

M. Tech.(VLSI & Embedded System Design) Programme Structure

First Semester				
Sl. No	Course Code	Course Title	L-T-P	Credit
1	VLM101	Program Core - I RTL Simulation and Synthesis with PLDs	3-0-0	3
2	VLM102	Program Core - II Microcontrollers and Programmable Digital Signal Processors	3-0-0	3
3	VLM111 VLM112 VLM113	Program Elective - I Digital Signal and Image Processing/ Programming Languages for Embedded Software/ VLSI signal processing	3-0-0	3
4	VLM121 VLM122 VLM123	Program Elective - II Parallel Processing System Design with Embedded Linux CAD of Digital System	3-0-0	3
5	VLM105	Research Methodology and IPR	2-0-0	2
6	VLM106	Audit Course- 1	2-0-0	0
7	VLM107	Laboratory - I RTL Simulation and Synthesis with PLDs Lab	0-0-4	2
8	VLM108	Laboratory - II Microcontrollers and Programmable Digital Signal Processors Lab	0-0-4	2
Total Credits				18

Audit course 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

VLM101	RTL Simulation and Synthesis with PLDs (3-0-0)	3 Credits
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Module-1: Top down approach to design, Design of FSMs (Synchronous and asynchronous), Static timing analysis, Meta-stability, Clock issues, Need and design strategies for multi-clock domain designs.

Module-2: Design entry by Verilog/VHDL/FSM, Verilog AMS.

Module-3: Programmable Logic Devices, Introduction to ASIC Design Flow, FPGA, SoC, Floor planning, Placement, Clock tree synthesis, Routing, Physical verification, Power analysis, ESD protection.

Module-4: Design for performance, Low power VLSI design techniques. Design for testability.

Module-5: IP and Prototyping: IP in various forms: RTL Source code, Encrypted Source code, Soft IP, Netlist, Physical IP, Use of external hard IP during prototyping.

Text Books:

1. Richard S. Sandige, "Modern Digital Design", MGH, International Editions.
2. Donald D Givone, "Digital principles and Design", TMH
3. Charles Roth, Jr. and Lizy K John, "Digital System Design using VHDL", Cengage Learning.
4. Samir Palnitkar, "Verilog HDL, a guide to digital design and synthesis", Prentice Hall.
5. Doug Amos, Austin Lesea, Rene Richter, "FPGA based prototyping methodology manual", Xilinx
6. Bob Zeidman, "Designing with FPGAs & CPLDs", CMP Books.

VLM102	Microcontrollers and Programmable Digital Signal Processors (3-0-0)	3 Credits
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Module-1: ARM Cortex-M3 processor: Applications, Programming model - Registers, Operation modes, Exceptions and Interrupts, Reset Sequence Instruction Set, Unified Assembler Language, Memory Maps, Memory Access Attributes, Permissions, Bit-Band Operations, Unaligned and Exclusive Transfers. Pipeline, Bus Interfaces

Module-2: Exceptions, Types, Priority, Vector Tables, Interrupt Inputs and Pending behaviour, Fault Exceptions, Supervisor and Pendable Service Call, Nested Vectored

Interrupt Controller, Basic Configuration, SYSTICK Timer, Interrupt Sequences, Exits, Tail Chaining, Interrupt Latency.

Module-3: LPC 17xx microcontroller- Internal memory, GPIOs, Timers, ADC, UART and other serial interfaces, PWM, RTC, WDT

Module-4: Programmable DSP (P-DSP) Processors: Harvard architecture, Multi port memory, architectural structure of P-DSP- MAC unit, Barrel shifters, Introduction to TI DSP processor family

Module-5: VLIW architecture and TMS320C6000 series, architecture study, data paths, cross paths, Introduction to Instruction level architecture of C6000 family, Assembly Instructions memory addressing, for arithmetic, logical operations, Code Composer Studio for application development for digital signal processing, On chip peripherals , Processor benchmarking

Text Books:

1. Joseph Yiu, “The definitive guide to ARM Cortex-M3”, Elsevier, 2nd Edition
2. Venkatramani B. and Bhaskar M. “Digital Signal Processors: Architecture, Programming and Applications” , TMH , 2nd Edition
3. Sloss Andrew N, Symes Dominic, Wright Chris, “ARM System Developer's Guide: Designing and Optimizing”, Morgan Kaufman Publication
4. Steve furber, “ARM System-on-Chip Architecture”, Pearson Education
5. Frank Vahid and Tony Givargis, “Embedded System Design”, Wiley
6. Technical references and user manuals on www.arm.com, NXP Semiconductor www.nxp.com and Texas Instruments www.ti.com

VLM111	Digital Signal and Image Processing (3-0-0)	3 Credits
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Module-1: Review of Discrete Time signals and systems, Characterization in time and Z and Fourier - domain, Fast Fourier Transform algorithms - In-place computations, Butterfly computations, bit reversal's.

