of Electronics and Communication Engineering

Bhagat Phool Singh Mahila Vishwavidyalaya, Khanpur Kalan (Sonepat), Haryana-131305

(A state university established by govt. of Haryana vides Act no. 31 of 2006)

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Course Structure for B. Tech Sixth Semester (Third Year)									
S. No.	**Code**	**Course Title**	**Hrs/Week**			**Total Credits**	**Internal Marks**	**External Marks**	**Total Marks**
			L	**T**	**P**				
Subjects									
1.	ECL-360	Computer Network	3	0	0	3	20	80	100
2.	ECL-362	Control Systems	3	0	0	3	20	80	100
3.	ECL-364	Single Board Computers for Electronic System Design	3	0	0	3	20	80	100
4.	ECL-366	Digital System Design	3	0	0	3	20	80	100
5.	*	Program Elective-II	3	0	0	3	20	80	100
6.	**	Open Elective-II	3	0	0	3	20	80	100
7.	**#HSMC-360**	**#Essence of Indian Traditional Knowledge**	**3**	**0**	**0**	**0**	**20**	**80**	**100#**
Labs									
8.	ECP-360	Computer Networks Lab	0	0	2	1	10	40	50
9.	ECP-362	Electronic Measurement Lab	0	0	2	1	10	40	50
10.	ECP-364	Single Board Computers for Electronic System Design Lab	0	0	2	1	10	40	50
11.	ECP-366	Scriptive Language Lab	0	0	2	1	10	40	50
Total			**21**	**0**	**8**	**22**	**160**	**640**	**800**

***Program Elective-2**		**** Open Elective-2**	
Subject Code	**Subject**	**Subject Code**	**Subject**
ECEL-360	Satellite Communication	OEL-360	Scriptive Language
ECEL-362	Telecommunication Switching Systems and Networks	OEL-362	Electronic Measurement & Instrumentation
ECEL-364	Wireless Sensor Network	OEL-364	Waste to Energy
ECEL-366	Scientific Computing	******	MOOCs / NPTEL Course

Note:

1. **#Essence of Indian Traditional Knowledge (HSL-366)** will be non-credit, mandatory and qualifying course. The marks of the same will not be counted in grand total and towards award of degree.
2. At the end of semester every student has to undergo 4-6 weeks Professional training/ Internship. The assessment and viva-voce for the same will be conducted in next semester.
3. Students may opt Programme Elective/Open Elective/Generic elective course from CBCS offered by another department.

Computer Network

ECL-360 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The objective of this course is:

- Understand the concepts of networking thoroughly.
- Understand the role of each layer to in a network.
- Proficient about design a network for a particular application.
- Learn and understand about to analyze the performance of the network.

Pre-requisite: None.

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

- Outline various models, topologies, and devices of Computer Networks.
- Explain the functions of various layers in Network Reference Model.
- Apply different network concepts in various network communication protocols.
- Analyze performance of various protocols in different scenarios.
- Design network for an organization.

Content

Unit – I	**10 Hours**
Introduction to computer networks: Uses of Computer Networks, Network categories: LAN, MAN, WAN, Introduction to models and layers: OSI & TCP/IP model. **Switching Techniques:** Circuit Switching, Packet Switching, Message Switching.	
Unit – II	**10 Hours**
Data Link Layer: Design issues, Framing Protocols, Error detection and correction mechanisms, Flow Control Protocols, Medium Access sub layer: Channel allocation methods, **Multiple Access Communication:** Random Access-ALOHA, Slotted-ALOHA, CSMA, CSMA-CD, LAN Standards: Ethernet, Fast Ethernet & Gigabit Ethernet.	
Unit – III	**12 Hours**
Transport Layer: Transport layer Services: Addressing, Multiplexing, Flow control, Buffering and Error control. Internet Transport Protocols: UDP, TCP, TCP Segment, TCP Connection, Congestion control. **Application Layer:** Introduction to DNS, FTP, TELNET, HTTP, SMTP, Electronic Mail, WWW and Multimedia.	
Unit – IV	**10 Hours**
Network Layer: Introduction, design issues, IP protocol and addressing in the Internet, store and forward packet switching, connection less and connection-oriented networks, Routing algorithms, Broadcast and Multicast routing. **Networking Devices:** Hubs, Repeaters, Bridges, Modems, Switches, Routers, and Gateways.	
Suggested Text Books	
1.	Computer Networks, 3rd Edition, A. S. Tananbaum, PHI, 1999.
2.	Internetworking with TCP-IP: Design, Implementation and Internals, D. E. Comer and D. L. Stevens, Prentice Hall, 1990.
3.	Computer Networks-Protocols, Standards and Interfaces, U. Black, PHI, 1996.
4.	Computer Communication Networks, W. Stallings, PHI, 1999.
5.	Introduction to Cisco Router Configuration, Laura Chappell, Techmedia, 1999.
6.	Data & Network Communications, Michael A. Miller, Vikas Publication, 1998.

