UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

M. Tech. (Electronics and Telecommunication)
2018

Semester-I

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Core 1/ MECT-101	Optoelectronics and optical fiber communication	3	0	0	3
2	Core 2/ MECT-102	Advanced digital Communication systems	3	0	0	3
3	Prog. Specific Elective PE1	Elective I	3	0	0	3
	MECT-111	(1) Advanced computer architecture				
	MECT-112	(2) Advanced computer networks				
	MECT-113	(3) Wireless networks				
4	Prog. Specific Elective PE2	Elective II	3	0	0	3
	MECT-121	(1) Telecommunications System modeling and simulation				
	MECT-122	(2) Reliability Engineering				
	MECT-123	(3) Optimization techniques				
5	LAB 1/ MECP-101	OOFC Lab	0	0	4	2
6	LAB 2/ MECP-102	ADCS Lab	0	0	4	2
7		Research Methodology and IPR	2	0	0	2
8	Aud 1	Audit course 1	2	0	0	0
9		**Total**	16	0	8	18

Semester-II

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Core 3/ MECT-201	Advance Signal Processing	3	0	0	3
2	Core 4/ MECT-202	Advanced VLSI Design	3	0	0	3
3	Prog. Specific Elective PE3	Elective III	3	0	0	3
	MECT-231	(1) Cellular & mobile Communication				
	MECT-232	(2) Telecommunication Switching & tele traffic engineering				
	MECT-233	(3) Fuzzy Logic & Design				
4	Prog. Specific Elective PE2	Elective IV	3	0	0	3
	MECT-241	(1) Satellite Communication				
	MECT-242	(2) Advanced Information Theory & coding				

	MECT-243	(3) Digital Image Processing				
5	LAB 3/ MECP-201	ASP Lab	0	0	4	2
6	LAB 4/ MECP-202	Advanced VLSI Lab	0	0	4	2
7	MECP-203	Seminar	0	0	4	2
8	Aud 2	Audit course 2	2	0	0	0
9		**Total**	14	0	12	18

Semester-III

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Prog. Specific Elective PE5	Elective V	3	0	0	3
	MECT-351	(1) Embedded Systems & RTOS				
	MECT-352	(2) Artificial Neural Networks				
	MECT-353	(3) Microwave Planar Transmission Lines & Ciruits				
	MECT3-354	(4)Smart Antennas for Mobile communications				
	MECT-355	(5)Spread Spectrum Techniques				
2	Open Elective / MECT-391	1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy	3	0	0	3
3	Dissertation / MECP-301	Dissertation Phase – I	0	0	20	10
		Total	06	0	20	16

Semester-IV

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Dissertation / MECP-401	Dissertation Phase – II	--	--	32	16
		Total	--	--	32	16

Audit course 1 & 2

English for Research Paper Writing

Disaster Management

Sanskrit for Technical Knowledge

Value Education
Constitution of India
Pedagogy Studies
Stress Management by Yoga
Personality Development through Life Enlightenment Skills.

Paper Code: MECT-101

Paper: Optoelectronics and Optical Fibre Communication

Unit-1

Introduction: Key elements of OFC system, Advantages of Optical Fiber, Optical Spectral Bands, Channel Capacity, Windows & Spectral Bands, Wave properties, Basic Optical Fiber Structures, Ray Optics Presentation, meridional rays and skew rays, Concept of Modes in dielectric slab waveguide, mode theory for circular waveguide, linearly polarized modes, Cutoff wavelength mode field diameter, normalized frequency of single mode fiber

Unit - 2

Transmission Losses: Attenuation, Absorption, scattering, losses, Bending losses, dispersion, Intramodal & Intermodal, polarization mode dispersion, dispersion shifted, flatted & compensating fiber.

Unit-3

Sources & Detectors: LED-principle, material, double heterojunction LED, efficiency, modulation of an LED, Laser diode-Principle, modes threshold condition, efficiency, laser diode rate equation, PIN photo detector, Avalanche photodiode, photodectector noise, detector response time

Unit-4

Optical amplifiers, EDFA, Amplifier gain, WDM concepts, Fiber grating filters, Optical TDM, Subscriber multiplexing, SONET/SDH, OCDMA

Text Books:

       Senior J., optical fiber communications, principles & practice, PHI.
       Keiser G., optical fiber communications, McGraw-hill.

Reference Books:

       Gowar J., optical communication systems, PHI.
       William B. Jones jr., Introduction to optical fiber communication systems, Holt, Rinehart and Winston, Inc.
       Fiber Optic Communication Systems by Mynbev, Pearson
       Fiber Optic Communication Systems by G.P. Aggarwal, John Wiley & sons.

Paper code: MECT-102

Paper: Advance Digital Communication

UNIT I
Waveform coding Techniques: Discretization in time and amplitude, linear quantizer, quantization noise power calculations, signal to quantization noise ratio, non-uniform quantizer, a-Law & μ-law, companding, encoding and PCM, Channel noise and error probability, DPCM and DM, Coding speech at low bit rates, PredMEion and adaptive filters, Baseband shaping for data transmission, PAM signals and their power spectra, Nyquist criterion, ISI and eye pattern

UNIT II
Digital modulation techniques: Binary and M-ary modulation techniques, Bit vs. symbol error probability and bandwidth efficiency, ASK, FSK, PSK Modulation techniques, comparison of QPSK, MSK & GMSK systems, Coherent and Non-Coherent detection techniques, Phase-Locked loops, Probability of error calculation for M-ary systems.

UNIT III
Equalization: Optimal Zero-Forcing Equalization, Fractionally Spaced and Transversal Filter Equalizers, Adaptive Linear Equalizer, Pass band Equalization.
Fading & Diversity: Types of diversity, Receiver Diversity, Performance analysis for Rayleigh Fading, The Diversity-Interference Trade-off.
 The Gaussian MIMO Channel, Basics of MIMO systems.