Module-2: Digital Filter design: FIR - Windowing and Frequency Sampling, IIR - Impulse invariance, bilinear Transformation.

Module-3: Fixed point implementation of filters - challenges and techniques.

Module-4: Digital Image Acquisition, Enhancement, Restoration. Digital Image Coding and Compression - JPEG and JPEG 2000.

Module-5: Color Image processing - Handling multiple planes, computational challenges.

Module-6: VLSI architectures for implementation of Image Processing algorithms, Pipelining.

Text Books:

1. J.G. Proakis, Manolakis “Digital Signal Processing”, Pearson, 4th Edition
2. Gonzalez and Woods, “Digital Image Processing”, PHI, 3rd Edition
3. S. K. Mitra. “Digital Signal Processing - A Computer based Approach”, TMH, 3rd Edition, 2006.
4. A K. Jain, “Fundamentals of Digital Image Processing”, Prentice Hall
5. Keshab Parhi, “VLSI Digital Signal Processing Systems - Design and Implementation”, Wiley India

VLM112	Programming Languages for Embedded Software (3-0-0)	3 Credits
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Module-1: Embedded ‘C’ Programming - Bitwise operations, Dynamic memory allocation, OS services - Linked stack and queue, Sparse matrices, Binary tree - Interrupt handling in C, Code optimization issues - Writing LCD drives, LED drivers, Drivers for serial port communication - Embedded Software Development Cycle and Methods (Waterfall, Agile)

Module-2: Object Oriented Programming - Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, objects, classes, data members, methods, data encapsulation, data abstraction and information hiding, inheritance, polymorphism

Module-3: CPP Programming: ‘cin’, ‘cout’, formatting and I/O manipulators, new and delete operators, Defining a class, data members and methods, ‘this’ pointer, constructors, destructors, friend function, dynamic memory allocation

Module-4: Overloading and Inheritance: Need of operator overloading, overloading the assignment, overloading using friends, type conversions, single inheritance, base and derived classes, friend classes, types of inheritance, hybrid inheritance, multiple inheritance, virtual base class, polymorphism, virtual functions

Module-5: Templates: Function template and class template, member function templates and template arguments, Exception Handling: syntax for exception handling code: try-catch- throw, Multiple Exceptions.

Module-6: Scripting Languages Overview of Scripting Languages - PERL, CGI, VB Script, Java Script. PERL: Operators, Statements Pattern Matching etc. Data Structures, Modules, Objects, Tied Variables, Inter process Communication Threads, Compilation & Line Interfacing.

Text Books:

1. Michael J. Pont , “Embedded C”, Pearson Education, 2nd Edition, 2008
2. Randal L. Schwartz, “Learning Perl”, O’Reilly Publications, 6th Edition 2011
3. A Michael Berman, “Data structures via C++”, Oxford University Press, 2002
4. Robert Sedgewick, “Algorithms in C++”, Addison Wesley Publishing Company, 1999
5. Abraham Silberschatz, Peter B, Greg Gagne, “Operating System Concepts”, John Willey & Sons, 2005

VLM113	VLSI Signal Processing (3-0-0)	3 Credits
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Module-1: Introduction to DSP systems, Pipelined and parallel processing.

Module-2: Iteration Bound, Retiming, unfolding, algorithmic strength reduction in filters and Transforms.

Module-3: Systolic architecture design, fast convolution, pipelined and parallel recursive and adaptive filters, Scaling and round off noise.

Module-4: Digital lattice filter structures, bit level arithmetic, architecture, redundant arithmetic.

Module-5: Numerical strength reduction, synchronous, wave and asynchronous pipe lines, low power design.

Module-6: Programmable digit signal processors.

