NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution– Affiliated to Anna University, Chennai)

K.R.NAGAR, KOVILPATTI–628503

www.nec.edu.in

REGULATIONS-2019

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABI

M.E.–EMBEDDED SYSTEM TECHNOLOGIES

SEMESTER I

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern
THEORY AND INTEGRATED COURSES								
1.	PCC	19ES11C	ARM CortexM3 Architecture	3	0	0	3	A
2.	PCC	19ES12C	Design of Embedded System	3	0	0	3	A
3.	PCC	19ES13C	Research Methodology and IPR	2	0	0	2	B
4.	PEC		Elective – I	3	0	0	3	A
5.	PEC		Elective – II	3	0	0	3	A
6.	AC-1		Audit Course – I	2	0	0	0	D
PRACTICAL COURSES								
7.	PCC	19ES14C	Microcontroller Interfacing Laboratory	0	0	4	2	-
8.	PCC	19ES15C	Device Driver Programming Laboratory	0	0	4	2	-
Total				**16**	**0**	**8**	**18**	

SEMESTER II

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern
THEORY AND INTEGRATED COURSES								
1.	PCC	19ES21C	Embedded Linux	3	0	0	3	A
2.	PCC	19ES22C	Software for Embedded system	3	0	0	3	A
3.	PEC		Elective – III	3	0	0	3	A
4.	PEC		Elective – IV	3	0	0	3	A
5.	AC-2		Audit Course – II	2	0	0	0	D
PRACTICAL COURSES								
6.	PCC	19ES23C	Embedded LINUX Programming Laboratory	0	0	4	2	-
7.	PCC	19ES24C	Machine Learning Laboratory	0	0	4	2	-
8.	PCC	19ES25C	Mini Project with Seminar	0	0	4	2	-
				14	**0**	**12**	**18**	

PCC – Programme Core Course, PEC – Programme Elective Course, OEC – Open Elective Course, AC – Audit Course

SEMESTER III

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern
THEORY AND INTEGRATED COURSES								
1.	PEC		Elective - V	3	0	0	3	A
2.	OEC		Open Elective	3	0	0	3	A
3.	PEC		Elective - VI	3	0	0	3	A
PRACTICAL COURSES								
4.	PCC	19ES31C	Project Work – I	0	0	20	10	-
				9	**0**	**20**	**19**	

SEMESTER IV

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern
PRACTICAL COURSES								
1.	PCC	19ES41C	Project Work – II	0	0	32	16	-
				0	**0**	**32**	**16**	

TOTAL CREDITS TO BE EARNEDFOR THE AWARD OF THE DEGREE - 71

ELECTIVE COURSES

S. No.	Course Code	Course Title	L	T	P	C	Question pattern
1.	19ES01E	CISC Microcontroller	3	0	0	3	A
2.	19ES02E	Automotive Embedded Systems	3	0	0	3	A
3.	19ES03E	Advanced Embedded Systems	3	0	0	3	A
4.	19ES04E	Protocols and Architectures for Wireless Sensor Networks	3	0	0	3	A
5.	19ES05E	VLSI Architecture and Design Methodologies	3	0	0	3	A
6.	19ES06E	Robotics and Control	3	0	0	3	A
7.	19ES07E	Embedded Wireless Sensor Networks	3	0	0	3	A

S. No.	Course Code	Course Title	L	T	P	C	Question pattern
8.	19ES08E	Embedded System Security	3	0	0	3	A
9.	19ES09E	Distributed Embedded Computing	3	0	0	3	A
10.	19ES10E	Machine Learning	3	0	0	3	A
11.	19ES11E	Internet of Things	3	0	0	3	A
12.	19ES12E	Semiconductor Device Modeling	3	0	0	3	A
13.	19ES13E	Radar Signal Processing	3	0	0	3	A
14.	19ES14E	Modern Wireless Communications	3	0	0	3	A
15.	19ES15E	Signal Integrity for High-speed Design	3	0	0	3	A
16.	19GD01E	Business Analytics	3	0	0	3	A
17.	19GD02E	Industrial Safety	3	0	0	3	A
18.	19GD03E	Operations Research	3	0	0	3	A
19.	19GD04E	Cost Management of Engineering Projects	3	0	0	3	A
20.	19GD05E	Composite Materials	3	0	0	3	A
21.	19GD06E	Waste to Energy	3	0	0	3	A

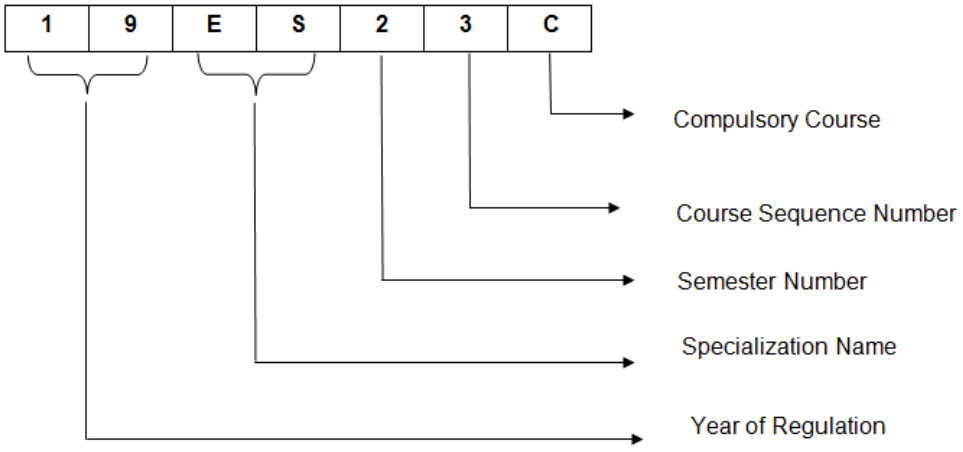
AUDIT COURSES

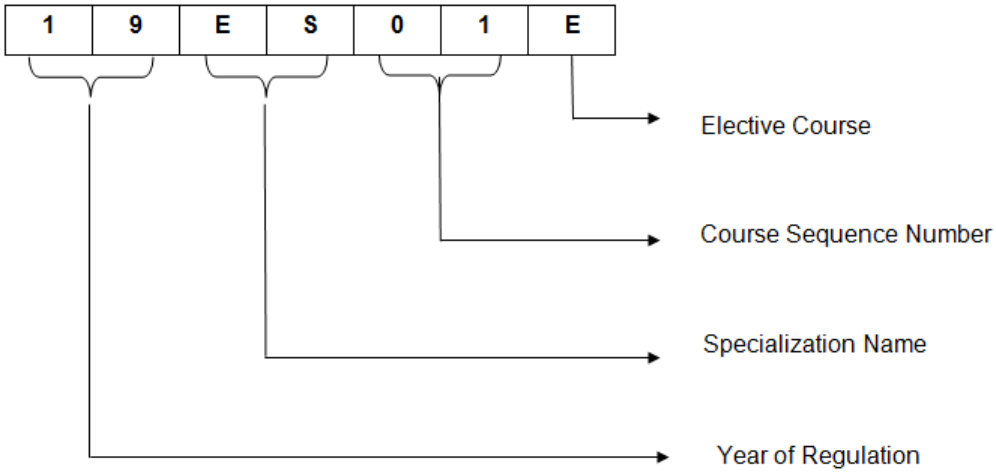
S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern
1	AC	19AC01E	English for Research Paper Writing	2	0	0	0	D
2	AC	19AC02E	Disaster Management	2	0	0	0	D
3	AC	19AC03E	Sanskrit for Technical Knowledge	2	0	0	0	D
4	AC	19AC04E	Value Education	2	0	0	0	D
5	AC	19AC05E	Constitution of India	2	0	0	0	D
6	AC	19AC06E	Pedagogy Studies	2	0	0	0	D
7	AC	19AC07E	Stress Management by Yoga	2	0	0	0	D
8	AC	19AC08E	Personality Development through Life Enlightenment Skills	2	0	0	0	D

QP - QUESTION PATTERN

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	20 marks	Total
Theory (3/4 Credit)	A	10	5	--	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
Theory (2 Credit)	B	10	-	-	1 Qn Compulsory & 4Qn (either or type)			75
Theory (1 Credit)	C	5	--	1 Qn Compulsory & 1 Qn (either or type)	--	--	--	30
Theory Trans Disciplinary	D	--	--	--	--	--	5 out of 8	100
Design oriented	E	--	--	--	--	--	1 Qn Compulsory & 4 Qns (either or type)	100
10,11 and 12 marks questions will be a single question and no subdivisions								

FORMAT FOR COURSE CODE

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Elective Course
Course Sequence Number
Specialization Name
Year of Regulation

19ES11C ARM CORTEX M3 ARCHITECTURE

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain the background of ARM Cortex M3 Processor. (K2)
CO 2: Illustrate about the various instructions of ARM Cortex M3 Processor. (K3)
CO 3: Explain about the memory mapping of ARM Cortex M3 Processor. (K2)
CO 4: Discuss about the debugging scheme of ARM Cortex M3 Processor. (K2)
CO 5: Write the programs with CMSIS of ARM Cortex M3 Processor. (K3)

UNIT I ARM CORTEX – M3 PROCESSOR 9

Overview of ARM Architecture Versions –Cortex family variants- Cortex-M3 Architecture– Cortex-M3 program example.

UNIT II INSTRUCTION SET 9

Cortex-M3 Instruction Set overview– Unsupported Instructions– Moving Data Instructions – Pseudo Instructions – Data Processing Instructions– Unconditional Branch Instructions – Decision and Conditional Branch Instructions – Combined Compare and Conditional Branch Instructions – Instruction Barrier and Memory Barrier Instructions Saturation Operations – Useful Instructions - simple programs.

UNIT III MEMORY SYSTEMS 9

Memory System Features – Memory Access Attributes – Bit Band Operations– Advantagesof Exclusive Accesses – Endian Mode – Pipeline – Bus Interfaces – Other Interfaces – Types of Exceptions – Vector Tables – Fault Exceptions – Interrupt Control – Software InterruptsInterrupt Latency – Faults related to Interrupts – Memory Protection Unit – Registers –– SYSTICK Timer – Power Management – Multiprocessor Communication – Self-Reset Control.

UNIT IV DEBUGGING ARCHITECTURE 9

Debugging Features – Coresight Overview – Debug Modes – Debugging Events – Accessing Register Content in Debug – Trace System – Trace Components – DWT, ITM, ETM and TPIU Flash Patch and Breakpoint Unit – Advanced High-Performance Bus Access Port – ROM Table.