UNIT IV
Error control coding: Concept of channel coding, Channel coding & Channel capacity theorems, Linear block codes, cyclic codes and convolution codes, Viterbi decoding algorithm, Turbo codes, Trellis codes, TCM. Spread-spectrum modulation: Pseudo noise sequences, direct sequence and frequency-Hop spread spectrum, Signal-space dimensionality and processing gain.

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 Text Books:

   Communication Systems By Simon Haykin, John Wiley and Sons,4th Edition, 2006.

   Digital Communication-Fundamentals and Applications By Sklar, 2nd edition, Pearson Education India.

 Reference Books:

   Communication Systems Engineering, By J. G. Proakis, Prentice Hall, 2nd Edition.

   Electronic Communication Systems, Fundamentals through Advanced, By Wayne Tomasi, 4th edition, Pearson Education India.

   Digital communication by John R. Barry, Third edition, Springer International Edition

ed in 40th meeting of Academic Council, dated 1st March, 2016

PROGRAM ELECTIVE 1

Paper code: MECT-111
Paper: Advance Computer Architecture

Unit-I

Parallel computer models:
The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers.

Program and network properties:
Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms

Unit-II

System Interconnect Architectures:
Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors:Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Unit-III

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Collision free scheduling, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch predMEion, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines

Unit-IV
Multiprocessors and Multicomputers: Multiprocessors System Interconnects, Hierarchal Bus system, Multistage and combining networks, Three generations of multicomputer, Message Passing Mechanism Deadlock and virtual channels,

Multivector and SIMD computers: Vector Processing principals: Vector Instruction Types, Vector Access memory Schemes, Multivector Multiprocessors, Performance directed Design rules.

TEXT BOOKS:
>   Kai Hwang, "Advanced computer architecture"; TMH. 2000
>   D. A. Patterson and J. L. Hennessey, "Computer organization and design", Morgan Kaufmann, 2nd Ed. 2002
REFERENCES:
>   J.P.Hayes, "computer Architecture and organization"; MGH. 1998
>   V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI. 2002
>   Kai Hwang and Zu, "Scalable Parallel Computers Architecture", MGH. 2001
>   Stalling W, "Computer Organisation & Architecture", PHI. 2000

M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing. 1998

D.A.Patterson, J.L.Hennessy, "Computer Architecture :A quantitative approach"; Morgan Kauffmann feb,2002.

Hwan and Briggs, " Computer Architecture and Parallel Processing"; MGH. 1999

Paper Code: MECT-112
Paper: Advanced Computer Networks

Unit - I

Introduction:
Introduction to Network models-ISO-OSI, SNA, Appletalk and TCP/IP models. Review of Physical layer and Data link layers, Review of LAN (IEEE 802.3, 802.5, 802.11b/a/g, FDDI) and WAN (Frame Relay, ATM, ISDN) standards.

Unit- II
Network layer
ARP, RARP, Internet architecture and addressing, internetworking, IPv4, overview of IPv6, ICMP, Routing Protocols- RIP, OSPF, BGP, IP over ATM.

Unit- III
Transport layer
Design issues, Connection management, Transmission Control Protocol (TCP), User Datagram Protocol (UDP)
Application layer
WWW, DNS, e-mail, SNMP, RMON

Unit- IV
Network Security: Cryptography, Firewalls, Secure Socket Layer (SSL) and Virtual Private Networks (VPN). Study of various network simulators, Network performance analysis using NS2

TEXT BOOKS:
Behrouz A. Forouzan, "TCP/IP Protocol Suit", TMH, 2000.
Tananbaum A. S., "Computer Networks", 3rd Ed., PHI, 1999.

REFERENCES:
Black U, "Computer Networks-Protocols, Standards and Interfaces", PHI, 1996.
Stallings W., "Data and Computer Communications", 6th Ed., PHI, 2002.
Stallings W., "SNMP, SNMPv2, SNMPv3, RMON 1 & 2", 3rd Ed., Addison Wesley, 1999.
Laurra Chappell (Ed), "Introduction to Cisco Router Configuration", Techmedia, 1999.

Paper Code: MECT-113
Paper: Wireless Networks

Unit 1
Introduction to Personal Communication Services (PCS): PCS architecture, Mobility management, Networks
signaling.
Global system for Mobile Communication (GSM) system overview: GSM Architecture, Mobility Management,
Network signaling.

Unit 2
General Packet Radio Services (GPRS): GPRS architecture, GPRS Network nodes. Enhanced Data rates for GSM
Evolution (EDGE), Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.
Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, Wireless
Markup Languages (WML).

Unit 3
Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT
2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in
3G. Fourth Generation (4G) Mobile services: Introduction to Long Term Evaluation (LTE), Orthogonal
Frequency Division Multiple Access (OFDMA), Multi-In Multi-Out Antenna system (MIMO), LTE-Advanced
Wireless local Loop (WLL): Introduction to WLL architecture, WLL technologies, WMAN (Wireless MAN),
IEEE802.16 standard, WiMAX

Unit 4
Global Mobile Satellite Systems: Case studies of IRIDIUM and GLOBALSTAR systems.
Bluetooth technology. Wireless Sensor Networks: Introduction, Architecture, ZigBee protocol, Applications.

Text Books:
[T1] Yi –Bing Lin & Imrich Chlamatac ,"Wireless and mobile Networks Architecture," John Wiley & Sons
Publication, 2001.
[T2] Raj Pandya, "Mobile & Personnel communication Systems and Services", Prentice Hall India, 2001.
[T3] Theodore S. Rappaport, "Wireless Communication- Principles and practices," 2nd Ed. Pearson Education
Pvt. Ltd, 2003.
[T4] Jochen Schiller, "Mobile communications," Pearson Education Pvt. Ltd., 2002.
[T5] Singhal & Bridgman, " The Wireless Application Protocol," Pearson Education, 2004.

References Books :
[R1] Hensmann, Merk, & Stober, "Principles of Mobile Computing," 2nd Ed., Springer International Edition,
2003.
[R2] Talukdar & Yaragal, "Mobile Computing," TMH, 2005.
[R3] Smith & Collins, "3G Wireless Networks," TMH, 2007.

PROGRAM ELECTIVE 2

Paper Code: MECT-121
Paper: Telecommunication System Modeling and Simulation

UNIT – I
SIMULATION OF RANDOM VARIABLES RANDOM PROCESS
Generation of Random numbers and Sequence, Gaussian and Uniform random numbers Correlated random sequences, testing of random numbers generators, Stationary and Uncorrelated Noise, Goodness of fit test.

UNIT – II
MODELING OF COMMUNICATION SYSTEMS
Radio frequency and Optical sources, Analog and Digital signals, Communication channel and Models, Free Space channels, Multipath channel and discrete channel noise and interference.

UNIT – III
ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION
Quality of Estimator, Estimation of SNR, Probability density function and Bit Error Rate, Monte Carlo method, Importance Sampling method, Extreme Value Theory.

UNIT – IV
SIMULATION AND MODELING METHODOLOGY
Simulation Environment, Modeling considerations, Performance Evaluation techniques, Error Source Simulation, Validation. Case Studies: Simulations of QAM Digital Radio link in environment, Light wave communication link and Satellite system.

TEXTBOOKS
   MC.Jeruchim, P.Balaban and Sam K Shanmugam, "Simulation of communication systems: Modeling, Methodology and Techniques", Plenum Press, New York, 2001.

REFERENCES
   Averill.M.Law and W.David Kelton, "Simulation Modeling and Analysis", McGraw-Hill, 2000.
   Geoffrey Garden, "System Simulation", Prentice Hall of India, 2nd Edition, 1992.
   W.Turin, "Performance Analysis of Digital Communication Systems", Computer Science Press, New York, 1990.
   Jery Banks and John S.Carson, "Discrete Event System Simulation", Prentice Hall of India, 1984.

PROGRAM ELECTIVE 2

Paper Code : MECT-122
Paper : Reliability Engineering

UNIT I
Concepts of Reliability:
Failure of systems and its modes: Measure of Reliability, Reliability Function, Hazard Rate
MTBF and their interrelations. Reliability Data Analysis: Data Sources, Data Collection, Use of
Reliability data, Reliability Analysis, Performance Parameters, Calculation of Failure Rate,
Application of Weibull distribution.

UNIT II
System Reliability and Modeling: Series Systems, Parallel systems, Series Parallel systems, Time
dependence, Reliability determination, Standby systems, r out of n configurations, Methods of tie
set and cut sets of or reliability evaluation, Simulation and Reliability Prediction, Monte Carlo
Method.

UNIT III
Maintainability and Availability: Maintainability and its equation, Factors affecting
maintainability, Measures of maintainability, Mean Down Time, Availability intrinsic availability
equipment availability & Mission availability, Replacement Process and Policies.

UNIT IV
Life Testing of Equipment:
Nondestructive tests, Destruction tests and their mathematic modeling, Quality and Reliability,
Measurement & Prediction of Human Reliability, Reliability and safety, Safety margins in
critical devices, Case studies. Value Engineering: Techniques in value Engineering, Structures of
Engineering. Reliability Management.

Text Books:
K.K.Aggarwal, "Reliability Engineering", Springer, 1993
A.K.Govil, "Reliability Engineering", Tata McGraw Hill, 1993

Reference Books:
L.S.Srinath, "Reliability Engineering", East West Press, 2005

PROGRAM ELECTIVE 2

Paper code: MECT-123
Paper: Optimization Techniques

UNIT-I
Introduction: Statement of an Optimization problem, Classification of Optimization problems

Classical Optimization Techniques: Single variable optimization, Multivariable optimization with no constraints– Hessian matrix, Multivariable saddle point, Optimization with equality constraints – Lagrange multiplier method, Multivariable optimization with inequality constrains – Kuhn-Tucker conditions.

UNIT-II
One-Dimensional Minimization Methods: Elimination Methods, UnrestrMEed Search Method, Fibonacci Methods, Interpolation Methods – Quadratic and Cubic Interpolation Methods

Integer Programming: Gomory's Cutting Plane Method for Integer Linear Programming, Formulation and Solution of Integer Polynomial and Non-linear problems.

Unit III

Unconstrained Minimization Methods: Univariate and pattern search method, steepest descent method, Newton method, Powell method.

Constrained Minimization Methods: Characteristics of a constrained problem, Direct Methods of feasible directions, Indirect Methods of interior and exterior penalty functions

UNIT-IV

Genetic Algorithm: Introduction to GA, fitness function, GA operators, Unconstrained and constrained optimization using Genetic algorithm, Global optimization using GA.

Text Books
"Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
Optimization Concepts and Applications in Engineering – Ashok D.Belegundu and Tirupathi R Chandrupatla — Pearson Education.

References
"Operations Research : An Introduction" – by H.A. Taha, PHI Pvt. Ltd., 6th edition
"Optimization for Engineering Design: Algorithms and Examples", Kalyanmoy deb, PHI publication
"Genetic Algorithm in Search Optimization and Machine Learning", D.E. Goldberg, Addision-Wesley Publication, 1989

Paper: Advanced Communication Networks Laboratory

Teaching Scheme
Lab work : 4 hrs/week

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

Identify the different types of network devices and their functions within a network. Understand and build the skills of sub-netting and routing mechanisms.
Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation.

List of Assignments:

Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.

Linux Network Configuration.

 Configuring NIC's IP Address.
Determining IP Address and MAC Address using if-config command.

Changing IP Address using if-config.
Static IP Address and Configuration by Editing.