Text Books:

1. Keshab K. Parthi[A1] , VLSI Digital signal processing systems, design and implementation[A2] , Wiley, Inter Science, 1999.
2. Mohammad Isamail and Terri Fiez, Analog VLSI signal and information processing, McGraw Hill, 1994
3. S Y. Kung, H.J. White House, T. Kailath, VLSI and Modern Signal Processing, Prentice Hall, 1985.
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VLM121	Parallel Processing (3-0-0)	3 Credits
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Module-1: Overview of Parallel Processing and Pipelining, Performance analysis, Scalability

Module-2: Principles and implementation of Pipelining, Classification of pipelining processors, Advanced pipelining techniques, Software pipelining

Module-3: VLIW processors Case study: Superscalar Architecture- Pentium, Intel Itanium Processor, Ultra SPARC, MIPS on FPGA, Vector and Array Processor, FFT Multiprocessor Architecture

Module-4: Multithreaded Architecture, Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions

Module-5: Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Shared Memory Programming, Data Parallel Programming, Parallel Software Issues

Module-6: Operating systems for multiprocessors systems Customizing applications on parallel processing platforms

Text Books:

1. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing", MGH International Edition
2. Kai Hwang, "Advanced Computer Architecture", TMH
3. V Rajaraman, L. Sivaram Murthy, "Parallel Computers", PHI.
4. William Stallings, "Computer Organization and Architecture, Designing for performance" Prentice Hall, Sixth edition
5. Kai Hwang, Zhiwei Xu, "Scalable Parallel Computing", MGH
6. David Harris and Sarah Harris, "Digital Design and Computer Architecture", Morgan Kaufmann.

VLM122	System Design with Embedded Linux (3-0-0)	3 Credits
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Module-1: Embedded Linux Vs Desktop Linux, Embedded Linux Distributions

Module-2: Embedded Linux Architecture, Kernel Architecture - HAL, Memory manager, Scheduler, File System, I/O and Networking subsystem, IPC, User space, Start-up sequence

Module-3: Board Support Package Embedded Storage: MTD, Architecture, Drivers, Embedded File System Embedded Drivers: Serial, Ethernet, I2 C, USB, Timer, Kernel Modules

Module-4: Porting Applications Real-Time Linux: Linux and Real time, Programming, Hard Real-time Linux

Module-5: Building and Debugging: Kernel, Root file system Embedded Graphics

Module-6: Case study of uClinux

Text Books:

1. Karim Yaghmour, "Building Embedded Linux Systems", O'Reilly & Associates
2. P Raghvan, Amol Lad, SriramNeelakandan, "Embedded Linux System Design and Development", Auerbach Publications
3. Christopher Hallinan, "Embedded Linux Primer: A Practical Real World Approach", Prentice Hall, 2nd Edition, 2010.
4. Derek Molloy, "Exploring BeagleBone: Tools and Techniques for Building with Embedded Linux", Wiley, 1st Edition, 2014.

VLM123	CAD of Digital System (3-0-0)	3 Credits
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Module-1: Introduction to VLSI Methodologies - Design and Fabrication of VLSI Devices, Fabrication Process and its impact on Design.

Module-2: VLSI design automation tools - Data structures and basic algorithms, graph theory and computational complexity, tractable and intractable problems.

Module-3: General purpose methods for combinational optimization - partitioning, floor planning and pin assignment, placement, routing.

Module-4: Simulation - logic synthesis, verification, high level Synthesis.

Module-5: MCMS-VHDL-Verilog-implementation of simple circuits using VHDL

Text Books:

1. N A. Sherwani, "Algorithms for VLSI Physical Design Automation".
2. S H. Gerez, "Algorithms for VLSI Design Automation.

VLM105	Research methodology & IPR (2-0-0)	2 Credits
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Module I:

Introduction to RM: Meaning and significance of research. Importance of scientific research in decision making. Types of research and research process. Identification of research problem and formulation of hypothesis. Research Designs.

Module II:

Measurement and Data Collection. Primary data, Secondary data, Design of questionnaire ; Sampling fundamentals and sample designs. Measurement and Scaling Techniques.

Module III:

Data Analysis : Hypothesis testing; Z-test, t-test, F-test, Chi-square test. Analysis of Variance, Non-parametric Test – Sign Test, Run test, Krushall – Wallis test.

Report Writing and Presentation: Research Report, Types and significance, Structure of research report, Ethical issues in research, Presentation of report.

Module-IV

Introduction to Intellectual property: Introduction, types of intellectual property, importance of intellectual property rights.

Trade Marks: Purpose and function of trade marks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration

Module -V:

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Text Books & References:

1. Research Methodology, C.R.Kothari
2. Research Methodology, Chawla and Sondhi, Vikas
3. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
4. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, Tata Mc Graw Hill Publishing Company Ltd.