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

Single Board Computers for Electronic System Design

ECL-364 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total arks:100

Course Objective: The basic objective of this course is:

- Comprehend the fundamental features of Single Board Computers and their role in electronic system design.
- Realize sensor interfacing of Raspberry Pi, Arduino, and ESP8266.

Pre- requisites: Basic knowledge of Electronics Circuits.

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

- Develop input/output and networking-related programs for Single Board Computers.
- Evaluate the performance of Raspberry Pi, Arduino, and ESP8266 for a given electronic system design for input/output, networking, time, and memory complexity.

Content

Unit – I	**10 Hours**
Single Board Computers: Introduction to the Computers, features, uses, role of Single Board Computers in electronic system design. **Arduino:** Introduction to Arduino, Programming Arduino, GPIO Basics, Interfacing Digital and Analog Sensors with Arduino, Visual and Audio Outputs for Arduino, Using, Modifying, and Creating Libraries Arduino Build Process and Memory Handling.	
Unit – II	**12 Hours**
Network Programming in Arduino: Remotely Controlling External Devices, Communicating Using I2C and SPI, Wired and Wireless Networking in Arduino, Using the Controller Chip Hardware. **Raspberry Pi:** Introduction to Raspberry Pi Models, RPi Setup and Management, Operating Systems for RPi and its porting, Displays for RPi, GPIO Basics, Programming RPi with Python, Interfacing Digital and Analog Sensors with RPi.	
Unit – III	**10 Hours**
Network Programming in RPi: Introduction to TCP/IP protocol suite, Bluetooth standard, Zigbee Standard, Network configuration of maker boards, Socket programming, Virtual Network Computing, Wired, and Wireless Networking in RPi, Arduino, and Raspberry Pi.	
Unit – IV	**12 Hours**
ESP8266: Introduction to ESP8266, GPIO Basics, Interfacing Digital and Analog Sensors with ESP8266, Programming ESP8266, Over the Air Update of ESP8266, Using Micro Python on the ESP8266 using ESP8266, Cloud Data Monitoring using ESP8266, Interacting with Web Services, Machine to Machine Interactions using ESP8266	
Suggested Text Books	
1.	Arduino Cookbook, Michael Margolis, O'Reilly.
2.	Raspberry Pi Cookbook, Simon Monk, O'Reilly.
3.	Internet of Things with ESP8266, Marco Schwartz, Packt Publishing.

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Digital System Design

ECL-366 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total arks:100

Course Objective: The basic objective of this course is:

- To implement digital logic circuits on FPGA and a CPLD.
- To synthesize complex digital circuits at several level of abstractions.
- To simulate and debug digital systems described in VHDL.
- To learn the Hardware Description Language.
- Demonstrate the use and application of Boolean algebra in the areas of digital circuit reduction, expansion, and factoring.

Pre-requisite: Digital Electronics.

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

- Apply Boolean algebra in reduction, expansion, factoring.
- Synthesize and analyze digital circuits through VHDL.
- Create complex digital circuits at several level of abstractions.
- Understand and analyze logic on an FPGA and a CPLD.

Content

Unit – I	**10 Hours**
Introduction: Computer-aided design tools for digital systems, Hardware description languages; introduction to VHDL, data objects, classes and data types, operators, overloading, logical operators, Types of delays entity and architecture declaration, Introduction to behavioral, dataflow and structural models.	
Unit – II	**10 Hours**
VHDL Statements: Assignment statements, sequential statements and process, conditional statements, case statement array and loops, resolution functions, packages and libraries, concurrent statements. **Finite State Machine**: Introduction to Finite State Machine, Pulse and fundamental mode of operation, Realization of state table from verbal description, State diagram & Transition matrix, Mealy and Moore machine, Reduction of flow tables of completely and incompletely specified sequential machines, Concept of secondary state assignment.	
Unit – III	**12 Hours**
Combinational Circuit Design: VHDL Models and simulation of combinational circuits such as multiplexers, demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc. **Sequential Circuits Design:** VHDL models and simulation of sequential circuits shift registers, counters etc.	
Unit – IV	**10 Hours**
EDA Tools: Introduction to EDA tools, Simulation, Event driven simulation, RTL synthesis, Behavioural synthesis, and Synthesis for FPGAs, Testing digital systems, Design for testability. Introduction to programmable logic devices: ROM, PLA, PAL based circuit, FPGA, CPLD, Architecture and Programming of FPGA/CPLD and hardware implementation.	
Suggested Text Books	
1.	A VHDL Primmer, Bhaskar, Prentice Hall, 1995.
2.	Digital System Design using VHDL, Charles. H. Roth, PWS, 1998.
3.	VHDL-IV Edition, Perry, TMH, 2002.