UNIT V CORTEX - M3 PROGRAMMING 9

Overview- A typical Development Flow - Simple programs using C - CMSIS: Background, areas of standardization, Organization, Benefits – simple programs for Cortex-M3-Bit band operation-concept of bit field extract and table branch.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Daniel Tabak, “Advanced Microprocessors”, McGraw Hill. Inc., 2nd Edition, 1996.
2. Joseph Yiu, “The Definitive Guide to the ARM Cortex-M3”, Elsevier, 2nd Edition, 2010.
3. Andrew N.Sloss, Dominic Symes, Chris Wright, “ARM System Developer’s Guide-Designing and Optimizing System Software”, Morgan Kaufmann, 1st Edition, 2004.
4. SteaveFurber, “ARM System-On-Chip Architecture”, Addison Wesley, 2nd Edition, 2000.
5. Daniel W. Lewis, “Fundamentals of Embedded Software with the ARM Cortex-M3”, Prentice Hall, 1st Edition, 2012.

19ES12C DESIGN OF EMBEDDED SYSTEM

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain the basic concepts, Building Blocks of Embedded System. (K2)
CO 2: Discuss about the serial data communication and interrupt mechanism. (K2)
CO 3: Explain about the task management using RTOS. (K3)
CO 4: Use GNU C to develop embedded application. (K3)
CO 5: Write the programs for character device driver. (K3)

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems –Classifications- selection of embedded processor-on chip processor memory types- external EEPROM interfacing for data storage–data representation and its orientation in memory concept- data manipulation in registers using logical operations- real world analog and digital sensor data conversion -Timer concept and Real Time Clock.

UNIT II EMBEDDED NETWORKING AND INTERRUPT MECHANISM 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – CAN – Inter Integrated Circuits (I^2C) – Difference between interrupt and exception-Programmed-I/O busy-wait approach without interrupt service mechanism- interrupt sources in Cortex M3 processor- simple programs using external and internal interrupt.

UNIT III RTOS BASED EMBEDDED SYSTEM DESIGN 9

Concept of user space and kernel space - Introduction to basic concepts of RTOS- Task, thread &process, context switching interrupt routines in RTOS- Multiprocessing and Multitasking- Preemptive scheduling and -rate monotonic scheduling policy with examples- Task management scheme in µC/OS-II with examples -Interprocess Communication using semaphores and Mailbox with examples

UNIT IV SOFTWARE FOR EMBEDDED SYSTEMS 9

Concept of different software programs associated with embedded system design-Introduction to GCC - Debugging with GDB - Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using *gprof* - Memory Leak Detection with *valgrind* - Introduction to GNU C Library-simple make file scripts.

UNIT V DEVICE DRIVER CONCEPTS 9

Classification of different device drivers-Introduction to character driver – Development environment – procedure for character driver development in Linux environment - simple character driver programs.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Rajkamal, “Embedded system-Architecture, Programming, Design”, TMH,2011.
2. Tammy Noergaard, ”Embedded System Architecture, A comprehensive Guide for Engineers and Programmers”, Elsevier, 2006
3. Lyla B Das,” Embedded Systems-An Integrated Approach”,Pearson2013
4. www.gnu.org
5. M. Tim Jones ,“GNU/Linux Application Programming” Charles River Media programming series, 2008
6. Sreekrishnan Venkateswaran, “Essential Linux Device Drivers”, Prentice Hall,2008

19ES13C RESEARCH METHODOLOGY AND IPR **L T P C QP**
2 0 0 2 B

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand research problem formulation. (K2)
CO2: Analyze research related information. (K4)
CO3: Understand the research ethics. (K2)
CO4: Understanding that when IPR would take such important place in growth of individuals & Nation. (K2)
CO5: Recognize the importance of Report writing. (K2)

UNIT I RESEARCH FORMULATION AND DESIGN 6

Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review - primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.

UNIT II DATA COLLECTION AND ANALYSIS 6

Method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statistical package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.

UNIT III RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING 6

Ethics - ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual Property rights (TRIPS); scholarly publishing - IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

UNIT IV CONTEMPORARY ISSUES IN IPR 6

Interface between IPR and Human Rights -Interface between IPR and Competition Law -IPR and sustainable development – Impact of Internet on IPR - IPR of Biological systems & E-Commerce.

UNIT V INTERPRETATION AND REPORT WRITING 6

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., “An introduction to Research Methodology”, RBSA Publishers, 2015.
2. Kothari, C.R., “Research Methodology: Methods and Techniques”, New Age International, 2018.
3. Wadehra, B.L. “Law relating to patents, trademarks, copyright designs and geographical indications”. Universal Law Publishing, Reprint, 2011.
4. Anthony, M., Graziano, A.M. and Raulin, M.L., Research Methods: A Process of Inquiry, Allyn and Bacon 2012.
5. Carlos, C.M., Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York, 2000.

19ES14C MICROCONTROLLER INTERFACING LABORATORY

L	T	P	C
0	0	4	2

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO 1: Perform interfacing on chip and peripherals with Cortex M processor. (K2)

List of Experiments

1. Time delay program using built in Timer / Counter feature
2. External Interrupt based decision taking system
3. Ultrasonic sensor Interface
4. Displaying a message in a 2 line X 16 Characters LCD display
5. ADC and Temperature sensor LM 35 Interface
6. 1^2C Interface – 7 Segment display
7. GPIO interface using CMSIS
8. Serial communication using CMSIS
9. ENCODER interface using CMSIS
10. Wi-Fi communication using Wi-Fi modules

P: 60; TOTAL: 60 PERIODS

19ES15C DEVICE DRIVER PROGRAMMING LABORATORY L T P C
0 0 4 2

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO1: Write simple character driver programs for the external serial peripheral (K3)

List of Experiments

1. Practicing useful Linux commands:
   lsmod,insmode,modprobe,rmmod,dmesg,objdump,nm,cat

2. Write character driver for external LED interfacing.

3. Write character driver for USB to Serial interfacing.

4. Write character driver for UART interfacing.

5. Write character driver for SPI Interfacing.

P: 60; TOTAL: 60 PERIODS

19ES21C EMBEDDED LINUX

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Understandimportant elements of Embedded Linux system (K2)
CO 2: Explain the architecture of .Linux based system (K2)
CO 3: Explain about the build process of embedded Linux system. (K2)
CO 4: Write the kernel modules (K3)
CO 5: Distinguish user space and kernel space programs (K2)

UNIT I COMPONENTS OF EMBEDDED LINUX SYSTEMS 9

Linux-based embedded system components-Reference hardware model-Reference hardware model implementations- CPU memory map- The role of the bootloader-Possible scenarios. An example of bootloader operations - Linux kernel-Device tree-- Typical layout of the root filesystem.

UNIT II ARCHITECTURE OF EMBEDDED LINUX SYSTEM 9

Linux architecture-Conceptual view of the kernel-Process scheduler- Memory manager- external interfaces, Memory manager architecture-Virtual file system, i-node, i-node interface- File interface, Virtual file system architecture- Inter-process communication architecture - Device tree example for the UDOO NEO, Device tree syntax, Device tree content, Device tree addressing-The U-Boot bootloader - UDOO NEO boot process, An example:UDOO NEO boot process.

UNIT III BUILD PROCESS 9

Introduction:The workflow, Build systems- BuildrootvsYocto – general aspects, BuildrootvsYocto – configuration, BuildrootvsYocto – purpose-The YoctoProject:TheYocto build system, The build system workflow- configuration files– user configuration, Metadata, Machine (BSP) configuration-The build system workflow – Distribution policy- source fetching- patching,

The build system workflow – configure/compile/install, The build system workflow – output analysis/packaging-image generation, SDK generation.

UNIT IV INTRODUCTION TO LINUX KERNEL MODULES 9

Introduction:CPU – I/O interface, CPU – I/O interface with polling, CPU – I/O interface with interrupt, CPU – I/O interface, CPU – I/O interface latency- Direct memory access (DMA) architecture, Direct memory access (DMA) transfer modes- The Virtual File System (VFS) abstraction, VFS – an example, VFS functions – include/linux/fs.h-The device file concept, Linux kernel modules: the initialization function, the cdev data structure, the initialization function the clean-up function, custom VFS functions.

UNIT V COMMUNICATION BETWEEN KERNEL AND USERSPACE 9

Introduction:The reference use case, The CPU/Device interface, The module level, The module level – file operations, ioctl() implementation, open()/release() implementation, read() implementation-Passing data to/from the kernel– write() implementation- The module level – communication with the device, Memory mapped I/O- initialization, - clean-up, Memory mapped I/O – read, write- GPIO-based I/O – initialization,– clean-up,– read, write-Interrupts, Requesting the interrupt line, Freeing the interrupt line, The interrupt handler, Interrupt handling, Top-half and bottom-half, Needed support, Work queue, The user level, The user level – the application.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Christoper Collinan, 'Embedded Linux primer ', Prentice Hall, 2006.
2. Richard Jones, "Beginning Linux Programming", Wiley Publishing Inc, 2008.
3. Craig Hollabaugh, "*Embedded Linux: Hardware, Software and Interfacing*", Pearson Education, 2002.
4. http://www.armcommunity.com
5. http://www.arm.com/resources/education/education- kits
6. Doug Abbott, "*Linux for embedded and real time applications*", Elsevier Science, 2003.

19ES22C SOFTWARE FOR EMBEDDED SYSTEM

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Understand elements of C Programming language (K2)
CO 2: Use GNU C to develop embedded software. (K3)
CO 3: Explain about the concept of using C language keywords to embedded programming. (K3)
CO 4: Discuss about the features of eCOS. (K2)
CO 5: Write simple programs with mPython for embedded system.(K3)

UNIT I EMBEDDED PROGRAMMING 9

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers Debugging and Optimization – In-line Assembly

UNIT II C PROGRAMMING TOOL CHAIN IN LINUX 9

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Memory Leak Detection with valgrind - Introduction to GNU C Library

UNIT III EMBEDDED C 9

Adding Structure to 'C' Code: Object oriented programming with C, Header files for Project and Port,Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

UNIT IV EMBEDDED OS 9

Basis of a simple embedded OS-Introduction to eCOS- architecture - Portability issue-Important design considerations when using eCOS **-** Memory requirements - embedding serial communication & scheduling data transmission - Case study: Intruder alarm system

UNIT V PYTHON PROGRAMMING 9

Basics of PYTHON Programming Syntax and Style – Python Objects– Dictionaries – comparison with C programming on Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.-simple programs in mPython for embedded system

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Steve Oualline, 'Practical C Programming 3rd Edition', O'Reilly Media, Inc, 2006.
2. Michael J Pont, "Embedded C", Pearson Education, 2007.
3. Christian Hill, "Learning Scientific Programming with Python", CAMBRIDGE UNIVERSITY PRESS,2016.
4. http://www.ecos.sourceware.org
5. David Griffiths, Dawn Griffiths, "Head First C", O'reilly,2015.

19ES23C EMBEDDED LINUX PROGRAMING LABORATORY L T P C
0 0 4 2

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO 1: Develop kernel modules using yocto build environment (K2)

List of Experiments

1. Introduction to UDOO NEO Board and work space setup
2. Custom embedded Linux system build using manual approach
3. Build simple kernel modules using yocto
4. Handling GPIO using kernel modules
5. Handling HC-SR04 Ranging sensor using kernel modules
6. Cross compile applications using yocto
7. Profile the execution of code using ARM DSS Streamline.

P: 60; TOTAL: 60 PERIODS

19ES24C **MACHINE LEARNING LABORATORY** **L T P C**
0 0 4 2

COURSE OUTCOME

Upon completion of this course, the students will be able to

CO 1: Understand and apply Machine learning concepts (K3)

List of Experiments

1. Consider any standard machine learning dataset. Define and train Neural network model using KERAS .And evaluate KERAS model on validation data set.
2. Consider MNIST (Modified National Institute of Standards and Technology) database. And train a simple multi layer perceptron model on it.
3. Consider MNIST (Modified National Institute of Standards and Technology) database. And to train a K-NN classifier on the raw pixel intensities and then classify unknown digits.
4. Download the open source software of your interest for machine learning. Document the distinct features and functionality of the software platform. You may choose WEKA, R or PYTHON
5. **Supervised Learning – Regression**
   Generate a proper 2-D data set of N points. Split the data set into Training Data set and Test Data set.
   a) Perform linear regression analysis with Least Squares Method.
   b) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error.
   c) Verify the Effect of Data Set Size and Bias-Variance Trade off.
   d) Apply Cross Validation and plot the graphs for errors.
   e) Apply Subset Selection Method and plot the graphs for errors. Describe your findings in each case.
6. **Supervised Learning – Classification**
   Implement Naïve Bayes Classifier and K-Nearest Neighbour Classifier on Data set of your choice. Test and Compare for Accuracy and Precision.
7. **Unsupervised Learning**
   Implement K-Means Clustering and Hierarchical clustering on proper data set of your choice. Compare their Convergence.

P: 60; TOTAL: 60 PERIODS

19ES25C **MINI PROJECT WITH SEMINAR** **L T P C**
0 0 4 2

During the seminar session, each student is expected to prepare and present a topic on Embedded System technology, for duration of about 15 to 20 minutes. Each student is expected to present atleast twice during the semester and the student is evaluated based on the presentation skill, concept and Query clarification. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance also. The seminar will be assessed by a committee appointed by the COE.

P: 60; TOTAL: 60 PERIODS

19ES01E CISC MICROCONTROLLER L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain the architecture of Renesas RX62N Microcontroller (K2)
CO 2: Understand the serial communication features of RX62N Microcontroller. (K2)
CO 3: Write interfacing programs with onchiptimer blocks. (K3)
CO 4: Write programs using the concepts of interrupt mechanism. (K3)

UNIT I ARCHITECTURE OF THE RENESAS RX62N MICROCONTROLLER 9

Architecture of the Renesas RX62N -data types – Endianness- Data Arrangement – Bus Specification – Advanced Concepts : Pipelining, Operating Modes, Memory Organization, Memory Map, I/O Registers.

UNIT II SERIAL COMMUNICATIONS 9

Basic Concepts of Serial Communications – Introduction to the RX62N Serial Communication Interfacing Renesas Serial Peripheral Interface , Renesas Inter Integrated Circuit Bus -Advanced concepts Applying FIFO Data Structures for Transmission and Reception using the UART Serial Communications Interface – Multiprocessor Communication Using Queues and the Renesas Serial Peripheral Interface – Transfer of data between peripherals connected on the I2C bus using FIFOs.

UNIT III EVENT COUNTERS, TIMERS AND REAL TIME CLOCK 9

Basic concepts Timer and Event Counter , Cascading Timers ,Pulse output Operation - Real Time Clock – Basic Examples of Setting Up cascaded Timers, Timer of Pulse Output , Reading from the Real Time Clock – Advanced Concepts using a cascaded Timer with 16 Bit Timer Constant Registers – Advanced examples using a cascaded Timer with 16 Bit Timer Constant Registers-simple programs

UNIT IV WATCHDOG TIMER & BROWNOUT DETECTOR 9

Basic Concepts of Watchdog Timer – Watchdog Timer, Register Descriptions – Operations of Watchdog Timer – Advanced Concepts of Watchdog timer – Interval Timer Mode, Independent Watchdog Timer – Brownout Condition – Detection.

UNIT V INTERRUPTS WITH PERIPHERALS 9

Basic concepts using Interrupts for Tasks versus Other Methods – Interrupts, Interrupt Vector Table, Interrupt Operation, Setting up an Interrupt for a Peripheral – Basic Examples of Polling a Switch for Input versus using an Interrupt - Brief Introduction to State Machines - simple programs.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. James Conrad, ‘Embedded Systems, an Introduction Using the Renesas Rx62n Microcontroller’ Micrium Publisher, 2011
2. James Conrad, ‘Advanced Embedded Systems concepts Using the Renesas Rx62n Microcntroller’ Renesas Books, 2014
3. Jean Labrosse, ‘ucosIII:Realtime kernel for Renesas Rx62n Microcontroller’ Micrium Publisher, 2011
4. https://www.renesas.com/

19ES02E AUTOMOTIVE EMBEDDED SYSTEMS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Describe various components associated with ECU unit (K2)
CO2: Understand various ARM board interconnection mechanism(K2)
CO 3: Identify various sensors needed for control parameters sensing (K2)
CO 4: Discuss electronic ignition system (K2)
CO 5: Explain the bus protocols in automotive control (K3)

UNIT I ELECTRONICS IN THE AUTOMOBILE 9

Introduction- Body and convenience electronics - vehicle power supply controllers and lighting modules, door control modules, Safety electronics - active safety systems: ABS, ASR, ESP passive safety systems: Restraint systems and their associated sensors in an automobile.- Powertrain Electronics:Gasoline engine management, Infotainment electronics: Dashboard/instrument cluster, car audio, telematic systems navigation systems multimedia systems cross application technologies.

UNIT II DRIVE BY WIRE 9

Challenges and opportunities of X-by-wire: system & design requirements, steer-by-wire, brake-by-wire, suspension-bypwire, gas-by-wire , power-by-wire, shift by wire.

UNIT III HARDWARE MODULES 9

Basic sensor arrangement, types of sensors such as- oxygen sensors, crank angle position sensors- Fuel metering vehicle speed sensors and destination sensors, Attitude sensor, Flow sensor, exhaust temperature, air mass flow sensors. Throttle position sensor, solenoids, stepper motors, relays.

UNIT IV ELECTRONIC IGNITION SYSTEMS 9

Electronic ignition systems. ypes of solid state ignition systems and their principle of operation Digital engine control system. Open loop and closed loop control system, Engine cranking and warm up control. Accelerationenrichment. Deceleration learning and ideal speed control Distributor less ignition – Integrated engine control system, Exhaust emission control engineering.

UNIT V BUS PROTOCOLS IN AUTOMOTIVE CONTROL 9

Flex Ray Protocol-Protocol Architecture and application,Multiprocessor communication using CAN bus, Case study- cruise control of car, Artificial Intelligence and engine management.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Frank Vahid and Tony Givargi ,“Embedded System Design: A unified Hardware / Software Introduction” , Wiley India Publishers,2006
2. Patrick R. Schaumont, “A Practical Introduction to Hardware/Software Co-Design”,Springer Publishers,2010.
3. Nicolas Navet and Francoise Simonot -Lion, “Automotive Embedded Systems hand Book”, Taylor & Francis Group, CRC Press / BSP Books, 2013.

19ES03E ADVANCED EMBEDDED SYSTEMS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Describe the concepts of embedded cyber physical modeling (K2)
CO 2: Explain the system modeling and partitioning of hardware and software (K2)
CO 3: Analyze the hardware &software co-synthesis and concurrent design process models. (K3)
CO 4**:** Understand the analysis and verification of cyber physical modeling (K2)

UNITI INTRODUCTION TOEMBEDDED CYBER PHYSICALMODELING 9

Introduction – Modeling Dynamic Behaviors – Continuous Dynamics – Newtonian Mechanics, Actor Models, Properties of system, Feedback Control – Discrete Dynamics – Discrete systems, The notion of state, Finite-State Machines, Extended State Machines, Non determinism, Behaviors and Traces – Hybrid systems – Modal Models, Classes of Hybrid systems.

UNIT II SYSTEM MODELLING WITH HARDWARE/SOFTWARE PARTITIONING 9

Embedded systems Hardware/Software Co-Design - System Specification and modeling , Single-processor Architectures &Multi-Processor Architectures, comparison of Co Design Approaches, Models of Computation, Requirements for Embedded System Specification, Hardware/Software Partitioning Problem, Hardware/Software Cost Estimation, Generation of Partitioning by Graphical modeling, Formulation of the HW/SW scheduling, Optimization.

UNIT III HARDWARE/SOFTWARE CO-SYNTHESIS 9

The Co-Synthesis Problem, State - Transition Graph, Refinement and Controller Generation, Distributed System Co-Synthesis.

UNITIV CONCURRENT PROCESS MODELS AND HARDWARESOFTWARECO-DESIGN 9

Modes of operation - Finite state machines models - HCFSL and state charts language – state machine models - Concurrent process model - Concurrent process communication - Synchronization among process - Implementation- Data Flow model - Automation synthesis - Hardware software co-simulation - IP cores - Design Process Model.