VLM107	RTL Simulation and Synthesis with PLDs Laboratory (0-0-4)	2 Credits
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List of Experiments:

1. Verilog implementation of 8:1 Mux/Demux, Full Adder, 8-bit Magnitude comparator, Encoder/decoder, Priority encoder, D-FF, 4-bit Shift registers (SISO, SIPO, PISO, bidirectional), 3-bit Synchronous Counters, Binary to Gray converter, Parity generator.
2. Sequence generator/detectors, Synchronous FSM – Mealy and Moore machines.
3. Vending machines - Traffic Light controller, ATM, elevator control.
4. PCI Bus & arbiter and downloading on FPGA.
5. UART/ USART implementation in Verilog.
6. Realization of single port SRAM in Verilog.
7. Verilog implementation of Arithmetic circuits like serial adder/ subtractor, parallel adder/subtractor, serial/parallel multiplier.
8. Discrete Fourier transform/Fast Fourier Transform algorithm in Verilog.

VLM108	Microcontrollers and Programmable Digital Signal Processors Laboratory (0-0-4)	2 Credits
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List of Experiments:

Part A) Experiments to be carried out on Cortex-M3 development boards and using GNU tool chain

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.

Audit Courses 1 & 2: English for Research Paper Writing

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Unit - I : (4 Hours)

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit - II : (4 Hours)

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit - III : (4 Hours)

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit - IV : (4 Hours)

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,

Unit - V : (4 Hours)

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit - VI : (4 Hours)

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Audit Courses 1 & 2: Disaster Management

Course Objectives: -

Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. 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.

Unit – I : (4 Hours)

Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit – II : (4 Hours)

Repercussions Of Disasters And Hazards: Economic Damage, Loss Of 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.

Unit – III : (4 Hours)

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

Unit – IV : (4 Hours)

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.

Unit – V : (4 Hours)

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.

Unit – VI :

(4 Hours)

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.

Suggested readings:

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies”,Deep &Deep Publication Pvt. Ltd., New Delhi.

Audit Courses 1 & 2: Sanskrit for Technical Knowledge

Course Objectives:

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

Unit – I :

(8 Hours)

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Unit – II :

(8 Hours)

Order, Introduction of roots, Technical information about Sanskrit Literature.

Unit – III :

(8 Hours)

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

Course Outcome:

Students will be able to

1. Understanding basic Sanskrit language

2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

Suggested reading

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

Audit Courses 1 & 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

Unit – I :

(4 Hours)

- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.

Unit – II :

(6 Hours)

- Moral and non- moral valuation. Standards and principles.
- Value judgements
- 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

Unit – III :

(6 Hours)

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- 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

Unit – IV :

(6 Hours)

- 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

Course outcomes:

Students will be able to:

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

Suggested reading

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Audit Courses 1 & 2: Constitution of India

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. 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.
3. 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.

Unit – I :

(4 Hours)

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)

Unit – II :

(4 Hours)

Philosophy of the Indian Constitution: Preamble Salient Features

Unit – III :**(4 Hours)**

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.

Unit – IV :**(4 Hours)**

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

Unit – V :**(4 Hours)**

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

Unit – VI :**(4 Hours)**

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.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. 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.
4. Discuss the passage of the Hindu Code Bill of 1956.

Suggested reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Audit Courses 1 & 2: Pedagogy Studies

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Unit - I : (4 Hours)

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.

Unit - II : (2 Hours)

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit - III : (4 Hours)

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.

Unit - IV : (4 Hours)

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

Unit - V : (2 Hours)

Research gaps and future directions: Research design, Contexts. Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what

conditions, and with what population of learners?

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

Suggested Reading:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. 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.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Audit Courses 1 & 2: Stress Management by Yoga

Course Objectives

1. To achieve overall health of body and mind
2. To overcome stress

Unit – I : **(4 Hours)**

Definitions of Eight parts of yog. (Ashtanga)

Unit – II : **(4 Hours)**

Yam and Niyam.

Do`s and Don`t`s in life.

- (i) Ahinsa, satya, astheya, bramhacharya and aparigraha
- (ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit – III : **(4 Hours)**

Asan and Pranayam

- (i) Various yog poses and their benefits for mind & body
- (ii) Regularization of breathing techniques and its effects-Types of pranayam

Suggested Reading:

1. 'Yogic Asanas for Group Training-Part-I' :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency.