Performance)

Module 2: (10 Hours)

Data link layer**:** Error Detection and Correction – Hamming Code, CRC, Checksum- Flow control mechanism – SlidingWindowProtocol-GoBack-N-SelectiveRepeat-MultipleaccessAloha-SlottedAloha - CSMA, CSMA/CD – Multiple Access Networks (IEEE 802.3), Token Ring (IEEE 802.5) and Wireless Networks (IEEE 802.11, 802.15)

Module 3: (10 Hours)

Network layer: IPV4 Address Space– Notations– Classful Addressing–Classless Addressing– network Address Translation – IPv6 Address Structure – IPv4 and IPv6 header format. Routing-Link State and Distance Vector Routing Protocols- Implementation-Performance Analysis- Packet Tracer.

Module 4: (9 Hours)

Transport layer & Application layer**:** TCP and UDP-Congestion Control-Effects of Congestion-Traffic Management-TCP Congestion Control-Congestion Avoidance Mechanisms-Queuing Mechanisms-QoS

Parameters. Application layer-Domain Name System-Case Study: FTP, HTTP, SMTP, SNMP. Recent Trends in Computer Networks.

References / Suggested Learning Resources:

1. D.,Voet,Voet,J.G.&Pratt,C.W.,"FundamentalsofBiochemistry",JohnWiley&Sons,2nd ed,2006
2. Pavel Pevzner, "Computational Molecular Biology: An Algorithmic Approach", MIT Press, 2000
3. Neil C. Jones, "An Introduction to Bioinformatics Algorithms", The MIT Press2004
4. Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids", Cambridge University Press 1998
5. David W. Mount, "Bioinformatics: Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press2001
6. Ewens, W. J. & Grant, G. R., "Statistical methods in bioinformatics: an introduction", New York. Springer, 2001

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IoT and Embedded Computing Lab

Course Code	PC CS 513
Course Title	IoT and Embedded Computing Lab
Number of Credits	01 (L: 0, T: 0, P: 2)
Prerequisites	Nil
Course Category	Program Core
Number of classes	24 Hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Understand the concept of Embedded systems and RTOS	K2
CO-2	Explain the Basic idea of IoT, Sensing, Actuation, Networking,Communication Protocols, and Sensor Networks.	K2
CO-3	Summarize the real-life applications of IoT in various fields	K2
CO-4	Experiment with arduino, raspberry pi coding for IoT implementation K3	K3

List of Experiments

1. Familiarization with Adruino/Raspberry Pi and perform necessary software installation.
2. To interface LED buzzer with Arduino/Raspberry Pi and write a program to turn on LED for 1 second after every 2 seconds.
3. To interface push button Digital sensor (IR/LDR) Arduino/Raspberry Pi and write a program to turn on LED when push button is pressed or a sensor detection.
4. To interface DHT 11 sensor with Arduino Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface monitor using relay with Arduino/Raspberry pi and write a program to turn on motor when push button is pressed.
6. To interface OLTD with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry pi and write a program to send sensor data to smart phone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn on LED ON/OFF when '1'/'0' is received from smart phone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to Things peak cloud.
10. Write a program on Arduino/Raspberry pi 2 retrieve temperature and humidity data fromThing speak cloud. To install MySQL database on Raspberry Pi and perform basic SQL queries.
11. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT blocker.

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Computer Hardware & Network Lab

Course Code	PC CS 509
Course Title	Computer Hardware & Network Lab
Number of Credits	02 (L: 0, T: 0, P: 4)
Prerequisites	Nil
Course Category	Program Core
Number of classes	44 Hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Understand the need of PC Hardware, internet & world wide web and office suites.	K2
CO-2	Identify the functions of common networking devices.	K3
CO-3	Construct a local area network (LAN) using a switches/hubs and configure TCP/IP for the LAN.	K3
CO-4	Apply the knowledge of installation for different system & application software	K3
CO-5	Construct and implement wide area network (WAN) using routers	K3

List of Experiments (*Minimum 6 experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Study of different types of cross-wired cable and straight through cable.
2. Study of different types of Network cables and Practically implement the
1. Cross-wired cable and straight through cable using clamping tool.
2. Study of Basic network commands and network configuration commands.
3. Study of network IP.
4. Study of Network Devices in Detail.
5. Socket programming using Java or C programming language.
6. Connect the computers in Local Area Network.
7. Study of basic network command and Network configuration commands.
8. Configure a Network topology using packet tracer software.
9. Configure a Network using Distance Vector Routing protocol.
10. Configure Network using Link State Vector Routing protocol.
11. Network topology configuration of static routing using packet tracer software
12. Routing Protocol Configuration of a network using any using packet tracer software (Eg. Static routing, RIP, RIP Version 2etc)
13. Firewall Configuration using IP tables and IP chain sand solve different general problems in Linux OS.
14. Practical on Server Configuration Example, Web Server, Mail Server, FTP Server, DHCP, NFS etc.