Determining IP Address using DHCP.
Configuring Hostname in /etc/hosts file.

Design TCP iterative Client and Server application to reverse the given input sentence.

Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".

Design UDP Client Server to transfer a file.

Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.

Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.

Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.

Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.

Signaling and QoS of labeled paths using RSVP in MPLS.
Find shortest paths through provider network for RSVP and BGP.

Understand configuration, forwarding tables, and debugging of MPLS.

Paper: Wireless and Mobile Communication Laboratory

Teaching Scheme
Lab work : 4 hrs/week

Course Outcomes: At the end of this course, students will be able toUnderstanding Cellular concepts, GSM and CDMA networks**.**To study GSM handset by experimentation and fault insertion techniques**.**Understating of 3G communication system by means of various AT commands usage in GSM Understanding CDMA concept using DSSS kit**.** To learn, understand and develop concepts of Software Radio in real time environment

List of Assignments:

Understanding Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, multi path environment, Coverage and Capacity issues using communication software.

Knowing GSM and CDMA architecture, network concepts, call management, call setup, call release,Security and Power Control, Handoff Process and types, Rake Receiver etc.

Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).

To study transmitters and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.

To study various GSM AT Commands their use and developing new application using it. Understating of 3G Communication System with features like; transmission of voice and video calls, SMS, MMS, TCP/IP, HTTP, GPS and File system by AT Commands in 3G network.

Study of DSSS technique for CDMA, observe effect of variation of types of PN codes, chip rate, spreading factor, processing gain on performance.

To learn and develop concepts of Software Radio in real time environment by studying the building blocks like Base band and RF section, convolution encoder, Interleaver and De-Inter leaver.

To study and analyze different modulation techniques in time and frequency domain using SDR kit.

Paper: Research Methodology and IPR
Teaching Scheme

Lectures: 2 hrs/week

Course Outcomes: At the end of this course, students will be able to Understand research problem formulation. Analyze research related information. Follow research ethics. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity. that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular..Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism , Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:
Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners
Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007. Mayall , "Industrial Design", McGraw Hill, 1992.
Niebel , "Product Design", McGraw Hill, 1974.
Asimov , "Introduction to Design", Prentice Hall, 1962.
Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Paper Code: **MECT-201**
Subject: Advanced Signal Processing

Unit I
Discrete Time Signals and Systems, Frequency Domain Representation, Z-Transforms, Discrete Fourier Transforms, Impulse Response and Transfer functions, Convolution and Correlation.

Unit II
IIR Filter Design: Filter Approximation, Impulse Invariant Method, Bi-linear Transformation method filter structures, Finite word length effects, limitations of IIR filters. FIR Filter Design: Linear phase response, Windowing technique, Gibb's Phenomenon,Frequency Sampling Method, FIR Filter structures.

Unit III
Frequency Domain Realization of Digital Filters, Radix-2 FFT Algorithm. Introduction to Multirate digital signal processing

Unit IV
Power Spectrum Estimation, Classical Spectral Estimation, Parametric Modeling - AR, MA, ARMA methods, Minimum variance spectral estimations. Principles of DSP Architecture.

Text:
  G. J. Proakis and D. G. Manolakis, "Digital Signal Processing, Principles, algorithms and applications", 4th ed. Pearson Education.
  S. K. Mitra, " Digital Signal Processing" 3rd ed. TMH.

References:
  A.V. Oppenheim and R.W. Schafer "Discrete Time Signal Processing", PHI 1992.
  Steven M. Kay "Modern Spectral Estimation", PHI 1988.
3.. Clark Cory.L, "Lab view DSP and Digital comm.", TMH 2005.
4. .Roman Kuc "Introduction to Digital Signal Processing", McGraw Hill 1988

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Core-4

Paper Code: MECT-202
Paper: Advanced VLSI Design

Unit 1
Introduction : Basic principle of MOS transistor, Introduction to large signal MOS models (long channel) for digital design.
MOS Circuit Layout & Simulation and manufacturing: scaling, MOS SPICE model and simulation, CMOS layout: design rules, Transistor layout, Inverter layout, NMOS and CMOS basic manufacturing steps.

Unit 2
The MOS Inverter : Inverter principle, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, switching characteristics, Propagation Delay, Power Consumption.

Combinational MOS Logic Design : Static MOS design, Ratioed logic, Pass Transistor logic, complex logic circuits.

Unit 3

Sequential MOS Logic Design
Static latches, Flip flops & Registers, Dynamic Latches & Registers, CMOS Schmitt trigger, Astable Circuits.
Memory Design: ROM & RAM cells design **Dynamic MOS design :** Dynamic logic families and performances.
Clock Distribution Clock Distribution. Input and Output Interface circuits.

Unit 4
Subsystem design
 Design styles, design concepts: Hierarchy, Regularity, Modularity, Locality. CMOS Sub system design: Adders, Multipliers.

Text Books

S. Kang & Y. Leblebici "CMOS Digital IC Circuit Analysis & Design"- McGraw Hill, 2003.

J. Rabaey, "Digital Integrated Circuits Design", Pearson Education, Second Edition, 2003.

Reference Books

Neil Weste and David Harris :" CMOS VLSI design" Pearson Education 2009.

PROGRAM ELECTIVE 3:

Paper Code: MECT-231

Paper : Cellular & Mobile Communication

Unit I

Introduction to Cellular Mobile Systems

A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, overview of generations of cellular systems. Elements of Cellular Radio Systems Design and interference General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems. Introduction to co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects,

Unit II

Cell Coverage for Signal & antenna structures General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model- characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation. Characteristics of basic antenna structures, antenna at cell site, mobile antennas.

Frequency Management & Channel Assignment, Hand Off & Dropped Calls
Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment. Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation.