4.	VHDL-Analysis & Modelling of Digital Systems, Navabi Z, McGraw Hill.
5.	Introduction to Digital Systems, Ercegovac Lang & Moreno, John Wiley, 1999.
6.	Fundamentals of digital Logic with VHDL Design, Brown and Vranesic, TMH, 2000.
7.	Modern Digital Electronics, 3rd Edition, TMH, 2003.
Other useful resource(s):	
1.	https://nptel.ac.in/courses/117108040 by Prof. Kuruvilla Varghese, IISc Bangalore.

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Satellite Communication

ECEL-360	**Total Credits: 3**
L T P	**Internal Marks: 20**
3 0 0	**External Marks: 80**
	Total Marks: 100

Course Objective: The basic objective of this course is:

- To have a conceptual knowledge of communication through satellites.
- To have a detailed understanding of navigation - both inertial and by navigation satellites.
- To analyze typical challenges of satellite-based systems.

Pre-requisite: Understanding of Digital Communication Systems concepts.

Course outcomes: After completion of the course, student will be able to:

- Understand the concept of orbits, launch vehicles and satellites.
- Comprehend the design of satellite subsystems.
- Imbibe the basics of digital transmission related to satellite communication.
- Have an in-depth knowledge of navigation satellite services.
- Understand the impact of diverse parameters on satellite link design.

Content

Unit – I	**10 Hours**
Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.	
Unit – II	**12 Hours**
Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems. **Typical Phenomena in Satellite Communication:** Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.	
Unit – III	**10 Hours**
Direct Broadcast Satellite Television systems and GPS: DBS TV system design, Direct broadcast satellite television transmitters and receivers, DBS TV link budget, Radio and satellite navigation, GPS position location principles, GPS navigation messages and signal levels, GPS receivers design, Role of satellites in future networks, Advanced error control codes for satellite systems.	
Unit – IV	**10 Hours**
Elements of Communication Satellite Design: Satellite Subsystems-Attitude and orbit control electronics-Telemetry and tracking-Power Subsystems- Communication subsystems-satellite antennas-Reliability and redundancy Frequency modulation techniques. **Digital Transmission Basics:** Multiple access techniques-FDMA, TDMA, CDMA, SDMA, ALOHA.	

Suggested Text Books

1.	Satellite Communication, 2nd edition, T. Pratt, C.W. Boastian and Jeremy Allnutt, JohnWiley and Sons, 2013.
2.	Digital Satellite Communications, Tri T. Ha, Tata McGraw Hill, 2009
3.	Satellite Communication, 4th Edition, Dennis Roddy, McGraw Hill, 2009.
4.	Satellite Communications, D.C. Agarwal, Khanna Publishers, 2001.
5.	Innovations in Satellite Communication and Satellite Technology, 1st Edition, Daniel Minoli, Wiley, New Delhi, 2015.

6.	Satellite Communications Systems: systems, techniques and technology, 5th Edition, G. Maral, M. Bousquet, Z. Sun, John Willy and sons.
Other useful resource(s):	
1.	https://archive.nptel.ac.in/content/syllabus_pdf/117105131.pdf by Prof. Kalyankumar Bandyopadhyay Electronics and Electrical Communication Engineering, IIT Kharagpur.
2.	https://ocw.mit.edu/courses/16-851-satellite-engineering-fall-2003/ by Prof. David Miller and Col. John Keesee

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Telecommunication Switching Systems and Networks

ECEL-362	**Total Credits: 3**
L T P	**Internal Marks: 20**
3 0 0	**External Marks: 80**
	Total Marks: 100

Course Objective: The basic objective of this course is:

- To understand various example and generations of Telecommunication systems.
- To understand the basic concepts of Switching systems and Networks.
- To analyze the use of multiple access techniques in telecommunication.

Pre-requisite: Fundamental of Analog and Digital Communication.