UNIT V ANALYSIS AND VERIFICATION OF CYBER PHYSICAL MODELING 9

Invariants and Temporal Logic – Invariants, Linear Temporal Logic, Equivalence and Refinement – Models as specifications, Type Equivalence and Refinement, Language Equivalence and Containment, Simulation, Bisimulation.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Edward Ashford Lee and Sanjit Arunkumar Seshia, “Introduction to Embedded Systems - A Cyber-Physical Systems Approach”, 2nd Edition, MIT Press, 2016.
2. David. E. Simon, "An Embedded Software Primer", Pearson Education, 2001.
3. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier,2006
4. Raj Kamal, "EmbeddedSystems - Architecture, Programmingand Design”, Tata McGraw Hill, 2006.
5. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & Sons, 2002.
6. Jorgen Staunstrup, Wayne Wolf, "Hardware/Software Co-Design: Principles and Practice", Kluwer Academic Pub, 1997.
7. Giovanni De Micheli, Rolf Ernst Morgon, “Readingin Hardware/Software Co - Design”, Kaufmann Publishers, 2001.

19ES04E PROTOCOLS AND ARCHITECTURE OFWIRELESS SENSOR NETWORKS

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3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Discuss the basic concepts and architecture of wireless sensor networks. (K2)
CO 2: Explain different network protocols. (K2)
CO 3: Explain infrastructure establishment for WSN Networks. (K3)

UNIT I ARCHITECTURE 9

Challenges for Wireless Sensor Network-Single node architecture-Energy consumption of sensor nodes-Some examples of sensor nodes-Sensor network scenarios-Optimization goals and figure of merit-Gateway concepts.

UNIT II PHYSICAL LAYER 9

Frequency allocation -Modulation and Demodulation-Wave propagation effects and noise-Channel models-Energy usage profiles-Choice of modulation scheme-Dynamic modulation scaling.

UNIT III MAC AND LINK PROTOCOLS 9

Fundamentals of MAC protocols-Low duty cycle protocol and wakeup concepts-Contention based protocols-Schedule based protocols-IEEE 802.15.4 MAC protocols-Error control protocols.

UNIT IV ROUTING PROTOCOLS 9

Gossiping and agent based unicast forwarding-Energy efficient unicast-Broadcast and Multicast - Geographic routing -Mobile nodes.

UNIT V INFRASTRUCTURE ESTABLISHMENT 9

Topology control – Clustering-Time synchronization-Localization and Positioning Sensor Tasking and Control - Medicine and Health care-Environmental disaster monitoring.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.
3. BhaskarKrishnamachari, “Networking Wireless Sensors”, Cambridge Press, 2005.
4. Mohammad IlyasAndImadMahgaob, “Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems”, CRC Press, 2005.
5. Wayne Tomasi, “Introduction to Data Communication and Networking”, Pearson Education, 2007.

19ES05E EVLSI ARCHITECTURE AND DESIGN METHODOLOGIES L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1 : Design CMOS Transistor level circuit for the given logic (K2)
CO2 : Explain the VLSI design aspects of operational amplifier (K2)
CO3 : Distinguish different FPGA Architectures (K2)
CO4 :Explain the concepts of ASIC (K2)
CO5 : Write the Verilog coding for digital circuits (K3)

UNIT I CMOS DESIGN 9

Overview of digital VLSI design methodologies - Logic design with CMOS transmission gate circuits-Clocked CMOS-dynamic CMOS circuits, Bi-CMOS circuits- CMOS IC technology - Stick diagram for all basic gates, Layout diagram for Inverter.

UNIT II ANALOG VLSI DESIGN 9

Introduction to analog VLSI- Design of 2 stage and 3 stage Op Amp -High Speed and High frequency Op Amps-Super MOS-Analog primitive cells.

UNIT III PROGRAMMABLE LOGIC DEVICES 9

Generic Architecture of FPGA – Functional blocks - I/O blocks – Interconnects - Programming Techniques - Anti fuse – SRAM-EPROM and EEPROM technology – Spartan VI: Functional Block Diagram and features - Cyclone V: Functional Block Diagram and features

UNIT IV ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENTAND ROUTING 9

System partitioning - Partitioning methods- floor planning – placement and routing - global routing - detailed routing - detailed routing - special routing- circuit extraction – Design Rule checker.

UNIT V VERILOG HDL 9

Introduction to Verilog HDL, hierarchical modeling concepts, modules and port definitions, gate level modeling, data flow modeling, behavioral modeling, task & functions, Verilog Simulation and synthesis, Verilog coding for Carry Look ahead adder, Multiplier, ALU, Shift Registers using structural modeling – Multiplexer, Sequence detector Traffic light controller using behavioralmodeling.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. M.J.S Smith, "Application Specific integrated circuits", Pearson Education, 5th Reprint, 2008.
2. Kamran Eshraghian, Douglas A. Pucknelland Sholeh Eshraghian, "Essentials of VLSI circuits and system", Prentice Hall India, 2005.
3. Wayne Wolf, “Modern VLSI design”, Pearson Education, 3rd Edition, 2007.
4. Mohamed Ismail, TerriFiez, "AnalogVLSI Signal and information Processing", McGraw Hill International Editions, 1994.
5. SamirPalnitkar, "Verilog HDL, A Design guide to Digital and Synthesis", Pearson, 2nd Edition, 2005.

19ES06E ROBOTICS AND CONTROL L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Define the basic robot terminologies. (K1)
CO 2: Discuss the concepts of kinematics and Jacobians in robot control (K1)
CO 3: Explain the basis of robot dynamics (K2)
CO 4: Discuss the path planning and robot control techniques (K1)

UNIT I INTRODUCTION AND TERMINOLOGIES 9

Definition - Classification - History - Robots components - Degrees of freedom - Robot joints coordinates- Reference frames - workspace-Robot languages-actuators - sensors- Position, velocity and acceleration sensors -Torque sensors-tactile and touch sensors - proximity and range sensors –social issues.

UNIT II KINEMATICS 9

Mechanism-matrix representation-homogenous transformation-DH representation – Inverse kinematics-solution and programming-degeneracy and dexterity.

UNIT III DIFFERENTIAL MOTION AND PATHPLANNING 9

Jacobian-differential motion of frames-Interpretation-calculation of Jacobian-Inverse Jacobian-Robot Path planning.

UNIT IV DYNAMIC MODELLING 9

Lagrangian mechanics- Two - DOF manipulator- Lagrange-Euler formulation – Newton Euler formulation – Inversedynamics.

UNIT V ROBOT CONTROLSYSTEM 9

Linear control schemes- joint actuators- decentralized PID control- computed torquecontrol– force control- hybrid position force control- Impedance/ Torque control.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. R.K. Mittal and I J Nagrath, “Robotics and Control”, Tata McGraw Hill, 4th Reprint, 2003.
2. Saeed B. Niku, "Introduction to Robotics ", Pearson Education,2002
3. K.S.Fu, R.C.Gonzalez and C.S.G.Lee, "Robotics Control, Sensing, Vision and Intelligence", Tata McGraw Hill, 2nd Reprint,2008.
4. R.D.Klafter, TA Chmielewski and Michael Negin, "Robotic Engineering, An Integrated approach", Prentice Hall of India, 2003.
5. Reza N.Jazar, “Theory of Applied Robotics Kinematics, Dynamics and Control”, Springer, 1st Indian Reprint, 2010.

19ES07E EMBEDDED WIRELESS SENSOR NETWORKS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Explain the basics of wireless sensor networks. (K2)

CO 2: Discuss about the sensor network components, architecture and design principles of WSN (K2)

CO 3: Explain the need of Physical layer design challenges and MAC Protocals(K2)

CO 4: Design the Smart Sensors and Applications of WSN(K3)

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Challenges for Wireless Sensor Networks - Characteristics requirements - Required mechanisms, Difference between mobile ad-hoc and sensor networks- Enabling Technologies for Wireless Sensor Networks.Single-Node Architecture - Hardware Components - Energy Consumption Sensor Nodes Operating Systems and Execution Environments - Sensor node Examples: EYES, MICA, MICAZ motes.

UNIT II NETWORK ARCHITECTURE 9

Sensor Network Scenarios – Optimization goals and Figure of Merit – Design principles for WSNs – Gateway concepts.

UNIT III PHYSICAL LAYER AND MAC PROTOCALS 9

Wireless Channel and communication fundamentals – Physical layer and transceiver design considerations in WSN – Fundamentals of MAC Protocals- Low duty cycle protocals and wakeup concepts – Contention based protocals - Schedule based protocals – IEEE 802.15.4 MAC protocol.

UNIT IV SMART SENSORS 9

Introduction to Smart Sensors – Signal Conditioning Circuits – Architecture of Smart Sensors Humidity Sensors – Soil Moisture Sensors– Temperature Sensors – Color Sensors – LevelSensors.

UNIT V APPLICATIONS AND PROTOCOL IMPLEMENTATIONONWSN 9

Home control - Medical Applications - Civil and Environmental Engineering applications – Wildfire monitoring - Habitat monitoring. Embedding LEACH protocol on ARM7 TDM microcontroller using embedded C language - Embedding Cryptographic algorithms on ARM 7 TDM microcontroller using embedded C language – FPGA based customizable event driven architecture.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier,2007.
2. Kazem Sohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks- Technology, Protocols and Applications”, John Wiley,2012.
3. Anna Hac, “Wireless Sensor Network Designs”, John Wiley,2003.
4. BhaskarKrishnamachari, “Networking Wireless Sensors”, Cambridge Press,2005.
5. Mohammad Ilyas and ImadMahgaob, “Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems”, CRC Press, 2005.

19ES08E EMBEDDED SYSTEM SECURITY L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Gain the knowledge of cryptographic concepts in the context of Embedded system.(K2)
CO 2: Understand public key encryption techniques and applications of secure hash functions.(K2)
CO 3: Categorize attacks and threats related to the system and its defense mechanism.(K2)
CO 4:Deliberate the format and functionality of different Network Security Protocols (K2)
CO 5: Realize the principle aspects of a comprehensive security strategy in Embedded systems. (K2)

UNIT I SYMMETRIC CIPHERS 9

OSI Security Architecture - Security Services, SecurityAttacks, Security Mechanism.Overview - Classical Encryption Techniques - Block Ciphers and the Data Encryption standard Introduction to Finite Fields - Advanced Encryption standard – Contemporary Symmetric Ciphers - Confidentiality using Symmetric Encryption.

UNIT II PUBLIC-KEY ENCRYPTION ANDHASHFUNCTIONS 9

Introduction to Number Theory - Public-Key Cryptography and RSA - Key Management - DiffieHellman Key Exchange - Elliptic Curve Cryptography - Hash Functions – Hash Algorithm - SHA-1 – Digital Signatures.