List of Experiments related to PC Hardware

1. To be familiar with and to be able to troubleshoot motherboard.
2. Identifying external ports and interfacing
3. Identifying PC cards and interfacing.
4. Identifying PC cards and interfacing.
5. Preventive maintenance of a PC
6. Understanding CMOS setup
7. Partitioning and formatting Hard disks.
8. Installing Different Operating System, Device Drivers and application software.
9. Understanding control panel settings.
10. To be familiar with SMPS.
11. To install video card, sound card, etc.
12. To install DMP, inkjet and laser printing; to undertake preventive maintenance and to troubleshoot DMP.
13. To disassemble and reassemble a total PC system.
14. Working with antivirus software
15. To practice anti-virus software installation and virus removal.
16. Working with Backups and Archival utilities

References / Suggested Learning Resources:

1. Hands on networking essentials with projects / M.J.Palmer
2. Internet working with TCP-IP / D.E. Comer and D. Stevens / Prentice Hall ofIndia
3. CISCO Internetworking / Charles Riley / SPD Pvt.Ltd.
4. Networking Cabling handbook / Chris Clark / Tata McGrawHill
5. Designing and implementing local and WANs / M.J. Palmer and R.B. Sinclair / Vikas Publishing House.

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Database Management System Laboratory

Course Code	PC CS 508
Course Title	Database Management System Laboratory
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	NIL
Course Category	Program Core
Number of classes	30 Hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Execute DDL, DML and TCL commands.	K3
CO-2	Create views, partitions and locks for a particular Database.	K4
CO-3	Create procedure for an application using exception handling and cursors.	K4
CO-4	Create procedure for an application using triggers.	K4

List of Experiments (Minimum 6 experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available):

Structured Query Language

1. Creating Database
    - Creating a Database
    - Creating a Table
    - Specifying Relational Data Types
    - Specifying Constraints
    - Creating Indexes
2. Table and Record Handling
    - INSERT statement
    - Using SELECT and INSERT together
    - DELETE, UPDATE, TRUNCATE statements
    - DROP, ALTER statements
3. Retrieving Data from a Database
    - The SELECT statement
    - Using the WHERE clause
    - Using Logical Operators in the WHERE clause
    - Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
    - Using Aggregate Functions
    - Combining Tables Using JOINS

- Subqueries

4. Database Management
    - Creating Views
    - Creating Column Aliases
    - Creating Database Users
    - Using GRANT and REVOKE
5. Cursors in Oracle PL / SQL
6. Creating database triggers and functions PL/SQL
7. Writing Oracle PL / SQL Stored Procedures

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Industry Internship – I

Course Code	EEC 510
Course Title	Industry Internship – I
Number of Credits	1 (L: 0, T: 0, P: 0)
Prerequisites	NIL
Course Category	Employment Enhancement Courses
Number of classes	20 Hours

Course Outcome:-

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

CO Number	CO Description	K-level
CO 1	Show professional ethics by displaying positive disposition during internship.	K2
CO 2	Demonstrate the skill to communicate and collaborate effectively and appropriately with different professionals in the work environment through written and oral means	K2
CO 3	Solve real life challenges in the workplace by analysing work environment and conditions, and selecting appropriate skill sets acquired from the course of study	K3
CO 4	Develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in a real organizational setting	K3
CO 5	Decide career options by considering opportunities in company, sector, industry, professional, educational advancement and entrepreneurship;	K5

Course Content:-

The industry internship aims to provide the student with:

1. A practice-oriented and 'hands-on' working experience in the real world or industry, and to enhance the student's learning experience. An opportunity to develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in a real organizational setting.

2. An opportunity to further develop and enhance operational, customer service and other life-long knowledge and skills in a real world work environment.

3. Pre-employment training opportunities and an opportunity for the company or organization to assess the performance of the student and to offer the student an employment opportunity after his/her graduation, if it deems fit.

Each student shall

1) Identify an internship program of relevance in his/her branch of engineering to undergo during summer break between 4^{th} and 5^{th}semester.
2) Get approval of the concerned HOD.
3) Undergo the industry internship program for minimum 4 weeks duration.
4) Prepare their own report.
5) Presentintheclassamongfellowstudentsandfacultymembers/delivervivavoce.
6) Submit the report and participation/course completion certificate.

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