Course Outcomes: After completion of the course, student will be able to:

- Understand the need of switching system and their solution from analogue to digital and describes the PSTN, Private Network and Integrated Network.
- Analyze the comparison of telephone Network, date network, ISDN Network and analyze Transmitter and receiver circuit.
- Understand the design issues advantages disadvantages and limitation of analog system and understand basic of telecommunication networking and information technologies.
- Continuously improve their technology knowledge and communication Skill.

Content

Unit – I	**12 Hours**
Evolution of Switching System: Switching, Types of Switching, Block Diagram of Telecommunication Network, Switching System Fundamentals, Classification of Switching System, Elements of a Switching System, Basic Function of Switching System, Basic Telephone Communication, Function of a Manual Switching System, Magneto or Local Battery Switchboard, Common Battery Switchboard, Limitations of Manual Switching System, Introduction to strowger switching system. **Crossbar Switching System:** Introduction, Principle of Common Control, Touch Tone Dial Telephone, Crossbar Switch Mechanism, Principle of Crossbar Switching, Crossbar Switch Configurations, Organization of a Crossbar Telephone Switch, A General Trunking, Electronic Switching, Classification Cross point Technology.	
Unit – II	**12 Hours**
Communication Networks-an Introduction and Overview: Introduction, Components of a Communication Network, Network Examples-Telephone Network, Computer/Data Networks, Entertainment/Distribution/Broadcast Network, Unified/Integrated Network, Mobile Communication Network, Network Hierarchy. **Circuit Switching:** Introduction, A Simple Switch, Model of a Telephone System, Signaling, Telephone Network Hierarchy, A Generic Switching Architecture. **Module Standards:** Introduction, Physical Layer-MODEM Standards, Data Link Layer-Introduction, Flow Control, Error Control, Frame Structure, Control Frames, Network Layer- X.25 Header, X.25 Call Setup Commands, Virtual Circuit Number Allocation, Transport and Session Layers- OSI Transport Layer Protocols, OSI Session Layer Protocols, application and Presentation Layers-Introduction, Telnet Protocol, File Transfer Protocol, HTTP, HTTP Get Request.	
Unit – III	**12 Hours**
Local Area Network: LAN Topologies, Access Mechanisms and Media, Contention Based LANs, Token Passing LANs. **Metropolitan Area Network:** Introduction, Distributed Queue Data Interface (DQDB)-IEEE standard 802.6., Fiber distributed data interface (FDDI). **Internet and Internet Protocol Suite:** Introduction, IPV4, IP Addressing, Internet Control Message	

Protocol, IPv6 address, IPV6 Packet Format, TCP-Introduction, TCP Header, Features of TCP, UDP-Introduction, The Protocol Suite. **Routing:** Introduction, Routing Techniques, Routing Algorithms. **Digital Switching:** Space Switching-Introduction, Concepts of Space Switching, Digitization of the Telephone Network, Multistage Switching, Time Multiplexed Space Switching and Time Switching, combination of Time and Space Switches.		
Unit – IV		**10 Hours**
Frame Relay and ATM: Introduction, Architecture, Frame Relay Layers, ATM Concepts and Header, ATM: Virtual Path, Virtual Channel, ATM Adaptation Layer (AAL). **Narrow band and Broadband ISDN:** ISDN-Data Rates, Access Channels Types. ISDN: Reference Points, Services and Standards, Broadband ISDN. **Control of Switching Systems:** Call Processing functions, common control, Reliability, Availability and Security. **Signaling:** Customer Line Signaling, Audio frequency junctions & trunk circuits, FDM carrier Systems, PCM signaling, Inter-register signaling.		
Suggested Text Books		
1.	Telecommunication Switching Systems and Networks, Thiagarajan Viswanathan, PHI.	
2.	Digital switching Systems, system reliability and analysis, Syed Riffat Ali, Tata MC Graw Hill, 2002.	
3.	Flood, Telecommunication Switching, Traffic and Networks, Pearson Education.	
4.	An Engineering Approach to Computer Network Networking, Keshav S, Pearson Education.	
5.	Telecommunication & Computer, 3 Edition, Martin, PHI.	
Other useful resource(s):		
1.	https://archive.nptel.ac.in/courses/117/105/117105076/ by Prof. S. L. Maskara, IIT Kharagpur.	

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Wireless Sensor Networks

ECEL-364 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objectives: The basic objective of this course is:

- Understand the fundamental concepts of wireless sensor networks and its applications.
- Study various protocols and their difference with traditional protocols.
- Understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Pre-requisite: Fundamental wireless communication.

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

- Design wireless sensor networks for a given application.
- Understand MAC protocols used for different communication standards used in WSN.
- Analysis of various critical parameters in deploying a WSN.

Content

Unit – I	**10 Hours**
Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, wireless Internet.	
Unit – II	**10 Hours**
Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.	
Unit – III	**12 Hours**
MAC Protocols: Issues in designing MAC protocols for adhoc wireless networks, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality issues, S-MAC, IEEE 802.15.4. **Routing Protocols:** Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.	
Unit – IV	**10 Hours**
QoS and Energy Management: Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.	
Suggested Text Books	
1.	AdHoc Wireless networks, C. Siva Ram Murthy, and B. S. Manoj, Pearson Education, 2008.
2.	Wireless sensor networks, Feng Zhao and Leonides Guibas, Elsevier publication, 2004.
3.	Mobile Communications Jochen Schiller, Pearson Education, 2nd Edition, 2003.
4.	Wireless Communications and Networks, William Stallings, Pearson Education, 2004.

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

Scientific computing

ECEL-366	**Total Credits: 3**
L T P	**Internal Marks: 20**
3 0 0	**External Marks: 80**
	Total Marks: 100

Course Objectives: The basic objective of this course is:

- Students will understand different types of errors and several necessary functions of scientific computing.
- Students will have a clear understanding of system of linear equations.

Pre-requisite: Fundamental knowledge of computing techniques.

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

- Understand the significance of computing methods, their strengths and application areas.
- Perform the computations on various data using appropriate computation tools.

Content

Unit – I	**10 Hours**
Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy. **Nonlinear equations:** Fixed Point Iteration, Newton's Method, Inverse Interpolation Method, Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation.	
Unit – II	**12 Hours**
System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems. **Linear least squares:** Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting, Nonlinear Least Squares.	
Unit – III	**12 Hours**
Eigen values and singular values: Eigen values and Eigenvectors, Methods for Computing All Eigen values, Jacobi Method, Methods for Computing Selected Eigen values, Singular Values Decomposition, Application of SVD. Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization. **Numerical Integration and Differentiation:** Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation. Partial Differential Equations: Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods.	
Unit – IV	**12 Hours**
Initial Value Problems for ODES: Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods. Boundary Value Problems for ODES: Finite Difference Methods, Finite Element Method, Eigenvalue Problems. **Fast Fourier Transform:** FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers and Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences.	
Suggested Text Books	
1.	Scientific Computing: An Introductory Survey, Heath Michael T., McGraw-Hill, 2nd Edition, 2002.
2.	Numerical Recipes: The Art of Scientific Computing, Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, Cambridge University Press, 3rd Edition, 2007.
3.	Introduction to Computational Mathematics, Xin-she Yang, World Scientific Publishing Co., 2nd

	Edition.
4.	Computational Science, Kiryanov D. and Kiryanova E., Infinity Science Press, 1st Edition, 2006
5.	Scientific Computing With MATLAB and Octave, Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, Springer, 3rd Edition, 2010.

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Scriptive Language

OEL-360 **Total Credits: 4**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks:100

Course objective: The basic objective of this course is:

- Understand the design of scripting languages and their applications.
- Study to manipulate text and data using subtle and complex coding to automate many tasks.
- Understand simple scripts to automate system administration tasks using appropriate languages.

Pre-requisite: Basics knowledge of Computer Programming and Data Structures.

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

- Analyse scripting programming language for solving engineering problems, data handling.
- Understand shell scripts in combination with the scripting language

Content

Unit – I	8 Hours
Linux Basics: Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts. Networking in Linux, Network basics & Tools, Dynamic hosting configuration Protocol & Network information Services.	
Unit – II	**12 Hours**
Python Basics: Objects- Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules Sequences - Strings, Lists, and Tuples, Mapping and Set Types.	
Unit – III	**10 Hours**
Perl Scripting: Introduction to Perl Scripting, working with simple values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting, References & Subroutines, Running and Debugging Perl, Modules, Object – Oriented Perl.	
Unit – IV	**8 Hours**
TCL Structure: Syntax, variables and data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface.	
Suggested Text Books	
1.	The World of Scripting Languages, David Barron, Wiley Publications.
2.	Ruby Programming language, David Flanagan and Yukihiro Matsumoto O'Reilly.
3.	Open-Source Web Development with LAMP using Linux Apache, MySQL, Perl and PHP, J. Lee and B. Ware (Addison Wesley) Pearson Education.
4.	Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD.

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Electronic Measurement & Instrumentation

OEL-362 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The basic objective of this course is:

- Understand the concept of measurement and analysis of various electronic circuits
- Understand the fundamental concepts and techniques used in electrical and electronic measuring instrument.

Pre-requisite: Basic concept of Electrical Science, Knowledge of basics of electronic components.

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

- Understand significance of measurement in various laboratories.
- Define the fundamental concepts and techniques used in electronic measurements and instrumentation.
- Understand and explain construction and working of various measuring instruments.
- Execute the knowledge of waveform generators, waveform analyzers, transducers.

Content

Unit – I	**10 Hours**
Introduction: Introduction of Measurement, Classification of Measurement Errors, Instrument Accuracy, accuracy & Precision, Resolution, Significant Figures, Analog Multimeter, digital Multimeter, digital Frequency meter, Digital measurement of time, Digital measurement of frequency (Mains), Digital tachometer, Digital pH meter, Q meter	
Unit – II	**12 Hours**
Oscilloscopes: Block Diagram based Study of CRO, vertical amplifier, Horizontal Deflecting System, Role of Delay Line, Typical CRT connections, Dual-Trace CROs, Measurement using Oscilloscope-Measurement of Voltage, Frequency, Phase Difference, Rise Time, Fall Time, Lissajous Figures in Detection of Frequency and Phase, Digital Storage Oscilloscope (DSO), Applications of DSO.	
Unit – III	**10 Hours**
Generation & Analysis of Waveforms: Low frequency Signal Generators, function generators, pulse generators, R.F signal generators, Sweep frequency generators, frequency synthesizer, Basic wave analyzer, Frequency selective wave analyzer, heterodyne wave analyzer, harmonic distortion analyzers, spectrum analyzer.	
Unit – IV	**10 Hours**
Transducers: Introduction, Electrical transducer, Selection Criteria of Transducers, Transducers types: Resistive transducer, Inductive transducer, capacitive transducer, Thermal transducer, optoelectronic transducer, Piezoelectric transducers. Introduction to Analog and Digital Data Acquisition Systems and Telemetry.	
Suggested Text Books	
1.	Electronic Instrumentation and Measurements: David A Bell, Oxford.
2.	Electronic Instrumentation, 2nd Edition, H. S. Kalsi, TMH.
3.	A course in Electrical & Electronics Measurements & Instrumentation, A. K. Sawhney, Dhanpat Rai.
4.	Electronic Instrumentation and Measuring Techniques, W. D. Cooper, PHI.
5.	Modern Electronic Instrumentation & Measuring Techniques, Helfrick & Copper, PHI
6.	Measurement Systems, E. O. Doebilin, McGraw Hill.

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

Waste to Energy

OEL-364 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The objective of this course is to:

- Understand the principles associated with effective energy management and to apply these principles in the day-to-day life.
- Develop insight into the collection, transfer, and transport of municipal solid waste.
- Explain the design and operation of a municipal solid wasteland fill.
- Device key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities.

Pre-requisite: Basic knowledge of Renewable Energy Sources, Physics, Environmental Studies.

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

- Describe basic concepts of waste to energy resources and their conversion devices.
- Understand the concept of pyrolysis and the production of different products by using pyrolysis.
- Explore different types of biomass gasification techniques and understand Biochemical conversion of biomass for energy application.
- Explore different types of biomass combustion techniques and their working operations.
- Describe the basic concepts of biogas and explore Biogas plant technology and their applications.

Content

Unit – I	**10 Hours**
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste, MSW, Conversion devices, Incinerators, gasifiers, digestors **Biomass Pyrolysis:** Pyrolysis – Types, slow fast, Manufacture of charcoal – Methods -Yields and application, Manufacture of pyrolytic oils and gases, yields and applications.	
Unit – II	**10 Hours**
Biomass Gasification: Gasifiers, Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers – Design, construction and operation, Gasifier burner arrangement for thermal heating, Gasifier engine arrangement and electrical power, Equilibrium, and kinetic consideration in gasifier operation.	
Unit – III	**10 Hours**
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation, Operation of all the above biomass combustors.	
Unit – IV	**12 Hours**
Biogas: Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system - Design and constructional features, Biomass resources and their classification, Biomass conversion processes - Thermo chemical conversion, Direct combustion, biomass gasification - pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, Types of biogas Plants,	

Applications, Alcohol production from biomass, Bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.	
Suggested Text Books	
1.	Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990
2.	Biogas Technology - A Practical Hand Book, Khandelwal K. C. and Mahdi S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3.	Food, Feed and Fuel from Biomass, Challal D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4.	Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.
Other Useful Resources: Links to course contents	
1.	http://nptel.ac.in/courses/103107125/

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

Essence of Indian Traditional Knowledge

HSMC-360 **Total Credits: 0**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The basic objective of this course is:

- To realize the concept of Traditional knowledge and its importance.
- To apply knowledge in preserving and protecting traditional knowledge.
- To develop knowledge and skills to streamline systems and patents for our indigenous traditional knowledge.
- To philosophy of Indian culture.
- To philosophy of ancient, medieval and modern India.

Pre-requisite: Awareness of Indian Traditions, Religion and Philosophy.

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

- Understand the concept of Traditional knowledge and its importance.
- Apply the knowledge in preserving and protecting traditional knowledge.
- Develop knowledge and skills to streamline systems and patents for our indigenous traditional knowledge.
- Analyze the Culture and Philosophy of ancient, medieval and modern India.

Content

Unit – I	**10 Hours**
Introduction to traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics.	
Unit – II	**10 Hours**
Traditional knowledge vs indigenous knowledge, traditional knowledge vs western knowledge, traditional knowledge vs formal knowledge. Protection of traditional knowledge, the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy.	
Unit – III	**10 Hours**
Role of Government to harness Traditional knowledge, Traditional knowledge and intellectual property, Systems of traditional knowledge protection, certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, strategies to increase protection of traditional knowledge, the role of Gurukulas in Education System, Value based Education.	
Unit – IV	**12 Hours**
Science and Technology in Indian, development of science in ancient, medieval and modern Indian. Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only), Indian Fine Arts & Its Philosophy (Art, Technology & Engineering).	
Suggested Text Books	
1.	Traditional Knowledge System in India, by Amit Jha, 2009.
2.	Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan, 2012.
3.	Knowledge Traditions and Practices of India, Kapil Kapoor and Michel Danino.
4.	Text and Interpretation: The India Tradition, Kapil Kapoor, 2005.

5.	Position paper on Arts, Music, Dance and Theatre, NCERT, ISBN 81-7450-494-X, 2006.
6.	Examination in Ancient India, S. Narain, Arya Book Depot, 1993.
7.	Founders of Sciences in Ancient India, Satya Prakash, Vijay Kumar Publisher, 1989.

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

Computer Network Lab

ECP-360
L T P
0 0 2

Total Credits: 1
Internal Marks: 10
External Marks: 40
Total Marks:50

Course Objectives: The basic objective of this course is:

- Understand the concepts and fundamentals of data communication and computer networks.
- Learn about various topologies of Local Area Network.
- Understand the working concepts of various network devices.
- Learn various routing protocols used in Computer Networks.
- Learn to device sharing amongst the network.

Pre-requisites: Basics of digital and analog communication.

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

- Demonstrate various network topologies and networking devices.
- Justify a particular routing protocol for any implemented data communication networks.
- Construct a network and implement various network protocols.
- Devise solutions for various routing and switching problems in Computer Networks.
- Create lab records for the solutions of the assignments.

List of Experiments

1.	Write specifications of latest desktops and laptops.
2.	Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
3.	Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
4.	Preparing straight and cross cables.
5.	Study of various LAN topologies and their creation using network devices, cables and computers.
6.	Configuration of TCP/IP Protocols in Windows/Linux.
7.	Implementation of file and printer sharing.
8.	Designing and implementing Class A, B, C Networks
9.	Subnet planning and its implementation
10.	Installation of ftp server and client.
Suggested Text/Reference Books	
1.	Computer Networks, 3rd Edition, A. S. Tananbaum, PHI, 1999.
2.	Internetworking with TCP-IP: Design, Implementation and Internals, D. E. Comer and D. L. Stevens, Prentice Hall, 1990.
3.	Computer Networks-Protocols, Standards and Interfaces, U. Black, PHI, 1996.
4.	Computer Communication Networks, W. Stallings, PHI, 1999.
5.	Introduction to Cisco Router Configuration, Laura Chappell, Techmedia, 1999.
6.	Data & Network Communications, Michael A. Miller, Vikas Publication, 1998.

Note: 10 experiments are to be performed by students in the semester. Out of which at least eight experiments should be performed from the above list, remaining two experiments may either be performed from the above list or designed and set by the concerned faculty as per the scope of the syllabus.

Electronics Measurement & Instrumentation Lab

ECP-362 **Total Credits: 1**
L T P **Internal Marks: 10**
0 0 2 **External Marks: 40**
Total Marks: 50

Course Objectives: The basic objective of this course is:

- To introduce students to the various types of measurements made in electronics and the instruments used for measuring them.
- To help students identify the different latest measurement techniques available for specific engineering applications.

Pre-requisites: Basic knowledge of Electronics.

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

- Demonstrate various types of measurement instruments.
- Analyze different measurement techniques for specific engineering applications.

List of Experiments

1.	Measurement of displacement using LVDT.
2.	Measurement of distance using LDR.
3.	Measurement of temperature using R.T.D.
4.	Measurement of temperature using Thermocouple.
5.	Measurement of pressure using Strain Gauge.
6.	Measurement of pressure using Piezo-Electric Pick up.
7.	Measurement of distance using Capacitive Pick up.
8.	Measurement of distance using Inductive Pick up.
9.	Measurement of speed of DC Motor using Magnetic Pick up.
10.	Measurement of speed of DC Motor using Photo Electric Pick up.
11.	Instrumentation amplifier using Op-Amps-gain and CMRR.
12.	Active notch filter/Narrowband active filter (using Op-Amp).
13.	Analog to digital converter circuit.
14.	Digital to analog converter circuit.
15.	Frequency to voltage converter, Voltage to frequency converter.
16.	Astable and monostable multivibrators using IC 555.
17.	Voltage regulators: IC 723, 78XX, 79XX family.
18.	Design of PLL for given lock and capture ranges, frequency multiplication.
Suggested Text/Reference Books	
1.	Electronic Instrumentation and Measurements: David A Bell, Oxford.
2.	Electronic Instrumentation, 2nd Edition, H. S. Kalsi, TMH.
3.	A course in Electrical & Electronics Measurements & Instrumentation, A. K. Sawhney, Dhanpat Rai.
4.	Electronic Instrumentation and Measuring Techniques, W. D. Cooper, PHI.

Note: At least 10 experiments are to be performed by students in the semester. Out of which at least eight experiments should be performed from the above list, remaining two experiments may either be performed from the above list or designed and set by the concerned faculty as per the scope of the syllabus.

Single Board Computers for Electronics System Design Lab

ECP-364
L T P
0 0 2

Total Credits: 1
Internal Marks: 10
External Marks: 40
Total Marks:50

Course Objectives: The basic objective of this course is:

- Comprehend the fundamental features of Single Board Computers and their role in electronic system design.
- Realize sensor interfacing of Raspberry Pi, Arduino, and ESP8266.

Pre-requisites: Basic knowledge of Electronics Circuits.

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

- Develop input/output and networking-related programs for Single Board Computers.
- Evaluate the performance of Raspberry Pi, Arduino, and ESP8266 for a given electronic system design for input/output, networking, time, and memory complexity.

List of Experiments

List of Experiments will be based on theory syllabus with a minimum of 10 experiments to be incorporated.

Scriptive Language Lab

ECP-366
L T P
0 0 2

Total Credits: 1
Internal Marks: 10
External Marks: 40
Total Marks:50

Course Objective: The basic objective of this course is:

- To Understand the concepts of scripting languages for developing web-based Projects.
- To understand the applications the of Ruby, TCL, Perl scripting languages

Pre-requisite: Any High-level programming language (C, C++)

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

- Ability to understand the differences between Scripting languages and Programming languages.
- Able to gain some fluency programming in Ruby, Perl, TCL.

List of Experiments

1.	Write a Ruby script to create a new string which is n copies of a given string where n is a nonnegative integer.
2.	Write a Ruby script which accept the radius of a circle from the user and compute the parameter and area.
3.	Write a Ruby script which accept the user's first and last name and print them in reverse order with a space between them.
4.	Write a Ruby script to accept a filename from the user print the extension of that.
5.	Write a Ruby script to find the greatest of three numbers.
6.	Write a Ruby script to check two integers and return true if one of them is 20 otherwise return their sum.
7.	Write a Ruby script to check two temperatures and return true if one is less than 0 and the other is greater than 100.
8.	Write a TCL script for Sorting a list using a comparison function.
9.	Write a TCL script to Copy a file and translate to native format.
10.	Write a Perl script to print the multiplication tables from 1-10 using subroutines.
11.	Write a Perl program to implement the following list of manipulating functions Shift, Unshift, Push.
12.	Write a Perl script to validate IP address and email address.
13.	Write a Perl script to print the file in reverse order using command line arguments.
Suggested Text Books	
1.	Ruby Programming language, David Flanagan and Yukihiro Matsumoto, O'Reilly.
2.	Programming Perl, Larry Wall, T. Christiansen and J. Orwant, O'Reilly, SPD.
3.	The World of Scripting Languages, David Barron, Wiley Publications.

Note: At least 10 experiments are to be performed by students in the semester. Out of which at least eight experiments should be performed from the above list, remaining two experiments may either be performed from the above list or designed and set by the concerned faculty as per the scope of the syllabus.