UNIT III SYSTEM SECURITY 9

Introduction - Access Control, Intrusion Detection and Prevention. Firewalls: Firewall Design Principles - Firewall Characteristics, Types of Firewalls. Trusted System. Malicious Softwares: Virus, Trojan Horse, Ad ware/ Spy ware, Worms, Logic Bomb.Cyber Law and Forensics - IT ACT 2000, Cyber Forensics.

UNIT IV NETWORK SECURITY 9

Introduction to Network Concepts, OSI Layers and Protocols, Network Devices,Network layer Security (IPSec) - IP Security Overview, IPSec Architecture,Authentication header, Encapsulating security Payload, Combining SecurityAssociations, Key management. Transport Layer Security - SSL/TLS, SET. ApplicationLayer Security - Authentication Applications, Kerberos, X. 509 Authentication Services.E-mail Security – PGP, S/MIME.

UNIT V EMBEDDED SECURITY 9

Introduction, Types of Security Features – Physical, Cryptographic, Platform. Kinds ofDevices – CDC, CLDC. Embedded Security Design, Keep It Simple and StupidPrinciple, Modularity Is Key, Important Rules in Protocol Design, Miniaturization ofsecurity, Wireless Security, Security in WSN.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. William Stallings, "Cryptography and Network Security - Principles And Practices", Pearson Education, 3rdEdition, 2003.
2. AtulKahate, "Cryptography and Network Security", Tata McGraw Hill,2003
3. Bruce Schneier, "Applied Cryptography", John Wiley and Sons Inc, 2001.
4. C.SivaRam Murthy, B.S.Manoj, “Adhoc Wireless Networks: Architectures and Protocols”, Prentice Hall, 2004.
5. Timothy Stapko, “Practical Embedded Security: Building Secure Resource Constrained Systems” -, Publisher Newnes.
6. Mai, "Modern Cryptography: Theory and Practice", Pearson Education, 1st Edition, 2003.

19ES09E DISTRIBUTED EMBEDDED COMPUTING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Discuss the hardware infrastructure of distributed system. (K2)
CO 2: Explain the concepts of internet (K2)
CO 3: Describe streaming, serialization and networking in JAVA (K2)
CO 4: Explain about embedded agent and co-ordination mechanisms (K3)
CO 5: Discuss the architecture of embedded computing and design methodologies (K2)

UNIT I THE HARDWARE INFRASTRUCTURE 9

Broad Band Transmission facilities – Open Interconnection standards – Local Area Networks – Wide Area Networks – Network management – Network Security – Cluster computers.

UNIT II INTERNETCONCEPTS 9

Capabilities and limitations of the internet – Interfacing Internet server applications to corporate databases HTML and XML Web page design and the use of active components.

UNIT III DISTRIBUTED COMPUTING USING JAVA 9

IO streaming – Object serialization – Networking – Threading – RMI – multicasting distributed databases – embedded java concepts – case studies.

UNIT IV EMBEDDED AGENT 9

Introduction to the embedded agents – Embedded agent design criteria – Behaviour based, Functionality based embedded agents – Agent co-ordination mechanisms and benchmarks embedded-agent. Case study: Mobile robots.

UNITV EMBEDDED COMPUTING ARCHITECTURE 9

Synthesis of the information technologies of distributed embedded systems – analog/digital co-design – optimizing functional distribution in complex system design – validation and fast prototyping of multiprocessor system-on-chip – a new dynamic scheduling algorithm for real-time multiprocessor systems.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Deitel & Deitel, “JAVA How to Program”, Prentice Hall, 10th Edition,2014.
2. Sape Mullender, “Distributed Systems”, Addison-Wesley,1993.
3. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems – Concepts and Design”, Pearson Education, 4th Edition,2009.
4. Bernd Kleinjohann, “Architecture and Design of Distributed Embedded Systems”, C - lab, Universitat Paderborn, Germany, Kluwer Academic Publishers, Boston, April 2001, 248pp.

19ES10E MACHINE LEARNING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1:Understand the concept of how to learn patterns and concepts from data (K2)
CO 2: Explore unsupervised learning paradigms of machine learning. (K2)
CO3:Understand thespecific features of reinforcement learning (K2)
CO 4: Discuss Machine learning in IOT applications. (K2)
CO 5: Discuss Machine learning applications across industries (K3)

UNIT I SUPERVISED LEARNING BASIC METHODS 9

Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification.

UNIT II UNSUPERVISED LEARNING CLUSTERING 9

K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion Generative Models (mixture models and latent factor models)
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests).

UNIT III REINFORCEMENT LEARNING 9

Need and specific features of reinforcement learning-Markov decision-Montecorlo prediction-Case study: Next best offer, Dynamic pricing.- Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

UNIT IV MACHINE LEARNING FOR IOT APPLICATIONS 9

Recent trends in various learning techniques of machine learning and classification methods for IOT applications, Introduction to Various models for IOT applications.

UNIT V MACHINE LEARNING APPLICATIONS ACROSS INDUSTRIES 9

Machine Learning Applications across Industries (Healthcare, Manufacturing, Hospitality)-Study on Cloud Based ML offerings.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Kevin Murphy, ‘Machine Learning: A Probabilistic Perspective’, MIT Press, 2012.
2. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, “The Elements of StatisticalLearning”, 2nd Edition, Springer, 2009.

19ES11E INTERNET OF THINGS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Understand the architectural elements of IOT system (K2)
CO 2: Identify different protocols of IOT system. (K2)
CO 3: Understand the functional elements of IOT system (K2)
CO 4: Explore ARM IOT Platforms. (K2)
CO 5: ExplaindifferentIoT applications (K3)

UNIT I INTRODUCTION 9

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT Middleware for IoT: Overview – Communication middleware for IoT : Open Sensor Web Architecture.

UNIT II IoT PROTOCOLS 9

Protocol Standardization for IoT – Efforts –Binary Web Service (BWS) protocol -M2M and WiFi Protocols – TinyREST Protocols –Unified Data Standards – Protocols – IEEE 802.15.4

UNIT III ELEMENTS OF IoT 9

IoT system functional diagram- Three functional elements: Hardware (made up of sensors, actuators and embedded communication hardware), middleware (on demand storage and computing tools for data analytics), Presentation (to understand visualization and interpretation tools which can be widely accessed on different platforms and which can be designed for different applications) Enabling technologies for functional elements of IoT: Radio Frequency Identification (RFID) , Wireless Sensor Networks monitoring scheme, Addressing schemes such as Uniform Resource Name (URN) system and IPv6, Data storage and analytics, Visualization. Communication through Bluetooth and Zigbee –WiFi module for IoT: WiSmart EC19D01.

UNIT IV ARM®mbed™IoT DEVICE PLATFORM 9

Embed platform for IoT:functional block diagram- mbed OS architecture- mbed device driver architecture- mbed tools- mbed for smart home- mbed for wearables.-Introduction about Trillion platform

UNIT V APPLICATIONS 9

Internet of Things for Environment monitoring - Internet of Things for Smart Grid – IoT for Agriculture.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles, “Architecting the Internet of Things”, Springer, 2011.
3. International Journal of Computer Science & Engineering Survey (IJCSES) Vol.2, No.3, August 2011.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
5. CharalamposDoukas, "Building Internet of Things with the Arduino", Create space, April 2002.
6. T. Luckenbach, P. Gober, S. Arbanowski, A. Kotsopoulos, and K. Kim, “TinyREST a protocol for integrating sensor Networks into the internet”, REALWSN, 2005.

7. Angelo P. Castellani,, “Architecture and Protocols for the Internet of Things: A Case Study”, Department of Information Engineering, University of Padova, Italy, 8th IEEE International Conference on Pervasive Computing and Communications, 2010

19ES12E SEMICONDUCTOR DEVICE MODELING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explore the properties of MOS capacitors.
CO2: Analyze the various characteristics of MOSFET devices.
CO3: Describe the various CMOS design parameters and their impact on performance of the device.
CO4: Discuss the device level characteristics of BJT transistors.
CO5: Identify the suitable mathematical technique for simulation.

UNIT I MOS CAPACITORS 9

Surface Potential: Accumulation, Depletion, and Inversion, Electrostatic Potential and Charge Distribution in Silicon, Capacitances in an MOS Structure, Polysilicon-Gate Work Function and Depletion Effects, MOS under Nonequilibrium and Gated Diodes, Charge in Silicon Dioxide and at the Silicon–OxideInterface, Effect of Interface Traps and Oxide Charge on Device Characteristics, High-Field Effects, Impact Ionization and Avalanche Breakdown, Band-to-Band Tunneling, Tunneling into and through Silicon Dioxide, Injection of Hot Carriers from Silicon into Silicon Dioxide, High-Field Effects in Gated Diodes, Dielectric Breakdown.

UNIT II MOSFET DEVICES 9

Long-Channel MOSFETs, Drain-Current Model, MOSFET I–V Characteristics, Subthreshold Characteristics, Substrate Bias and Temperature Dependence of Threshold Voltage, MOSFET Channel Mobility, MOSFET Capacitances and Inversion-Layer Capacitance Effect, Short-Channel MOSFETs, Short-Channel Effect, Velocity Saturation and High-Field Transport Channel Length Modulation, Source–Drain Series Resistance, MOSFET Degradation and Breakdown at High Fields

UNIT III CMOS DEVICE DESIGN 9

MOSFET Scaling, Constant-Field Scaling, Generalized Scaling, Nonscaling Effects, Threshold Voltage, Threshold-Voltage Requirement, Channel Profile Design, Nonuniform Doping, Quantum Effect on Threshold Voltage, Discrete Dopant Effects on Threshold Voltage, MOSFET Channel Length, Various Definitions of Channel Length, Extraction of the Effective Channel Length, Physical Meaning of Effective Channel Length, Extraction of Channel Length by C–V Measurements.

UNIT IV BIPOLAR DEVICES 9

n–p–n Transistors, Basic Operation of a Bipolar Transistor, Modifying the Simple Diode Theory for Describing Bipolar Transistors, Ideal Current–Voltage Characteristics, Collector Current, Base Current, Current Gains, Ideal IC–VCE Characteristics, Characteristics of a Typical n–p–n Transistor, Effect of Emitter and Base Series Resistances, Effect of Base–Collector Voltage on Collector Current, Collector Current Falloff at High Currents, Nonideal Base Current at Low Currents, Bipolar Device Models for Circuit and Time-Dependent Analyses Basic dc Model, Basic ac Model, Small-Signal Equivalent-Circuit Model, Emitter Diffusion Capacitance, Charge-Control Analysis, Breakdown Voltages, Common-Base Current Gain in the Presence of Base–Collector Junction Avalanche, Saturation Currents in a Transistor, Relation Between BVCEO and BVCBO.