Unit III

Modulation methods and coding for error detection and correction
Introduction to Digital modulation techniques, modulation methods in cellular wireless systems, OFDM. Block coding, convolution coding and Turbo coding. Multiple access techniques: FDMA, TDMA, CDMA; Time-division multiple access (TDMA), code division multiple access (CDMA), CDMA capacity, probability of bit error considerations, CDMA compared with TDMA.

Unit IV

Second generation, digital, wireless systems GSM, IS_136 (D-AMPS), IS-95, mobile management, voice signal processing and coding.

Text Books:

Mobile Cellular Telecommunications; 2nd ed.; William, C Y Lee McGraw Hill

Mobile wireless communications; Mischa Schwartz, Cambridge University press, UK, 2005

Reference Books

Mobile Communication Hand Book; 2nd Ed.; IEEE Press

Wireless communication principles and practice, 2nd Ed, Theodore S rappaport, Pearson Education.

3G wireless Demystified; Lawrence Harte, Mc. Graw Hill pub.

Principles of Wireless Networks, Kaveh Pahlavan and Prashant Krishnamurthy: PHI

Wireless communication theory, Blake, pub: Thomson Delmar 2004

PROGRAM ELECTIVE 3:
Paper Code: MECT-232
Paper: Telecommunication Switching and Tele-traffic
Engineering

Unit – I: Multiplexing
Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing: Pulse Transmission, Line Coding, Binary N – Zero Substitution, Digital Biphase, Differential Encoding, Time Division Multiplexing, Time Division Multiplex Loops and Rings.
SONET/SDH: SONET Multiplexing Overview, SONET Frame Formats SONET Operations, Administration and Maintenance, Payload Framing and Frequency Justification, Virtual Tributaries, DS3 Payload Mapping, E4 Payload Mapping, SONET Optical Standards, SONET Networks. SONET Rings: Unidirectional Path-Switching Ring, Bidirectional Line-Switched Ring.

Unit – II: Digital Switching
Switching Functions, Space Division Switching, Time Division Switching, two-dimensional switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Gross-Connect Systems, and Digital Switching in an Analog Environment. Elements of SSNO7 Signaling.

Unit – III: Network Synchronization Control and Management
Timing: Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic
Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

Unit – IV: Digital Subscriber Access and traffic analysis
ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-
Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, and Voice band Modems: PCM Modems, Local microwave Distribution Service, Digital Satellite Services. Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, And Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, And Delay Systems: Exponential Service Times, Constant Service Times, Finite Queues.

Text:
Bellamy John, "Digital Telephony", John Wily & Sons, Inc. 3rd ed. 2000
Viswanathan. T., "Telecommunication Switching System and Networks", PHI 1994
References:
Robert G. Winch, "Telecommunication transmission systems", 2nd ed. TMH 2004
Marion Cole, "Intro. to Telecommunications" 2nd ed. Pearson education 2008.
Tom Sheldon, "Encyclopedia of Networking and telecom." TMH seventh reprint2006

Paper Code: MECT-233

Paper: Fuzzy Logic & Design

Unit-I
Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

Unit-II
Fuzzy Relations: Crisp & Fuzzy Relations, Projections & Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on single set, Equivalence, Compatibility & Ordering Relations, Morphisms, Fuzzy Relation Equations.

Unit-III
Possibility Theory: Fuzzy Measures, Evidence & Possibility Theory, Possibility versus Probability Theory.

Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

Unit-IV
Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp sets, Fuzziness of Fuzzy Sets.

Applications of Fuzzy Logic:

Text Book:
   G.J.Klir , Yuan,"Fuzzy Sets and fuzzy logic, Theory and applications", Prentice Hall India, 1995.

Reference Books:
   John Yen, Reza Langari, "Fuzzy Logic Intelligence, Control and Information", Pearson Education, 2006.
   Ross, "Fuzzy Logic with Engineering Applications", 2nd Edition, John Wiley, 2004.
   H. Zimmermann, "Fuzzy Set Theory and its application

Paper Code: MECT-241
Paper: Satellite Communication

Syllabus Contents:

Unit 1: Architecture of Satellite Communication System: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks.

Unit 2: Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, 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 3: Satellite sub-systems: 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, antenna sub-system.

Unit 4: 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 5: Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.

Unit 6: Modulation and Multiple Access Schemes used in satellite communication.Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO. GPS.

References:

Timothy Pratt and Others, "Satellite Communications", Wiley India, 2nd edition,2010.

S. K. Raman, "Fundamentals of Satellite Communication", PearsonEducation India, 2011. Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.

Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008.

Paper code: MECT-242

Paper: Advanced Information Theory & Coding

UNIT I
Measure of Information, Information contents of discrete memoryless sources, Entropy & Mutual Information, Source coding theorem: Huffman coding, Shannon-Fano coding, Lempel-Ziv algorithm, Prefix codes,

UNIT II
Channel Coding theorem, Channel capacity theorem, Channel models, BSC, DMC, Lossless, Noiseless channels, Linear Block codes, Systematic & Non-Systematic codes, Repitition codes, Hamming codes, Cyclic codes, Cyclic Redundancy check (CRC) codes, Golay codes, BCH Codes, Read-Solomon codes.

UNIT III
Convolutional codes, Polynomial representation of Convolutional codes, Tree, State and Trellis diagrams, Maximum-likelihood/Viterbi Decoding of Convolutional codes, Concept of Interleaving, Turbo Codes, Turbo decoding,

UNIT IV
Combined coding and Modulation, Trellis Coded Modulation (TCM), Mapping by set partitioning, TCM decoder, TCM for fading channels, Concept of Space time Trellis Codes.

Text Books:
Information Theory, Coding and Cryptography By Ranjan Bose, Tata McGraw Hill, 2002.
Introduction to Error Control Codes by Salvatore Gravano, Oxford University Press

Reference Books:
1, Information Theory, Inference, and Learning Algorithms By David J.C. MacKay, Cambridge University Press, 2003.
2, Entropy & Information Theory by Robert M Gray, Springer-Verlag, Newyork, INC, 1990.

Paper code: MECT-243
Paper: Digital Image Processing

UNIT I
Introduction to 2-D Signals and Systems, Image Digitization, Image Transforms, Image Data Compression:
Transform Domain Coding, Predictive Coding, JPEG. Image Enhancement:

UNIT II
Image Restoration: Inverse Filtering, Algebraic Approach to Restoration, Wiener (LMS) approach, Constrained Least Squares Restoration, Interactive and other methods for restoration.

UNIT III
Image Reconstruction: The Filtered Back-Projection Algorithm, Algebraic reconstruction Method. Image
Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection,

UNIT IV
Thresholding, Region-Oriented Segmentation, Selected Topics of Current Interest (for example multi-resolution analysis, morphological processing etc.).

Text books/ References:

Digital Image Processing By R. C. Gonzalez and R. E. Woods, Prentice-Hall.
Digital Image Processing and Computer vision By Milan Sonka, CL-Engineering Publisher.

Paper: Antennas and Radiating Systems Laboratory

List of Assignments:

Simulation of half wave dipole antenna.

Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.

Simulation of quarter wave, full wave antenna and comparison of their parameters.

Simulation of monopole antenna with and without ground plane.

Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.

Simulation of a half wave dipole antenna array.

Study the effect of change in distance between elements of array on radiation pattern of dipole array.

Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.

Case study

Paper Code: MECT-351
Paper: Embedded Systems & RTOS

Unit – I
Introduction to an embedded systems design (ESD), Role of Real-Time Operating System, Issues in Real-time Computing: Architecture issues and Operating system issues, Structure of Real-Time system, Task Classes, Performance measures for real-time systems, Properties of performance measures, traditional performance measure, Performability, Cost function and hard deadlines, Estimating program run times, Accounting for pipelining

Unit – II
Real-Time Scheduling: Clock-Driven Approach: Static, Timer-Driven Scheduler, General structure of Cyclic schedules, Cyclic Executives, Improving the average response time for aperiodic jobs, Scheduling sporadic jobs, Practical consideration and generalizations, Algorithm for constructing static schedules, Pros and Cons of clock-driven scheduling Priority-Driven Scheduling of Periodic Tasks: Static assumption, Fixed-priority versus dynamic-priority algorithm, Rate-Monotonic and Deadline-Monotonic Algorithms, EDF algorithm, Relative merits, Schedulable utilizations of the EDF algorithm, Schedulability test for the EDF algorithm, Optimality of the RM and DM algorithm, A Schedulability test for fixed-priority tasks with short response times, Schedulability test for fixed-priority tasks with arbitrary response times, Sufficient Schedulability conditions for the RM and DM algorithms

Unit – III
Scheduling Aperiodic and Sporadic Jobs in Priority-Driven systems: Assumptions and approaches, Deferrable servers, Schedulability of deadline-driven systems in the presence of deferrable server, Sporadic server, Constant utilization, total bandwidth and weighted fair-queuing servers, Slack stealing in deadline-driven systems, Slack stealing in fixed-priority systems, Scheduling of sporadic jobs, Real time performance for jobs with soft timing constraints, A two level scheme for integrating scheduling

Unit - IV
Resource and Resource Access Control: Assumption on resources and their usage, Effects of resources contention and Resource access control, Non preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack based, priority-ceiling protocol, use of priority-ceiling protocol in dynamic-priority systems, preemption ceiling protocol, controlling accesses to multiple-unit resources.
Multiprocessor scheduling, resource access control and synchronization: Model of multiprocessor and distributed systems, task management, multiprocessor priority-ceiling protocol, elements of scheduling algorithm for end-to-end periodic tasks, Schedulability of fixed-priority end-to-end periodic tasks, end-to-end tasks in heterogeneous systems, predictability and validation of dynamic multiprocessor systems

Text Books:

Real-Time systems by Jane W. S. Liu, Pearson Education India, 2007
Real-Time Systems by Rajib Mall, Pearson Education India, 2011

References:

Real-Time Systems by C. M. Krishna and Kang G. Shin, The McGraw-Hill Companies, 2007
Programming Microsoft windows CE, .Net, Douglas Boling, WP publishers & Distributors.

Real-Time Concepts for Embedded Systems by Qing Li and Caroline Yao, CMP Books, 2005

Mobile Development Handbook by Andy Wigley, Daniel Moth and Peter Foot, Microsoft Press, WP Publisher, 200

Embedded Programming with the Microsoft .NET Micro Framework by Donald Thompson and Rob S. Miles, WP Publisher, 2007

PROGRAM ELECTIVE 5

Paper Code: MECT-352
Paper: Artificial Neural Networks

Unit-I
Biological analogy, Architecture classification, Neural Models, Learning Paradigm and Rule, single unit mapping and the perception.

Unit-II
Feed forward networks – Review of optimization methods, back propagation, variation on Backpropagation, FFANN mapping capability, properties of FFANN's Generalization.

Unit-III
PCA, SOM, LVQ, Adaptive Resonance Networks.

Unit-IV
Hopfield Networks, Associative Memories, RBF Networks.

Applications of Artificial Neural Networks: Regression, applications to function approximation, Classification, Blind Source Separation.

Text Book:
Haykin S., "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.

References:
Anderson J.A., "An Introduction to Neural Networks", PHI, 1999.
Hertz J, Krogh A, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.
Hertz J, Krogh A, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.
Freeman J.A., D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison-Wesley, Reading, Mass, (1992).
Golden R.M., "Mathematical Methods for Neural Network Analysis and Design", MIT Press, Cambridge, MA, 1996.
.
Charles Elachi and Jakob J. van Zyl , Introduction To The Physics and Techniques of Remote Sensing , Wiley Series in Remote Sensing and Image Processing, 2006.
Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman& Co, 1978

ROGRAM ELECTIVE 5

Paper Code: MECT-353
Paper: Microwave Planner Transmission Lines & circuits

Unit I:

Review of parallel plate wave-guide: analysis of TEM mode, TE Modes and TM Modes, Surface Waves
on grounded dielectric slab: analysis of TE Modes, TM Modes
Strip line: study of different Modes, electrostatic solution, propagation constant, characteristic impedance, attenuation

Unit II:

Microstrip lines: properties, Quasi static and frequency dependant closed form models, modes in microstrip line. Variational method, conformal transformation, numerical analysis
Analysis for effective relative permittivity, dispersion, propagation constant, characteristic impedance, surface waves, resonance
Losses in microstrip lines. Effect of conductor thickness and shielding on propagation characteristic of microstrip.

Unit III:

Microstrip discontinuities: open end, corners, bends, steps, junctions, and gaps.
Microstrip Passive components: branch line coupler, hybrid ring coupler, power dividers, resonators, filters

Unit IV:

Introduction to slotlines, coupled lines, Coplanar lines, defective ground structure, surface integrated waveguide structure

Text Books

   Microwave Engineering using Microstrip Circuits – E H Fooks, R A Zakarevicius-Prentice Hall
   Microwave Microwave Engineering By D.M.Pozar,

Reference Books:

   Microstrip Lines and Slotlines – K C Gupta-Artech Publishing
   Foundations for microstrip design – T C Edward-John Wiley &Sons

PROGRAM ELECTIVE 5

Paper Code: MECT-354
Paper: Smart Antennas for Mobile Communications

Unit I

Statistical signal processing concepts, Basics of mobile wireless communications.

Unit II:

Radio-frequency signal modeling and channel characterization.

Unit III:

Smart antennas and generalized array signal processing. Source localization problem, Joint angle and delay estimation.

Unit IV:

Smart antenna array configurations, Mobile communication systems with smart antennas.

TEXT BOOKS:
Smart Anteena for Wireless Communications: With MATLAB by Frank Gross, Mc Graw Hill,Sept 2005.
Smart Anteena Engineering by Ahmed El- Zooghby, Artech House, July 2005.

REFERENCE BOOKS:
Smart Anteena for Mobile Communications by Mohamed El-Said Shaban, BSD License, Sept 2009.

PROGRAM ELECTIVE 5 :

Paper Code: MECT-355
Paper: Spread Spectrum Techniques.

UNIT I
INTRODUCTION: Origin of Spread Spectrum – Spreading the Spectrum – Progress Gain – Jamming Margin – Direct Sequence System – Direct Sequence Signal Characteristics – Direct Sequence Code – Spectrum relationship – Frequency Hopping Signal Characteristics – Frequency Hopping Rate and No. of frequencies – Time Hopping – Chirp System – Hybrid Forms

UNIT II
CODE GENERATION: Coding – Maximal sequences – Linear Code Generator – Auto Correlation and Cross Correlation of codes– Composite codes – Chip rate and code length – Choosing a linear code – Generating high rate codes –Code selection and Signal spectra – Initial Synchronization – Tracking

UNIT III
MODULATION – CORRELATION AND DEMODULATION: Modulation – Balanced Modulation – Frequency Synthesis – Sending the Information – Remapping the Spread Spectrum – Effect of non synchronous input signal – Base band recovery.

UNIT IV
SYNCHRONISATION: Noise figure and Cochannel users - Dynamic range and AGC - Propagation Medium - Overall Receiver-Transmitter Design – Ranging Techniques – Direction finding – Special Antennas. APPLICATIONS OF SPREAD SPECTRUM METHODS: Space Systems – Avionics Systems – Test Systems and Equipment – Message Protection – Position Location – Test and Evaluation of Spread Spectrum Systems – Sensitivity, Selectivity, Jamming Margin, Synchronous acquisition, loss of Synchronization – Signal to noise ratio Vs Interference level – Process gain – FCC Method – Cross Correlation – Transmitter Measurements.

TEXT BOOKS:
R.C. Dixon, "Spread Spectrum Systems with commercial appications", Wiley Interscience, 3rd Edition,1994
George Cooper & Clare. D. Mc Gillen, "Modern Communications and Spread Spectrum", Mc Graw Hill, 1985.

REFERENCE BOOKS:

M.K. Simon, J.K. Omura, R.A. Scholtz , "Spread Spectrum Communications Handbook, Elctronic Edition", McGraw Hill, 1st Edition, 2001.
Rodger E. Ziemer, Roger L. Peterson, David E. Borth, "Introduction to Spread Spectrum Communications", Prentice Hall Inc., 1995

(Dissertation) Dissertation Phase – I(MECP-301) and Phase - II (MECP-401)

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

    Relevance to social needs of society

        Relevance to value addition to existing facilities in the institute

        Relevance to industry need

    Problems of national importance

    Research and development in various domain

The student should complete the following:

        Literature survey Problem Definition

        Motivation for study and Objectives

        Preliminary design / feasibility / modular approaches

        Implementation and Verification

    Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

    Experimental verification / Proof of concept.

    Design, fabrication, testing of Communication System.

    The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II

    As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

    The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

    After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred

literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.

Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.

Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work

Business Analytics

Teaching scheme
  Lecture: - 3 h/week

Course Code	
Course Name	**Business Analytics**
Credits	
Prerequisites	

Total Number of Lectures: 48

Course objective
Understand the role of business analytics within an organization.
Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
To become familiar with processes needed to develop, report, and analyze business data.
Use decision-making tools/Operations research techniques.
Mange business process using analytical and management tools.
Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	9
Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	8
Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling,	9

Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	
Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, 10 Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	
Unit 5: Decision Analysis: Formulating Decision Problems, Decision 8 Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	
Unit 6: Recent Trends in : Embedded and collaborative business intelligence, 4 Visual data recovery, Data Storytelling and Data journalism.	

COURSE OUTCOMES	
Students will demonstrate knowledge of data analytics. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making. Students will demonstrate the ability to translate data into clear, actionable insights.	

Reference:

Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

Business Analytics by James Evans, persons Education.

OPEN ELECTIVES
Industrial Safety

Teaching scheme
 Lecture: - 3 h/week

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electricalhazards, 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.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering,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.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reductionmethods, 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.

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

Unit-V: 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, repair complexities 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

Reference:
Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
Maintenance Engineering, H. P. Garg, S. Chand and Company.
Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OPEN ELECTIVES
Operations Research

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes: At the end of the course, the student should be able to
   Students should able to apply the dynamic programming to solve problems of discreet and
    continuous variables.
   Students should able to apply the concept of non-linear programming
   Students should able to carry out sensitivity analysis
   Student should able to model the real world problem and simulate it.

Syllabus Contents:
Unit 1:
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex
Techniques, Sensitivity Analysis, Inventory Control Models
Unit 2
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex
method - sensitivity analysis - parametric programming
Unit 3:
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max
flow problem - CPM/PERT

Unit 4
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.
Unit 5
Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:
H.A. Taha, Operations Research, An Introduction, PHI, 2008
H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
Hitler Libermann Operations Research: McGraw Hill Pub. 2009
Pannerselvam, Operations Research: Prentice Hall of India 2010
Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

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Open Elective
Cost Management of Engineering Projects

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Teaching scheme
Lecture: - 3 h/week

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi

Charles T. Horngren and George Foster, Advanced Management Accounting

Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting

Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Open Elective
Composite Materials

Teaching scheme
Lecture: - 3 h/week

UNIT–I: INTRODUCTION: Definition – Classification and characteristics of Composite materials.Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: REINFORCEMENTS: Preparation-layup, curing, properties and applications of glassfibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique,Cladding – Hot isostaticpressing.Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds andprepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximumstrain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

Hand Book of Composite Materials-ed-Lubin.

Composite Materials – K.K.Chawla.

Composite Materials Science and Applications – Deborah D.L. Chung.

Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Open Elective
Waste to Energy

Teaching scheme
Lecture: - 3 h/week

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forestresidue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors**Unit-II:** Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: 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-IV: 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-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technologyand 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.

References:
Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:
Students will be able to:
Understand that how to improve your writing skills and level of readability
Learn about what to write in each section
Understand the skills needed when writing a Title

Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
	Clarifying Who Did What, Highlighting Your Findings, Hedging 4 and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
	skills are needed when writing the Methods, skills needed when 4 writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	
6	useful phrases, how to ensure paper is as good as it could possibly 4 be the first- time submission	

Suggested Studies:
Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .
Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

AUDIT 1 and 2: DISASTER MANAGEMENT

Course Objectives: -Students will be able to:

learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Syllabus		
Units	**CONTENTS**	**Hours**
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
	Repercussions Of Disasters And Hazards: Economic Damage, Loss 4Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

SUGGESTED READINGS:

    R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

    Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

    Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

    To get a working knowledge in illustrious Sanskrit, the scientific language in the world
    Learning of Sanskrit to improve brain functioning
    Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
    The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Unit	Content	Hours
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	8
2	Order Introduction of roots Technical information about Sanskrit Literature	8
3	Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Suggested reading

    "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

    "Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

    "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to
    Understanding basic Sanskrit language
    Ancient Sanskrit literature about science & technology can be understood
    Being a logical language will help to develop logic in students

AUDIT 1 and 2: VALUE EDUCATION

Course Objectives
Students will be able to
1.Understand value of education and self- development
2. Imbibe good values in students

3. Let the should know about the importance of character

Syllabus

Unit	Content	Hours
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements	4
2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature ,Discipline	6
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity oflabour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature	6
4	Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	6

Suggested reading
1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi
Course outcomes
Students will be able to
1.Knowledge of self-development
2.Learn the importance of Human values
3.Developing the overall personality

AUDIT 1 and 2: CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

	Syllabus	
Units	**Content**	**Hours**
History	**History of Making of the Indian Constitution:** Drafting Committee, (Composition& Working)	4
Preamble	**Philosophy of the Indian Constitution:** Salient Features	4
3	**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.	4
4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4

5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	4
6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggested reading

The Constitution of India, 1950 (Bare Act), Government Publication.

Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

Discuss the passage of the Hindu Code Bill of 1956.

AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives:		
Students will be able to: Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. Identify critical evidence gaps to guide the development.		
Syllabus		
Units	**Content**	**Hours**
1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.	4

2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	2
3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.	4
4	Professional development: alignment with classroom practices and follow-up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes	4
5	**Research gaps and future directions** Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.	2

Suggested reading

Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

Course Objectives

To achieve overall health of body and mind

To overcome stress

Syllabus

Unit	*Content*	*Hours*
1	Definitions of Eight parts of yog. (Ashtanga)	8
2	Yam and Niyam. Do`s and Don'ts in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	8

Suggested reading

'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami YogabhyasiMandal, Nagpur

"Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

Develop healthy mind in a healthy body thus improving social health also

Improve efficiency

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

To learn to achieve the highest goal happily

To become a person with stable mind, pleasing personality and determination

To awaken wisdom in students

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue) Verses- 52,53,59 (dont's) Verses- 71,73,75,78 (do's)	8

2	Approach to day to day work and duties. ShrimadBhagwadGeeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	8
3	Statements of basic knowledge. ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. ShrimadBhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	8

Suggested reading

"Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Bhartrihari's Three Satakam (Niti-sringar-vairagya) by

P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

The person who has studied Geeta will lead the nation and mankind to peace and prosperity
Study of Neetishatakam will help in developing versatile personality of students.