UNIT V MATHEMATICAL TECHNIQUES FOR DEVICE SIMULATIONS 9

Poisson equation, continuity equation, drift-diffusion equation, Schrodinger equation, hydrodynamic equations, trap rate, finite difference solutions to these equations in 1D and 2D space, grid generation.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Yuan Taur and Tak H.Ning, "Fundamentals of Modern VLSI Devices", Cambridge University Press, 2016.
2. A.B. Bhattacharyya “Compact MOSFET Models for VLSI Design”, John Wiley & Sons Ltd, 2009.
3. Ansgar Jungel, “Transport Equations for Semiconductors”, Springer, 2009
4. Trond Ytterdal, Yuhua Cheng and Tor A. Fjeldly Wayne Wolf, “Device Modeling for Analog and RF CMOS Circuit Design”, John Wiley & Sons Ltd, 2004
5. Selberherr, S., “Analysis and Simulation of Semiconductor Devices”, Springer-Verlag., 1984
6. Behzad Razavi, “Fundamentals of Microelectronics” Wiley Student Edition, 2nd Edition, 2014
7. J P Collinge, C A Collinge, “Physics of Semiconductor devices” Springer, 2002.
8. S.M.Sze, Kwok.K. NG, “Physics of Semiconductor devices”, Springer, 2006.

19ES13E RADAR SIGNAL PROCESSING L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Understand Radar Signal Processing Concepts. (K1)
CO 2: Explain different Target Recognition techniques. (K1)
CO 3: Use Time Frequency analysis for Target recognition. (K2)
CO 4: Use SAR and ISAR images for Target recognition. (K2)

UNIT I INTRODUCTION TO RADAR SYSTEMS 9

Radar signal models - Radar Range Equation - Radar cross section - Range and angular resolution - Distributed Targets - Range Equation - Volume and Area Target Range Equation - RCS of complex targets - Statistical Models of RCS - Swerling RCS models - Noise and Signal to Noise Ratio - Clutter and Jamming - Doppler Shift - Spatial Doppler Shift - Pulsed radar - data acquisition - Nyquist and fast time sampling - Slow time sampling - Range and Doppler ambiguity - Straddle loss - Spatial and angular sampling - I/Q Errors and correction - Digital I/Q .

UNIT II RADAR WAVEFORMS 9

Matched filter - Range Resolution - Matched filtering of moving targets - Ambiguity function - Pulse burst waveform - Pulse burst ambiguity function - Pulse compression - LFM waveform – Side lobe control - Stretch processing - Barker coded waveforms – Poly phase codes - MTI concept - Pulse cancellers - Pulsed Doppler processing - DFT as a matched filter - Ambiguity resolution techniques - Binary integration.

UNIT III CFAR DETECTION 9

Cell Averaging CFAR – Effect of varying PFA – Cell Averaging CFAR concept - CFAR reference windows – Analysis of cell averaging CFAR - Cell averaging CFAR limitations – Extensions to Cell Averaging CFAR – Order Statistics CFAR – Adaptive CFAR - Clutter map CFAR - Distribution free CFAR - Two parameter CFAR - Distribution free CFAR.

UNIT IV FREQUENCY AND TIME DOMAIN ANALYSIS OF RADAR SIGNATURE 9

Helicopter recognition - Blade flash parameters - Detection of blade flash - Extraction of a blade flash from radar data - Helicopter classification using blade flash – Main rotor spectrum - Jet engine recognition - Interaction of radar signal with engine blades - JEM spectrum - Front rotor stage spectrum - Jet engine recognition from JEM spectrum - Spectral analysis and jet engine recognition – Target recognition using Synthetic Aperture Radar and Inverse Synthetic Aperture Radar.

UNIT V HIGH-RESOLUTION RANGE PROFILE AND TARGET RECOGNITION 9

Range profile signature - Aspect angle effects -Target scatterers - Individual scatterers – Scatterer interference effects - Overview of range profiling process - Measurement of target signature - Target signature database - Signature conditioning and recognition algorithms - Applications of Non co -operative target recognition - Fixed wing aircraft with jet engines - Propeller driven aircraft - Helicopters - Ships - Surface based platforms - Airborne platforms - Land vehicles and people - Air breathing missile recognition techniques - Techniques for recognizing ballistic missiles.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Mark A.Richards, James A. Scheer, William A.Holm, “Principles of Modern Radar”, Scitech Publishers, 2012.
2. Mark A.Richards, “Fundamentals of Radar Signal Processing”, 2nd Edition, Mcgraw Hill, 2014.
3. Tait, P, “Introduction to Radar Target Recognition”, Institution of Engineering and Technology, London, 2009.
4. Chen, V.C. Tahmoush. D, Miceli. W.J, “Radar micro-Doppler signature”, Processing and Applications” IET Digital Library, 2014.
5. Chen, V.C., “The Micro-Doppler Effect in Radar”, Artech House, 2011.

19ES14E MODERN WIRELESS COMMUNICATIONS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Apply MIMO basics in recent wireless communication technologies. (K2)

CO 2: Comprehend significance and implementation of mm-Wave communication for the next generation wireless networks. (K2)

CO 3: Understand the concepts of Massive MIMO for new radio. (K2)

CO 4: Understand architecture and physical layer deployment for the fifth generation wireless communication systems. (K2)

CO 5: Understand physical layer concepts of fourth Generation wireless communication system. (K2)

UNIT I MIMO BASICS 9

Fundamentals of multiple antenna theory - Overview- MIMO Signal Model - Single User MIMO techniques – Multi-User MIMO techniques - Capacity of MIMO Communication Systems. MIMO schemes in LTE – Practical considerations.

UNIT II MILLIMETER WAVE COMMUNICATIONS 9

Spectrum and regulations – Channel propagation – Hardware technologies for mmW systems- Deployment scenarios- Architecture and Mobility - Beamforming - Physical layer techniques- Transmission schemes.

UNIT III MASSIVE MIMO COMMUNICATION 9

Multiple Base Station Antennas and MultipleTerminals - single-Cell System and Multi-Cell System, Capacity, Pilot design, Resource allocation and transceiver algorithms, Fundamentals of baseband and RF implementations, Channel models.

UNIT IV 5G ARCHITECTURE AND RADIO ACCESS TECHNOLOGIES 9

High level requirements for 5G Architecture - Functional architecture and 5G flexibility- Physical architecture and 5G deployment- Non orthogonal schemes for effective multiple access.

UNIT V LTE and LTE ADVANCED 9

Comparison of LTE (Release 8) and LTE Advanced (Release 10) – LTE downlink- LTE uplink-LTE Modulation schemes-Carrier aggregation-Throughput for LTE SISO link and LTE Advanced 8x 8 MIMO link-LTE Frame structure-Logical and Physical Channels.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Andreas F.Molisch, “Wireless Communications”, John Wiley & Sons Ltd, 2016.
2. Stefania Sesia, Issam Toufik, Matthew Baker, “LTE- The UMTS Long Term Evolution”, John Wiley & Sons Ltd, 2011.
3. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, 2016.
4. Simon Haykin , Michael Moher, David Koilpillai, “Modern Wireless Communication”, First Edition, Pearson Education 2013.
5. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education 2012.
6. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.

WEB REFERENCE

1. http://download.ni.com/evaluation/rf/Introduction_to_LTE_Device_Testing.pdf

19ES15E SIGNAL INTEGRITY FOR HIGH-SPEED DESIGN

L	T	P	C	QP
3	0	0	3	A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Explore the signal propagation on transmission lines. (K2)
CO2: Analysis the different factors related to cross talk. (K2)
CO3: Understand the effect of switching pattern. (K2)
CO4: Understand concept of vias on multi conductor system. (K2)
CO5: Explore system power delivery and parametric analysis. (K3)

UNIT I SIGNAL PROPAGATION ON TRANSMISSION LINES 9

Issues on signal Integrity-Characteristic impedance-Propagation velocity-Propagation delay-Time delay-Reflection coefficient-Lattice diagrams-Microstrip and strip lines-Termination schemes – Layer stack up

UNIT II CROSS TALK 9

Near end cross talk-Far end cross talk-Coupling due to electric field-Coupling due to magnetic field – Inductance matrix for multi conductor system – Capacitance matrix for multi conductor system - Minimization of far end and near end cross talks

UNIT III EFFECT OF SWITCHING PATTERN 9

Pulse generation: Even and odd mode – Equivalent circuit for even and odd mode capacitance – Equivalent circuit for even and odd mode inductance – Characteristic impedance – Time delay – Problems – Coupling coefficient – Differential signaling – Terminations: Pi Termination and T termination – Dispersion – Lossy and loss less multi conductor transmission lines

UNIT IV VIAS FOR MULTI CONDUCTOR SYSTEM 9

Layer connectivity using vias – Parasitic capacitance – Parasitic inductance – Rise time - Trace pitch – PCB tracks – Problems – Capacitance and Inductance of vias – Distortion – Connectors – Performance measure: Mutual inductance, Series inductance and parasitic capacitance – Measure of radiation – Way to reduce emissions

UNIT V PARAMETRIC ANALYSIS 9

Distribution of uniform voltage – Effect of power supply wiring on gates connected system – Supply and ground rail provisions – Inductance and bypass capacitance of power supply wiring – Trade off between range of frequency and noise – Problems – Power dissipation: Static and dynamic – Inter symbol interference (ISI) - Minimization of ISI – Issue on Clock skew-Fan in – Fan out – Gate delay – Wire delay-Noise margin

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Brain young, “Digital Signal Integrity: Modeling and Simulation with Interconnects and Packages”, Prentice Hall, 2008.
2. H. W. Johnson and M. Graham, High–Speed Digital Design: A Handbook of Black Magic, Prentice Hall, 1993.
3. Douglas Brooks, Signal Integrity Issues and Printed Circuit Board Design, Prentice Hall PTR 2003.
4. S. Hall, G. Hall, and J. McCall, High–Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices, Wiley –Inter science, 2000.
5. Eric Bogatin, Signal and Power Integrity Simplified, Prentice Hall PTR, 2nd Edition 2010

6. Paul G. Huray " The Foundations of Signal Integrity" John Wiley & Sons, Inc., Publication,2010
7. http://www.hottconsultants.com/outlines/ad-si.html
8. http://www.electrical-integrity.com/Links.html

19GD01E BUSINESS ANALYTICS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Understand the importance of business analytics in an organization and understand relationships between business analytics process and organization decision making process. (K1)

CO2: Study the data analytics process and issues (K2)

CO3: Study the descriptive analytics and predictive analytics for business data (K2)

CO4: Use decision-making models for formulation of decision theory. (K2)

UNIT I BUSINESS ANALYTICS 9

Overview of Business analytics- Scope of Business Analytics- Business Analytics Process- Relationship of Business Analytics Process and organization- competitive advantages of Business Analytics. Statistical Tools: Statistical Notation- Descriptive Statistical methods-Review of probability distribution and data modeling- Statistical Testing.

UNIT II DATA ANALYTICS PROCESS AND ISSUES 9

Organization/sources of data, Importance of data quality, Dealing with missing or incomplete data Data Mining Process Introduction to Data Mining, Data Classification: Decision trees, Association Analysis: Market Basket Analysis – Data mining tools.

UNIT III DESCRIPTIVE ANALYTICS 9

Introduction, Visualizing and Exploring business data, Descriptive Statistics, Sampling and Estimation: Sampling Methods, Sampling Estimation, Introduction to Probability Distributions, Marketing/Planning Case Study on Descriptive Analytics model.

UNIT IV PREDICTIVE ANALYTICS 9

Introduction, Predictive Modeling: Logic-Driven Models, Data-Driven Models, Data mining for Types of Variation in Time Series Data, Regression Model, Smoothing, Fitting models to Data, Marketing/Planning Case Study on Predictive Analytics model.

UNIT V DECISION THEORY 9

Introduction, Decision Theory Model Elements for business process, Types of Decision Environments, Decision Theory Formulation, Decision-Making Under Certainty, Decision-Making Under Risk, Decision-Making under Uncertainty, Expected Value of Perfect Information, Sequential Decisions and Decision Trees, The Value of Imperfect Information: Bayes's Theorem, Decision Theory Practice Problems.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications, Pearson FT Press, 1st Edition, 2014.
2. James R Evans, "Business Analytics", Pearson Education, 2nd Edition, 2017

19GD02E INDUSTRIAL SAFETY L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: list out important legislations related to health, Safety and Environment. (K1)
CO 2: list out requirements mentioned in factories act for the prevention of accidents. (K1)
CO 3: understand the health and welfare provisions given in factories act. (K2)
CO 4: understand the statutory requirements for an Industry on registration, license and its renewal. (K2)
CO 5: prepare onsite and offsite emergency plan. (K2)

UNIT I INTRODUCTION 9

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

UNIT II FIRE HAZARDS AND PREVENTION 9

Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – fire stoppers –hydrant pipes – hoses – monitors – fire watchers – lay out of stand pipes – fire station-fire alarms and sirens – maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills– notice-first aid for burns. Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards – alarm and detection systems. Other suppression systems – CO2 system, foam system, dry chemical powder(DCP) system, halon system – need for halon replacement – smoke venting. Portable extinguishers –flammable liquids – tank farms – indices of inflammability-fire fighting systems.

UNIT III BIOLOGICAL AND ERGONOMICAL HAZARDS 9

Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design. Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck- back injuries..

UNIT IV CHEMICAL HAZARDS AND PREVENTION 9

Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education

UNIT V INDUSTRIAL ACTS 9

Statutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes,welfare, working hours, employment of young persons – special provisions – penalties and procedures-Tamilnadu Factories Rules 1950 under Safety and health chapters of Factories

Act 1948 , Occupational Safety and Health act of USA (The Williames - Steiger Act of 1970) – Health and safety work act (HASAWA 1974, UK) – OSHAS 18000 – ISO 14000 – American National Standards Institute (ANSI).

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Practical Industrial Safety, Risk Assessment and Shutdown Systems, 1st Edition, Dave Macdonald, Elsevier publications, 2003
2. Occupational Ergonomics: Practical Approach, Theresa Stack, Lee T.Ostrom, Cheryl A. Wilhelmsen, Wiley Publications, 2016
3. The Handbook of Safety Engineering: Principles and Applications, Frank R. Spellman and Nancy E. Whiting, Government Institutes, 2009
4. Benjamin O.Alli, “Fundamental Principles of Occupational Health and Safety”, ILO Geneva, 2nd Edition, 2008.
5. Danuta Koradecka, Handbook of Occupational Health and Safety, CRC, 2010.
6. National seminar on hazardous waste management organized by National Safety council, Ministry of environment and forests, Government of India, United States – Asia environmental partnership, Tamilnadu pollution control board and Indian chemical manufacturers association, April 2001.

19GD03E OPERATIONS RESEARCH **L T P C QP**
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: apply the dynamic programming to solve problems of discrete and continuous variables. (K2)
CO2: apply the concept of non-linear programming. (K2)
CO3: carry out sensitivity analysis.(K2)
CO4: model the real world problem and simulate it. (K2)

UNIT I INTRODUCTION **9**

Optimization Techniques- Model Formulation- models, General L.R Formulation- Simplex Technique-Sensitivity Analysis

UNIT II LINEAR PROGRAMMING **9**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming-Transportation and Assignment problems

UNIT III NONLINEAR PROGRAMMING PROBLEM **9**

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.

UNIT IV SCHEDULING AND INVENTORY CONTROL MODELS **9**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V FINITE AND INFINITE QUEUING MODELS **9**

Finite Queuing Models: Introduction, Finite Queuing Models, nfinite Queuing Models: Introduction, Queuing Theory, Operating Characteristics of a Queuing System, Constituents of a Queuing System, Service Facility, Queue Discipline

L: 45; TOTAL: 45 PERIODS

REFERENCES

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

19GD04E COST MANAGEMENT OF ENGINEERING PROJECTS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Students should able to apply the dynamic programming to solve problems of discreet and continuous variables. (K1)

CO2: Students should able to apply the concept of non-linear programming Students should able to carry out sensitivity analysis. (K2)

CO 3: Student should able to model the real world problem and simulate(K2)

UNIT 1 **9**

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.

UNIT II **9**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project

UNIT III **9**

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

UNIT IV **9**

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.

UNIT V **9**

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

L: 45;TOTAL: 45 PERIODS

REFERENCES

1. Charles T. Horngren, Srikant M. Datar, “Cost Accounting A Managerial Emphasis”, Prentice Hall of India, 14thEdition,New Delhi. 2011
2. Charles T. Horngren and George Foster,“Advanced Management Accounting”. Pearson Education India; 16thEdition,2013.
3. Ashish K. Bhattacharya, “Principles & Practices of Cost Accounting” A. H. Wheeler publisher,Delhi
4. N.D. Vohra,” Quantitative Techniques in Management”, Tata McGraw Hill Book Co. Ltd.

19GD05E COMPOSITE MATERIALS L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: Identify, describe and evaluate the properties of fibre reinforcements polymer matrix materials and commercial composites. (K1)

CO 2: Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.(K1)

CO 3: Analyse the elastic properties and simulate the mechanical performance of composite laminates; and understand and predict the failure behaviour of fibre-reinforced composite products. (K2)

CO 4: Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project. (K2)

UNIT I INTRODUCTION 9

Definition – Classification and characteristics of Composite materials. Advantages and application of composites- Types of reinforcements and matrices-Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENTS 9

Preparation-layup, curing- properties and applications of glass fibers-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 9

Casting – Solid State diffusion technique,Cladding – Hot isostatic pressing. 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 9

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT V DESIGN AND ANALYSIS OF COMPOSITE MATERIALS 9

Strength: Laminar Failure Criteria-strength ratio- maximum stress criteria-maximum strain 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.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Mechanics of Composite Materials, Autor K Kaw,Taylor & Francis, 2nd Edition, 2006
2. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany,1993
3. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

19GD06E WASTE TO ENERGY L T P C QP
3 0 0 3 A

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: analyze the various aspects of Waste to Energy Management Systems (K2)

CO2: understand biochemical conversion of biomass for energy application, bioenergy systems and process integration.(K2)

CO3: understand the management of e-waste (K2)

UNIT I INTRODUCTION TO WASTE AND WASTE PROCESSING 9

Solid waste sources solid waste sources, types, composition, properties, global warming; Municipal solid waste: Physical, chemical and biological properties, waste collection and, transfer stations, waste minimization and recycling of municipal waste, segregation of waste, size reduction, managing waste, status of technologies for generation of energy from waste treatment and disposal aerobic composting, incineration, furnace type and design, medical waste / pharmaceutical waste treatment technologies, incineration, environmental impacts, measures to mitigate environmental effects due to incineration

UNIT II WASTE TRATMENT AND DISPOSAL 9

Land fill method of solid waste disposal land fill classification, types, methods and sitting consideration, Layout and preliminary design of landfills: Composition, characteristics, generation, movement and control of landfill leach ate and gases, environmental monitoring system for land fill gases.

UNIT III BIO-CHEMICAL CONVERSION 9

Energy generation from waste bio-chemical conversion: Sources of energy generation, anaerobic digestion of sewage and municipal waste, direct combustion of MSW-refuse derived solid fuel. Industrial waste, agro residues and anaerobic digestion.

UNIT IV THERMO-CHEMICAL CONVERSION 9

Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion.

UNIT V E- WASTE MANAGEMENT 9

E-waste: E-waste in the global context: Growth of electrical and electronics industry in India, environmental concerns and health hazards; Recycling e-waste: A thriving economy of the unorganized sector, global trade in hazardous waste, impact of hazardous e-waste in India; Management of e-waste: E-waste legislation, government regulations on e-waste management, international experience, need for stringent health safeguards and environmental protection laws of India.

L: 45; TOTAL: 45 PERIODS

REFERENCES

1. Nicholas P Cheremisinoff, “Handbook of Solid Waste Management and Waste Minimization Technologies”, An Imprint of Elsevier, New Delhi, 2003.
2. Paul Breeze, “Energy from Waste”, An Imprint of Elsevier, New Delhi, 2018.
3. P Aarne Vesilind, William A Worrell and Debra R Reinhart, “Solid Waste Engineering”, 2nd Edition 2002.
4. C Parker and T Roberts (Ed), “Energy from Waste”, An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
5. KL Shah, “Basics of Solid and Hazardous Waste Management Technology”, Prentice Hall, Reprint Edition, 2000.
6. M Datta, “Waste Disposal in Engineered Landfills”, Narosa Publishing House, 1997.

M.E. – EMBEDDED SYSTEM TECHNOLOGIES
AUDIT COURSES

19AC01E ENGLISH FOR RESEARCH PAPER WRITING L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: enhance the knowledge of section wise research improve writing skills and level of readability (K2)

CO2: Learn about what to write in each section (K1)

CO3: Understand the skills needed to draft a perfect research paper (K2)

UNIT I **5**

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

UNIT II **5**

Clarity in main objective, Highlighting the Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, writing Abstracts and Introduction.

UNIT III **5**

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

UNIT IV **5**

Key skills needed to write a Title, Abstract, Introduction skills needed to write a review of the Literature.

UNIT V **5**

Writing methodology and skills needed to write the results and discussion, skills needed to write the conclusions.

UNIT VI **5**

Useful phrases drafting a perfect paper.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Using English for Academic Purposes. A guide for students in higher education, comprises a large collection of links, including writing materials: http://www.uefap.com/.
2. British Association of Lecturers in English for Academic Purposes: http://www.baleap.org.uk/.
3. Goldbort R, Writing for Science, Yale University Press, 2006
4. Day R How to Write and Publish a Scientific Paper, Cambridge University Press, 2011
5. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998.
6. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht

19AC02E DISASTER MANAGEMENT L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and manitarian response.(K2)

CO2: Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. (K2)

CO3: Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. (K2)

CO4. 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 (K2)

UNIT I INTRODUCTION 4

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

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

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 DISASTER PRONE AREAS IN INDIA 6

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 DISASTER PREPAREDNESS AND MANAGEMENT 6

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard-Evaluation Of Risk-Application Of Remote Sensing- Data from Meteorological and other Aaencies-Media Reports-Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT AND DISASTER MITIGATION 8

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.

Meaning: Concept And Strategies Of Disaster Mitigation-Emerging Trends In Mitigation-Structural Mitigation and Non-Structural Mitigation-Programs of Disaster Mitigation In India.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Singhal J.P. "Disaster Management", Laxmi Publications, ISBN-10: 9380386427 ISBN-13: 978-9380386423, 2010.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., ISBN-10: 1259007367, ISBN-13: 978-125900736, 2012.
3. Gupta Anil K, Sreeja S. Nair, "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.

4. Kapur Anu, "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi, 2010.
5. National Disaster Management Plan, 2018, https://ndma.gov.in/images/pdf/NDMP-2018-Revised-Draft-1-2018OCT16-A.pdf
6. National Disaster Management Authority, Government of India, 2018, https://ndma.gov.in/images/pdf/Draft-Guidelines-thunderstorm-final.pdf

19AC03E SANSKRIT FOR TECHNICAL KNOWLEDGE L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Learn the Sanskrit sources of technical knowledge (K1)
CO2: Drawing their attention to a different dimension of Sanskrit literary tradition (K3)
CO3: Create awareness of the contemporary relevance of the Sanskrit sources of traditional wisdom (K3)

UNIT I INTRODUCTION 7

Scope and meaning of study of technical literature in Sanskrit. Different disciplines-interdisciplinary approach-dimensions-contemporary relevance- important works in this direction-scientific methodology in ancient India.

UNIT II AYURVEDA 7

Beginnings of Ayurveda in Atharvaveda-Ayurvedic literature-basic principles of Ayurveda-Pancabhutasiddhanta-Tridosasiddhanta-eight anga-s of Ayurveda- Rasacikitsa-contribution of Kerala to Ayurveda

UNIT III ASTRONOMY AND MATHEMATICS 8

Major texts in Vedic and classical period-Vedangajyotisa-Sulbasutra-s-Aryabhatiya- Aryabhata's contribution-Varahamihira-Brahmagupta-Lalla-etc. Suryasiddhanta- Kerala school Parahita and drk systems-Later astronomical works commentaries.

UNIT IV VASTUSASTRA AND ARTHASASTRA 8

Principles of Vastusastra-Basic texts-Vastuvidya and Ecology-Iconography and sculpture-Kerala tradition of Vastusastra. Arthasastra, a historical and sociaological perspective-structure and contents of the text-emphasis to aspects of agriculture and architecture.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Ramakrishna Mission Institute ,"Cultural Heritage of India", (Vol. i and iii), Calcutta,2010
2. Dr. P. C. Muraleemadhavan and Dr. N. K.Sundareswaran," Sanskrit in Technological Age, (Ed.) ", New Bharatiya Book Corporation, Delhi, 2006
3. https://sanskritdocuments.org/articles/ScienceTechSanskritAncientIndiaMGPrasad.pdf
4. http://www.vedanta.gr/wp-content/uploads/2012/03/3_GlossaryOfCommonSanskrit Terms.pdf

19AC04E VALUE EDUCATION L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Understand the need of values and its classification in contemporary society (K2)
CO2: Become aware of role of education in building value as dynamic social reality. (K1)
CO3: Know the importance of value education towards personal, national and global development. (K1)

UNIT I **10**

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.
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 II **10**

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 III **10**

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.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Sharma, S.P., "Moral and Value Education: Principles and Practices", Kanishka publishers, 2013.
2. Kiruba Charles & V.Arul Selvi.," Value Education", Neelkamal Publications, New Delhi, 2012.
3. Passi, B.K. and Singh, P.,"Value Education", National Psychological Corporation, Agra. 2004.
4. http://cbseportal.com/exam/e-books/download-free-ncert-e-book-education-for-values-in-school-a-framework/
5. http://cbseacademic.in/web_material/ValueEdu/Value%20Education%20Kits.pdf

19AC05E CONSTITUTION OF INDIA L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. (K2)

CO2: 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. (K2)

CO3: 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. (K1)

UNIT I HISTORY AND PHILOSOPHY OF INDIAN CONSTITUTION 6

History-Drafting Committee, (Composition & Working). - Preamble- Salient Features.

UNITII CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 6

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 III ORGANS OF GOVERNANCE 6

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 IV LOCAL ADMINISTRATION 6

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 V ELECTION COMMISSION 6

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.

L: 30; TOTAL: 30 PERIODS

REFERENCES

1. Subhash .C, kashyap "Our Constitution", 5th Edition, 2017
2. www.ieagreements.org/IEA-Grad-Attr-Prof-Competencies.pdf
3. The Constitution of India, 1950 (Bare Act), Government Publication.
4. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
5. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
6. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

19AC06E PEDAGOGY STUDIES L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: Describe the pedagogical practices used by teachers in formal and informal classrooms (K3)

CO2: Understand the effectiveness of these pedagogical practices, in what conditions, and with what population of learners (K2)

CO3: Analyze how teacher education (curriculum and practicum) and the school curriculum with guidance materials support effective pedagogy (K3)

UNIT I INTRODUCTION AND METHODOLOGY 8

Aims and rationale, Policy background, Conceptual framework and terminology-Theories of learning, Curriculum, Teacher education.Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview- Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries- Curriculum- Teacher education.

UNIT II EFFECTIVENESS OF PEDAGOGICAL PRACTICES 8

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 III PROFESSIONAL DEVELOPMENT 7

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 IV RESEARCH GAPS AND FUTURE DIRECTIONS 7

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

L:30; TOTAL:30 PERIODS

REFERENCES

1. Dr.S.K.Bhatia and Dr.Sonia Jindal, “A Text Book Of Curriculum, Pedagogy And Evaluation”,Paragon International Publications, 2016.
2. Ackers J, Hardman F Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261, 2001.
3. Agrawal M ,"Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379,2004.
4. Akyeampong K ," Teacher training in Ghana - does it count?", Multi-site teacher education research project (MUSTER) country report 1. London: DFID,2003.
5. Akyeampong K, Lussier K, Pryor J, Westbrook J ," Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?", International Journal Educational Development, 33 (3): 272–282,2013.
6. Alexander RJ,"Culture and pedagogy: International comparisons in primary education",Oxford and Boston: Blackwell,2001.
7. Chavan M, "Read India: A mass scale, rapid, ‘learning to read’", campaign, 2003.
8. www.pratham.org/images/resource%20working%20paper%202.pdf.

19AC07E STRESS MANAGEMENT BY YOGA L T P C QP
2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: achieve overall health of body and mind (K1)

CO2: overcome stress (K2)

UNIT I INTRODUCTION 10

Introduction to Stress-Concept of Stress-Solutions through Mandukya karika - Relaxation and stimulation combined as the core for stress management-Practice of Stimulation and relaxation.

UNIT II ASAN AND PRANAYAM 10

Definitions of Eight parts of yoga. (Ashtanga)-Various yoga poses and their benefits for mind & body-Regularization of breathing techniques and its effects-Types of pranayam.

UNIT III YOGA AND STRESS MANAGEMENT 10

Concepts and Techniques of Stress Management in Ashtanga Yoga of Patanjali - specific practices for stress management-breathe awareness.

L:30; TOTAL:30 PERIODS

REFERENCES

1. Swami Vivekananda, Advaita Ashrama ,“Rajayoga or conquering the Internal Nature”, 2016.
2. K. N. Udupa**, “**Stress and Its Management by Yoga”, Edited by R.C.Prasad, Motilal Banarashidass Publishers, Delhi, 2010.
3. Lisa Shea,”Yoga for Stress Relief and Forgiveness”, Kindle Edition, 2015.
4. BKS Iyengar, “Yoga: The path to Holstic Health”, DK Publication, 2019
5. https://www.longdom.org/open-access/stress-and-yoga-2157-7595.1000109.pdf

19AC08E	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L T P C QP 2 0 0 0 D

COURSE OUTCOMES

Upon completion of this course, the student will be able to

CO1: learn to achieve the highest goal happily (K1)

CO2: become a person with stable mind, pleasing personality and determination (K1)

CO3: awaken wisdom in students (K1)

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 10

The concept of personality - Dimensions of personality – Theories of Freud & Erickson- Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure-SWOT analysis.

UNIT II LIFE ENLIGHTENMENT SKILLS 10

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).Approach to day to day work and duties, Shrimad Bhagwad Geeta, 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.

UNIT III SHRIMAD BHAGWAD GEETA STATEMENTS 10

Statements of basic knowledge, Shrimad Bhagwad Geeta: Chapter2 Verses 56, 62, 68, Chapter 12 Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta, Chapter2 Verses 17, Chapter3 Verses 36,37,42, Chapter4 Verses 18, 38,39, Chapter18 Verses 37,38,63

L:30; TOTAL:30 PERIODS

REFERENCES

1. Swami Swarupananda Advaita Ashram ,"Srimad Bhagavad Gita" , Publication Department, Kolkata.
2. P.Gopinath, Rashtriya Sanskrit Sansthanam, " Bhartrihari's Three Satakam (Niti-sringar-vairagya) ", New Delhi.