INSTITUTE OF INFORMATION TECHNOLOGY
APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MAKAUT, W.B.
AN ISO 9001 - 2008 & ISO 14001 - 2004 CERTIFIED INSTITUTE
A UNIT OF RCC INSTITUTE OF TECHNOLOGY AN AUTONOMOUS SOCIETY OF DEPARTMENT OF HIGHER EDUCATION, GOVT. OF WEST BENGAL

COURSE BOOKLET
B.TECH,3RDD YEAR
2018-2022 BATCH

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
RCC INSTITUTE OF INFORMATION TECHNOLOGY
CANAL SOUTH ROAD, BELIAGHATA
KOLKATA - 700 015, WEST BENGAL, INDIA

This revised version of Course booklet is being published in accordance with Outcome Based Education (OBE) policy approved by Program Assessment Committee (PAC), Departmental Advisory Board(DAB), Department of Electronics and Communication Engineering (ECE)

Department of Electronics and Communication Engineering

All faculty members associated with Department of Electronics and Communication Engineering, RCCIIT, concerned faculty members of Basic Science and Humanities and the honorable members of DAB, Electronics and Communication Engineering of RCCIIT are acknowledged for their timely support and relevant inputs towards the preparation of this booklet.

Table of Content

About Department:

Department of Electronics and Communication Engineering is successfully running since 2006 with a intake of 60 seats. In 2010 intake increased to 120; from 2012 the department also started 2 years full time PG program in Tele Communication to make a significant contribution in the field of higher studies.

The Department used to organize seminars, development programs, and workshops for faculties, staffs and students in support of incessant development. A pool of competent faculty member of the Department constantly motivates the students to get placed by means of job, research and higher studies; and the outcomes reflect in the achievement.

The pass out students of the ECE Department now associated with pioneer Institutions like North Dakota State University (USA), University of Regina (Canada), College of Medicine Swansea University (UK), University of Illinois, Chicago (USA), University of Buffalo (USA), Texas Tech University, different IITs (Kharagpur, Kanpur, Roorkee, Guwahati), IIM (Kozhikode), IIEST, ISM, Jadavpur University etc. Moreover the students of this Department are also allied with prestigious organizations like BSNL, ECIL, WBSEB, AAI, INTERRA SYSTEM, TCS, CTS, INFOSYS, IBM, ACCENTURE, TECH MAHINDRA, ERICSSON L&T etc. The Department is also involved actively in the frontier research, corroborated by a significant number of research papers in various national and international journals and conferences.

Vision of the Department

Graduates of this department will be part of global academia/industry through sincere professional commitments, research and innovations by ethically considering environmental impacts and societal benefits in the multidisciplinary culture for sustainable development of civilization throughout their career.

Mission of the Department

Mission No.	Mission Statements
M1	Be able to develop sustainable solutions of problems related to electronics and communication engineering as individual or part of a team maintaining professional ethics and environmental aspects.
M2	Be competent to perceive higher studies through research, innovation and managerial skills for integrated life-long learning..
M3	Create leadership qualities through learning beyond classroom, effective communication, inter-personal skill, technological development and innovation for benefit of society

Program Outcome (POs) of the Department

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend andwriteeffective reports and design documentation, make effective presentations, and giveand receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives (PEOs) of the Department

PEO No.	Program Educational Objectives Statements
PEO1	Be competent to solve electronics and communication engineering related problems by applying fundamental principles of natural sciences, domain knowledge using modern tools, techniques and inter-personal skills for early employment in industry/academia.
PEO2	Be part of diverse multinational sectors by continuously interpreting global professional development through innovative research and self-study in subject domain and allied fields as a part of life-long learning.
PEO3	Be qualified to construct professional work using acquired domain knowledge as individual or team-member in global environment pertaining to electronics fulfilling ethical, societal and environmental issues.

Program Specific Outcomes (PSOs)

PSO No.	Program Specific Outcome(PSOs) Statements
PSO1	Investigate the design/development of intra and interdisciplinary complex problems/systems through acquired technical knowledge in the field of electronics and communication engineering using state-of-the-art hardware and software tools.
PSO2	Estimate every multidisciplinary project in the light of professional ethics for societal welfare prior to implementation and keeping the environment safe through teamwork or individual means.
PSO3	Invent novel technical solutions applicable for academia/industry relevant to electronics and communication engineering through complex engineering activities maintaining specified constraints with possible life-long impact.

Correlation between PEOs and Mission of the Department of Electronics & Communication Engineering, RCCIIT

PEO No.	PEO statements	M1	M2	M3
PEO1	Be competent to solve electronics and communication engineering related problems by applying fundamental principles of natural sciences, domain knowledge using modern tools, techniques and inter-personal skills for early employment in industry/academia.	3	2	2
PEO2	Be part of diverse multinational sectors by continuously interpreting global professional development through innovative research and self-study in subject domain and allied fields as a part of life-long learning.	1	3	3
PEO3	Be qualified to construct professional work using acquired domain knowledge as individual or team-member in global environment pertaining to electronics fulfilling ethical, societal and environmental issues.	2	2	3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Odd Semester(V)

Sl.No.	Paper Code	Paper Name	Credit
1.	*EC501*	Electromagnetic Waves	*3*
2.	*EC502*	*Computer Architecture*	*3*
3.	*EC503*	*Digital Communication & Stochastic Process*	*3.5*
4.	*EC504*	Digital Signal Processing	*3*
5.	*PE-EC505*	*Program Elective-1*	*3*
6.	*OE-EC506 A/B/C/D*	*Open Elective-1*	*3*
7.	*EC591*	Electromagnetic Waves Lab	*1*
8.	*EC592*	*Digital Communication Lab*	*1*
9.	*EC593*	Digital Signal Processing Lab	*1*
10.	*MC-HU581*	*Effective Technical Communication*	*0*

Even Semester(VI)

Sl.No.	Paper Code	Paper Name	Credit
1.	*EC601*	Control System & Instrumentation	*3*
2.	*EC602*	*Computer Network*	*3*
3.	*PE-EC603*	*Program Elective-2*	*3*
4.	*OE-EC604*	*Open Elective-2*	*3*
5.	*HS-HU601*	*Economics for Engineers*	*3*
6.	*EC691*	Control System & Instrumentation Lab	*1*
7.	*EC692*	*Computer Network Lab*	*1*
8.	*EC681*	*Mini Project/Electronic Design Workshop*	*2*
9.	*MC681*	*Universal Human Rights*	*0*

Odd Semester(V) Articulation Matrix

Paper Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EC501	3	3	1	2	0	1	1	0	0	0	2	3	3.00	1.00	1.50
EC502	2.84	1.67	1.67	2	1.34	--	--	--	--	--	1.20	1.17	2.67	1.84	1.00
EC503	3.00	2.83	2.17	2.50	1.80	1.00	-	-	-	-	-	1.50	2.83	1.00	1.00
EC504	3	2.83	1.50	1.83	2.67	2	0	0	0	0	0	3.00	3	2	3
PE-EC505D	3.00	2.50	1.40	2.00	1.80	1.70	1.80	--	--	--	--	2.17	3.00	2.50	1.40
OE-EC506 C	3.00	3.00	3.00	0	3.00	0	1.00	0	1.00	0	0	0	1	1	0
EC591	3	3	2	1	2	1.33	1.75	1	2	1	-	1	3	1.67	1
EC592	3.00	3.00	1.67	2.17	2.33	1.00	1.00	-	2.00	1.00	-	2.00	3.00	2.00	1.00
EC593	3	3.00	1.67	3.00	1.67	1.00	0	0	2	1	0	2.50	3	2	2.5
MC-HU581	1.33	1.2	1.8	1.83	1.83	1.6	1.6	2	2.5	3	2.25	1.83	1.60	2.50	1.83

Even Semester(VI) Articulation Matrix

Paper Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EC601	3	2.4	2		2.5	1			1	1		1	3	1.33	1
EC602	3.00	3.00	3.00	1.00	--	1.00	--	2.00	2.00	1.00	--	1.00	2.00	1.00	1.00
PE-EC603C	2.5	2.5	2.4	1.66	2	1.66	2	0	0	0	0	2.166	2.33	1.5	1.33
PE-EC603D	3	2.83	2.67	--	--	1.67	1.50	--	--	--	--	3.00	3.00	2.83	2.67
OE-EC604	3	2	2	1	3	-	-	1	1	-	1	1	1.83	1.2	1.83
HS-HU601	3	3	3	0	3	0	1	0	1	0	0	0	1.00	1.00	0.00
EC691	3.00	2.50	1.83	1.40	2.66	-	-	-	-	-	-	2.00	2.33	1.00	1.00
EC692	3	3.00	1.67	3.00	1.67	1.00	0	0	2	1	0	2.50	3	2	2.5
EC681	3.0	3.0	2.5	2.3	2.5	2.0	2.0	2.5	2.8	3.0	3.0	2.7	2.40	3.00	2.83
MC681	0	1	0	0	0	0	1	1	0	0	0	1	1	1	1

Course Title:Electromagnetic Waves	**Code: EC-501**
Type of Course:Theory	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 marks	**Final Exam:70Marks**
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Prerequisite Courses:

1. Vector calculus
2. Differential and Integral calculus
3. Electrostatics, Magnetostatics

Course Outcomes (CO's) of Electromagnetic Waves

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC-501.CO1	**Relate**thevector calculus, coordinate systems, laws of electrostatics and magneto-statics to realize the behaviour of electromagnetic vector field.	KL2: Understanding
EC-501.CO2	**Analyze**the characteristics of uniform plane wavesto study the wave propagationthrough different media and media interface.	KL4: Analyzing
EC-501.CO3	**Model** transmission lines at high frequencies to explore the propagation phenomena of electromagnetic wave.	KL3: Applying
EC-501.CO4	**Estimate** transmission line parameters under various conditionsfor various applications viz. impedance matching	KL5: Evaluating
EC-501.CO5	**Examine**the different modes associated with metallic waveguides to investigate the nature of electromagnetic wave propagation.	KL4: Analyzing
EC-501.CO6	**Assess**different antenna parameters for realization ofthe radiation characteristics of an antenna	KL5: Evaluating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	2	3	3	1	1
CO2	3	3	1	2	-	1	1	-	-	-	2	3	3	1	1
CO3	3	3	1	2	-	1	-	-	-	-	2	3	3	1	2
CO4	3	3	1	2	-	1	-	-	-	-	2	3	3	1	2
CO5	3	3	1	2	-	1	-	-	-	-	2	3	3	1	1
CO6	3	3	1	2	-	1	1	-	-	-	2	3	3	1	2
AVG	3	3	1	2	0	1	1	0	0	0	2	3	3.00	1.00	1.50

University Syllabus:

Unit	Content	Hrs/Unit
ModuleI	1. Basics of Vectors, Vector calculus, Maxwell's Equations, Basic laws of Electromagnetic, 2. Poynting Vector, Boundary conditions at Media Interface.	6
ModuleII	1. Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wavepolarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Surface current and power loss in a conductor. 2. Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.	8
ModuleIII	1. Transmission Lines- Equations of Voltage and Current on TX line, Propagationconstant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, 2. Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.	8
ModuleIV	1. Wave propagation in parallel planewaveguide, Analysis of waveguide general approach, 2. Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide	6
ModuleV	1. Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, 2. Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna,	6

RESOURCES:

Text Books:

T1.Elements of Electromagnetics by Matthew Sadiku
T2.R.K.Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005

Reference Books:

R1. David Cheng, Electromagnetics, Prentice Hall Text
R2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India

E-Resource (Website link/E-book/Journal/MOOC etc.):

E1.https://drive.google.com/file/d/1pS02l5JoRzxOQh_p-Wdw5Y1yzgCObfto/view

E2.https://www.youtube.com/watch?v=0OwmYAljz4A&list=PL0925FD10648D664E

E3.https://www.youtube.com/watch?v=pGdr9WLto4A&list=PLl6m4jcR_DbOx6s2toprJQx1MORqPa9Rg

Course Title: Computer Architecture	Code: EC502
Type of Course: Theory	Course Designation: Compulsory
Semester: 5th	Contact Hours: 3L/week
Continuous Assessment: 25 marks	
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Digital System Design, Microprocessor & Microcontrollers.

Course Outcomes (CO's) of Computer Architecture

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC502.CO1	***Understand*** the fundamental organization, functional units and performance measurements of a computer system.	**K2: Understand**
EC502.CO2	***Define*** the use of addressing modes, instruction formats and program control statements.	**K1: Remember**
EC502.CO3	***Implement*** proper hardware circuit for arithmetic operations.	**K3: Apply**
EC502.CO4	***Compare*** different designing methodologies of control unit and their impact on CPU performance.	**K4: Analyse**
EC502.CO5	***Discuss*** the hierarchical view of memory organization, mapping techniques and I/O interfacing.	**K2: Understand**
EC502.CO6	***Explain*** the advantages of parallel processing and pipelining in the context of high performance CPU designing.	**K2: Understand**

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	--	--	--	--	--	--	---	1	1	3	1	1
CO2	3	1	1	--	--	--	--	---	--	--	1	1	3	1	1
CO3	2	3	3	3	2	--	--	--	--	--	2	1	2	2	1
CO4	3	3	2	2	1	--	--	--	--	--	--	2	2	3	1
CO5	3	1	1	--	--	--	--	--	--	--	1	1	3	2	1
CO6	3	1	2	1	1	--	--	--	--	--	1	1	3	2	1
AVG	2.84	1.67	1.67	2	1.34	--	--	--	--	--	1.20	1.17	2.67	1.84	1.00

University Syllabus:

Unit	Content	Hrs/Unit
1: Basic Structure of Computers	1. Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Queues, Subroutines 2. Processor organization, Information representation, number formats.	8
2: Computer Arithmetic	Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats.	4
3: Control Unit Design	1. Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. 2. Micro programmed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Micro programmed computers - CPU control unit	10
4: Memory organization and I/O organization	1. RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory. 2. System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces	10
5. Parallel Processing	Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network.	4

RESOURCES:

1. "**Fundamentals of Computer Organization and Architecture**, by M. Abd-El-Barr and H. El-Rewini. 1st Edition, **Wiley-Interscience, 21 April 2008.**
2. Hayes J.P, "Computer Architecture and Organization", PHI, Second edition.
3. Online Nptl tutorials lectures of "Computer Architecture".

Course Title: Digital Communication & Stochastic Process	Code: EC503
Type of Course: Theory	Course Designation: Theory
Semester: 5th	Contact Hours: 3L+1T / week
Continuous Assessment: (30 + 70) marks	
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Basic Probability Theory, Signals and Systems, Analog Communication

Course Outcomes (CO's) of Digital Communication & Stochastic Process

On completion of the course students will be able toDigital Communication & Stochastic Process

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC503.CO1	**Explain** the working principles of digital baseband transmission techniques and related phenomena.	K2: Understanding
EC503.CO2	**Determine** various parameters related to digital baseband transmission techniques.	K5: Evaluating
EC503.CO3	**Interpret** different carrier modulation techniques considering noise aspects.	K5: Evaluating
EC503.CO4	**Identify** different types of stochastic processes in communication systems.	K3: Applying
EC503.CO5	**Evaluate** various parameters related to the stochastic process.	K5: Evaluating
EC503.CO6	**Analyze** signal vector representations and receiver principles.	K4: Analyzing

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	-	-	-	-	-	2	3	1	1
CO2	3	3	3	3	1	-	-	-	-	-	-	1	3	-	1
CO3	3	2	1	1	2	1	-	-	-	-	-	2	2	1	1
CO4	3	3	3	3	2	-	-	-	-	-	-	1	3	-	1
CO5	3	3	3	3	2	-	-	-	-	-	-	1	3	-	1
CO6	3	3	2	2	-	-	-	-	-	-	-	2	3	-	1
AVG	3.00	2.83	2.17	2.50	1.80	1.00	-	-	-	-	-	1.50	2.83	1.00	1.00

University Syllabus:

Unit	Content	Hrs/Unit
1: Introduction to Stochastic Processes (SPs)	Definition and examples of SPs, classification of random processes according to state space and parameter space, elementary problems. Stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density. Definition and examples of Markov Chains, transition probability matrix, Chapman-Kolmogorov equations; calculation of n-step transition probabilities	8
2: Signal Vector Representation	Analogy between signal and vector, distinguishibility of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point , signal constellation, geometric interpretation of signals, likelihood functions,	8

	Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error , error function, complementary error function, Type-I and Type-II errors	
3: Digital Data Transmission	Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and μ -law companding, differential PCM, delta modulation and adaptive delta modulation. Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction	10
4: Digital Modulation Techniques	Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PSK, Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-aryPSK, power spectra of MPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset Quadrature Phase shift Queuing (OQPSK), Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram, Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA)	10

GATE syllabus mapping:

GATE syllabus content	**Mapping unit of university syllabus**
Basic control system components; Feedback principle;	Module 1
Transfer function; Block diagram, representation; Signal flow graph	Module 2
Transient and steady-state analysis of LTI systems	Module 3
Routh-Hurwitz and root-locus plots	Module 4
Frequency response; Bode Plot	Module 5
Nyquist stability criteria	Module 6
Lag, lead and lag-lead compensation	Module 7
State variable model and solution of state equation of LTI systems	Module 8

RESOURCES:

Text Books:

T1. Digital Communications, S. Haykin, Wiley India.
T2. Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
T3. Wireless Communication and Networks : 3G and Beyond, I. SahaMisra, TMH Education.
T4. Digital Communications, J.G.Proakis, TMH Publishing Co.
T5. S.M. Ross, Stochastic Processes, 2nd Edition, Wiley, 1996 (WSE Edition).

Reference Books:

R1. Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray, Pearson.
R2. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
R3. Digital Communication, A. Bhattacharya, TMH Publishing Co.
R4. J. Medhi, Stochastic Processes, 3rd Edition, New Age International, 2009

E-Resource (Website link/E-book/Journal/MOOC etc.):

E1. https://nptel.ac.in/courses/108/102/108102096/

E2. https://www.classcentral.com/course/swayam-principles-of-digital-communications-12951

Course Title: Digital Signal Processing	**Code: EC504**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 marks	**Final exam: 70 marks**
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Signals & systems

Course Outcomes (CO's) of Digital Signal Processing

On completion of the course students will be able to

CO#	CO Statements	Bloom's Revised Knowledge Level
EC504.CO1	**Build** knowledge on the time domain representation and classification of discrete-time signals and systems to classify different real-time DSP Signals and Systems and their attributes.	**K3:Build**
EC504.CO2	**Build** knowledge on different Frequency Domain transformation attributes to analyze the discrete-time signals and systems.	**K3:Build**
EC504.CO3	**List** different application areas of frequency-domain transform like z transform and DFT to define DSP applicability in real needs.	**K1:List**
EC504.CO4	**Design** the methods of IIR and FIR filters and their Realization for the use of LTI filters.	**K6:Design**
EC504.CO5	**Illustrate** the mulitirate signal processing aspects and spectral estimation with finite word length effects in filter implementation to address different DSP applications.	**K2:Illustrate**
EC504.CO6	**Define** wavelets and their different attributes to understand multiresolution signal analysis for advanced signal processing.	**K1:Define**

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	-	-	-	-	-	-	3	3	-	3
CO2	3	3	-	2	-	-	-	-	-	-	-	3	3	-	3
CO3	3	3	-	2	-	-	-	-	-	-	-	3	3	-	3
CO4	3	3	2	2	2	2	-	-	-	-	-	3	3	2	3
CO5	3	3	-	1	3	-	-	-	-	-	-	3	3	-	3

CO6	3	2	1	2	3	-	-	-	-	-	-	3	3	-	3
AVG	3	2.83	1.50	1.83	2.67	2	0	0	0	0	0	3.00	3	2	3

University Syllabus:

Unit	Content	Hrs/Unit
1:Module-I	Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform and ROC, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT),Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems.	8
2:Module-II	Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low pass, Band pass, Band stop and High pass filters.	8
3:Module-III	Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing. Application of DSP.	10
4:Module-IV	Origin of Wavelets, Classification(CWT & DWT), Filter Bank.	8

RESOURCES:

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

Course Title: Scientific Computing	Code: PE-EC505D
Type of Course: Theory	Course Designation: Elective
Semester: 5th	Contact Hours: 3L/week
Continuous Assessment: 25 marks	Final Marks:70Marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Engineering Mathematics, Numerical Methods

Course Outcomes (CO's) of Scientific Computing

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
PE-EC505D.CO1	**Understand** the significance of scientific computing and the needs of approximations in science and engineering	K2: Understand
PE-EC505D.CO2	**Apply** scientific computing in solving the problems of linear and non-linear equations	K3: Apply
PE-EC505D.CO3	**Evaluate** Eigen values and singular value decompositions to find numerical solutions of algebraic equations and their applications.	K5: Evaluate
PE-EC505D.CO4	**Apply** numerical methods to solve different mathematical operations like optimization, interpolation, differentiation and integration.	K3: Apply
PE-EC505D.CO5	**Analyze** different numerical methods in simplifying the problems related to ODEs and PDEs	K4: Analyze
PE-EC505D.CO6	**Analyze**different computing methods to justify applications in signal processing	K4: Analyze

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	--	1	1	2	--	--	--	--	--	1	3	1	--
CO2	3	3	1	2	2	1	1	--	--	--	--	2	3	3	1
CO3	3	2	1	2	2	2	2	--	--	--	--	3	3	2	1
CO4	3	3	2	2	2	2	3	--	--	--	--	2	3	3	2
CO5	3	3	1	2	2	1	1	--	--	--	--	2	3	3	1
CO6	3	3	2	3	2	2	2	--	--	--	--	3	3	3	2
AVG	3.00	2.50	1.40	2.00	1.80	1.70	1.80	--	--	--	--	2.17	3.00	2.50	1.40

University Syllabus:

Unit	Content	Hrs/Unit
1: Introduction	1. Sources of Approximations 2. Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error 3. Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy	3
2: Computer Arithmetic	1. Floating Point Numbers, Normalization, Properties of Floating Point System 2. Rounding, Machine Precision, Subnormal and Gradual Underflow,	3

	Exceptional Values, 3. Floating Point Arithmetic,Cancellation	
3: System of liner equations	1. Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan 2. Norms and Condition Numbers 3. Symmetric Positive Definite Systems and Indefinite System 4. Iterative Methods for LinearSystems	4
4: Linear least squares	1. Data Fitting, Linear Least Squares, Normal Equations Method 2. Orthogonalization Methods, QR factorization 3. Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting	3
5: Eigenvalues and singular values	1. Methods for Computing All Eigen values 2. Jacobi Method, Methods for Computing Selected Eigenvalues 3. Singular Values Decomposition, Application ofSVD	3
6: Optimization	1. One-Dimensional Optimization 2. Multidimensional Unconstrained Optimization 3. Nonlinear Least Squares	3
7: Interpolation	1. Purpose for Interpolation, Choice of Interpolating Function 2. Polynomial Interpolation 3. Piecewise Polynomial Interpolation	3
8: Numerical Integration and Differentiation	1. Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule 2. Finite Difference Approximation	3
9. Ordinary Differential Equations and Partial Differential Equations	1. Initial Value Problems for ODES, Euler's Method 2. Taylor Series Method, Runga-KuttaMethod, Extrapolation Methods 3. Boundary Value Problems For ODES 4. Finite Difference Methods, Finite Element Method 5. EigenvalueProblems 6. Time Dependent Problems, Time Independent Problems, 7. Solution for Sparse Linear Systems 8. Iterative Methods	7
10. Fast Fourier Transform	1. FFT Algorithm, Limitations, 2. DFT, Fast polynomial Multiplication 3. Wavelets	3
11. Random Numbers And Simulation	1. Stochastic Simulation 2. Random Number Generators 3. Quasi-RandomSequences	3

RESOURCES:

1. "Scientific Computing: An Introductory Survey", Heath Michael T., McGraw-Hill, 2nd Ed., 2002
2. "Numerical Recipes: The Art of Scientific Computing", William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, Cambridge University Press, 3rd Ed., 2007
3. "Introduction To Computational Mathematics", Xin-she Yang (Ed.)., World Scientific Publishing Co., 2nd Ed., 2008

4. “Computational Science”, Kiryanov D. and Kiryanova E., Infinity Science Press, 1st Ed., 2006
5. “Scientific Computing With MATLAB And Octave”, Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, Springer, 3rd Ed., 2010
6. https://onlinecourses.nptel.ac.in/noc21_ae02/preview
7. https://onlinecourses.nptel.ac.in/noc20_ma33/preview

Course Title: Human Resource Management	Code: OE-EC506C
Type Of Course: Theory	Course Designation: Compulsory
Semester: 7th	Contact Hours: 3L/week
Continuous Assessment: 25 Marks Attendance : 5 Marks	Final Exam: 70 Marks
Writer: (Course Coordinator)	Approved by HoD (Convenor of DAB)

Pre-requisites: Fundamental knowledge in Management

Course Objective (COb's) of Principles of Management:

1. Know the professional and personal qualities of a HR manager.

2. Learn different methods of selecting human resources through recruitment, training and performanceappraisal system.

3. Know how to develop a favourable working environment in an organisation through participation in management and maintain a good industrial relation for benefit of the society.

4. Know about consequence of industrial dispute and employee indiscipline of an organization

5. Learn about motivational techniques and skill required to work in a group and the process of group decision making.

6. Know various leadership styles and the role of leader in achievement of organisational objective.

Course Outcome (CO's) of Principles of Management:

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
OE-EC506C. :CO1	Recall the concepts of Management and learn different theories used in industrial applications.	**K4:**Analyzing
OE-EC506C. :CO2	Discuss the appropriate theory required for solving real life problems.	**K3:**Applying
OE-EC506C. :CO3	Apply and demonstrate the use of Management concepts.	**K3:**Applying
OE-EC506C. :CO4	Analyze the Marketing Mix and functions of production.	**K4:**Analyzing
OE-EC506C. :CO5	Design the materials as per different materials management analysis.	**K3:**Applying
OE-EC506C. :CO6	Understand MBO and learn its application in organizations.	**K5:**Evaluating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO2	0	3	0	0	0	0	1	0	0	0	0	0	1	1	0
CO3	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0
CO4	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
CO5	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
CO6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVG	3.00	3.00	3.00	0	3.00	0	1.00	0	1.00	0	0	0	1	1	0

University Syllabus:

Module	Content	Hrs/Unit
I -Human Resource Management	Meaning & Definition, Functions, Scope & Objectives, Qualities of a HR Manager	06
II Human Resource Planning	Meaning & Definition, Importance of HRP,HRP Process. Barriers of HRP, Factors of sound HRP.Recruitment – Meaning & Definition, Sources of Recruitment, Recruitment Process, Effective Recruitment. Training & Performance Appraisal- Definition & Objective ,Areas of Training, Meaning & Definition of Performance Appraisal, process, Effective principles of performance Appraisal.	08
III Industrial Relations	Concept & Meaning, Objective & Importance, Reasons of poor Industrial Relation. Industrial Disputes- Meaning & Definition, Causes of Industrial Dispute, Prevention of Industrial Dispute, Conditions for good Industrial Relation.	09
IV Workers Participation in Management	Meaning & Need, Forms of Participation, Scheme of participation ,Merits& Demerits. Collective Bargain- Meaning & Definition, Objective & Importance, Process of Collective Bargain, Effective Condition. Employee Discipline-Guidelines for action, Penalties & Punishment, Rewards of Discipline**.**	08

RESOURCES:

Text Book

1. Human Resource Management. P. Subba Rao, Himalaya Publishing House, 2012.
2. Human Resource Management. K.Aswathappa. Mc GRAW HILL Education, 2013.

Reference Book

1. Human Resource Development Management . A. M.SeikhS.Chand, 2003.
2. Human Resource Management .S.S.Khanka, S. Chand, 2014.

Course Title: Electromagnetic Wave Lab	Code: EC591
Type of Course: Lab	Course Designation: Compulsory
Semester: 5th	Contact Hours: 2P/week
Continuous Assessment: 40 marks(PCA1 & PCA2)	Final Exam: 60 Marks
Writer: (Course Coordinator)	Approved by HoD (Convenor of DAB)

Pre-requisites: Knowledge on Physics, Programming software

Course Outcomes (CO's) of Electromagnetic Wave Lab

On completion of the course, students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC591: CO1	**Determine** unbounded wave characteristics with varying terminal properties	K5: Evaluating
EC591:CO2	**Examine** electrical properties of unbounded transmission line using graphical techniques	K4: Analyzing
EC591:CO3	**Analyze** electrical properties of bounded transmission line	K4: Analyzing
EC591:CO4	**Evaluate** field characteristics of transmitting/receiving active elements for determining coverage area	K5: Evaluating
EC591:CO5	**Estimate** field characteristics of multi-element transmitting device for determining region of maximum power	K5: Evaluating
EC591:CO6	**Investigate** RF characteristics of microwave trans-receiving system excited by high power active source	K4: Analyzing

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	1	-	1	2	1	-	-	3	1	1
CO2	3	3	2	1	2	1	-	1	2	1	-	-	3	1	1
CO3	3	3	2	1	2	1	1	1	2	1	-	-	3	2	1
CO4	3	3	2	1	2	1	2	1	2	1	-	1	3	2	1
CO5	3	3	2	1	2	2	2	1	2	1	-	1	3	2	1
CO6	3	3	2	1	2	2	2	1	2	1	-	1	3	2	1
AVG	**3**	**3**	**2**	**1**	**2**	**1.33**	**1.75**	**1**	**2**	**1**	**-**	**1**	**3**	**1.67**	**1**

University Syllabus:

Module	Content	Hrs/Unit
Module 1	**Ex 1:**Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.	2
	Ex 2: Input Impedance of a terminated coaxial line using shift in minima technique.	2
	Ex 3: Study of Smith chart on Matlab platform.	2
	Ex 4: Simulation study of Smith chart - Single and double stub matching.	2

Module 2	**Ex 1:** Radiation Pattern of dipole antenna. **Ex 2:** Radiation Pattern of a folded-dipole antenna. **Ex 3:** Radiation pattern of a 3-element Yagi-Uda Antenna. **Ex 4:** Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna - Comparative study. **Ex 5:** Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.	2 2 2 2 2

RESOURCES:

1. Mastering MATLAB – Hanselman& Littlefield – Pearson
2. Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.
3. Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education

Course Title: Digital Communication Laboratory	**Code: EC592**
Type of Course: Lab	**Course Designation: Practical**
Semester: 5th	**Contact Hours: 4P/week**
Continuous Assessment: (40 + 60) marks	
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Signals and Systems, Analog Communication

Course Outcomes (CO's) of Digital Communication Laboratory

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC592.CO1	**Experiment with** different source encoding techniques.	K3: Applying
EC592.CO2	**Identify** various line encoding techniques.	K3: Applying
EC592.CO3	**Experiment with** different carrier modulation techniques.	K3: Applying
EC592.CO4	**Analyze** probability of symbol error for binary carrier modulation techniques by simulation study.	K4: Analyzing
EC592.CO5	**Examine** the properties of 7-length and 15-length PN sequences using shift register.	K4: Analyzing
EC592.CO6	**Construct** a digital data transmission system via optical fiber link.	K6: Creating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	2	1	1	-	2	1	-	2	3	2	1
CO2	3	3	1	2	2	1	1	-	2	1	-	2	3	2	1
CO3	3	3	1	2	2	1	1	-	2	1	-	2	3	2	1
CO4	3	3	2	2	3	1	1	-	2	1	-	2	3	2	1
CO5	3	3	2	2	2	1	1	-	2	1	-	2	3	2	1
CO6	3	3	3	3	3	1	1	-	2	1	-	2	3	2	1
AVG	3.00	3.00	1.67	2.17	2.33	1.00	1.00	-	2.00	1.00	-	2.00	3.00	2.00	1.00

University Syllabus:

Unit	Content	Hrs/Unit
Exp-1	Study of PAM and demodulation	2
Exp-2	Study of PCM and demodulation	2
Exp-3	Study of delta modulator and demodulator	2
Exp-4	Study of adaptive delta modulator and demodulator	2
Exp-5	Study of line coders: polar/unipolar/bipolar NRZ ,RZ and Manchester	2
Exp-6	Study of BPSK modulator and demodulator	2
Exp-7	Study of BFSK modulator and demodulator	2
Exp-8	Study of ASK modulator and demodulator	2
Exp-9	Study of QPSK modulator and demodulator	2
Exp-10	Simulation study of probability of symbol error for BPSK modulation	2
Exp-11	Simulation study of probability of symbol error for BFSK modulation	2
Exp-12	Design, implementation and study of all the properties of 7-length and 15-length PN sequences using shift register	2
Exp-13	Construction of a digital data transmission system via optical fiber link.	2

RESOURCES:

Text Books:

T1. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
T2. Principle of Communication System - Taub& Schilling, TMH

Reference Books:

R1. Communication Systems: Analog and Digital – Sanjay Sharma, S.K.Kataria& Sons
R2. Communication Systems: Analog and Digital – Singh and Sapre, TMH

E-Resource (Website link/E-book/Journal/MOOC etc.):

E1. https://nptel.ac.in/courses/108/102/108102096/

Course Title: Digital Signal Processing Lab	Code: EC593
Type of Course: Lab	Course Designation: Compulsory
Semester: 5th	Contact Hours: 2P/week
Continuous Assessment: 40 marks	Final exam: 60 marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Signals & systems

Course Outcomes (CO's) of Digital Signal Processing Lab

On completion of the course students will be able to

CO#	CO Statements	Bloom's Revised Knowledge Level
EC593.CO1	**Experimentwith** signal sampling and various signal arithmetic operations to understand DSP operations on signals using simulation and hardware realization.	**K3:Experiment with**
EC593.CO2	**Develop** the linear convolution algorithm to analyze the LTI system output.	**K6:Develop**
EC593.CO3	**Evaluate** the Z Transform of various sequences to understand the frequency response of discrete time LTI system.	**K5:Evaluate**
EC593.CO4	**Examine** the DFT to inspect the frequency components of discrete time signals.	**K4:Examine**
EC593.CO5	**Construct** different kinds of digital filters in simulation and hardware implementation for real-time signal processing.	**K6:Construct**
EC593.CO6	**Apply** OLA and OLS methods to find the real-time LTI system response to the long data sequences.	**K3:Apply**

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	3	-	-	-	2	1	-	2	3	2	2
CO2	3	3	1	-	1	-	-	-	2	1	-	2	3	2	2
CO3	3	3	2	-	1	-	-	-	2	1	-	2	3	2	2
CO4	3	3	2	3	1	1	-	-	2	1	-	3	3	2	3
CO5	3	3	2	3	3	1	-	-	2	1	-	3	3	2	3
CO6	3	3	2	-	1	-	-	-	2	1	-	3	3	2	3

AVG	3	3.00	1.67	3.00	1.67	1.00	0	0	2	1	0	2.50	3	2	2.5

University Syllabus:

Unit	Content	Hrs/Unit
1	Sampled sinusoidal signal, various sequences and different arithmetic operations.	2
2	Convolution of two sequences using graphical methods and using commands-verification of the properties of convolution.	2
3	Z-transform of various sequences – verification of the properties of Z-transform.	2
4	Twiddle factors – verification of the properties.	2
5	DFTs / IDFTs using matrix multiplication and also using commands.	2
6	Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.	2
7	Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.	2
8	Butterworth filter design with different set of parameters.	2
9	FIR filter design using rectangular, Hamming and Blackman windows.	2
10	Hardware Laboratory using DSP Processor and Xilinx FPGA.	2

RESOURCES:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis&D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.
5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

Course Title: Effective Technical Communication	**Code: MC-HU581**
Type of Course: Sessional	**Course Designation: Compulsory**
Semester: 2nd	**Contact Hours: 3P/week**
Sessional Continuous Assessment: 25 Marks **Attendance : 5 Marks**	**Final Exam: 100 Marks**
Writer⊗Course Coordinator)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: NA

Course Objective:

Students will be industry ready and also acquire skills for higher studies

Course Outcomes:

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
MCHU581:CO1	**Build** confidence in listening, speaking, reading and writing English professionally	**K6:**Creating
MCHU581:CO2	**Enable** the students to think and speak effectively on everyday topics, including topics related to technical concepts	**K3:**Applying
MCHU581:CO3	**Equip** students with the basics of Academic writing	**K3:**Applying
MCHU581:CO4	**Develop** industry-ready attitude towards professional communication	**K3:**Applying
MCHU581:CO5	**Master** the skills of GD, Presentation and Interview	**K6:**Creating
MCHU581:CO6	**Prepare** for competitive exams like TOEFL, IELTS	**K6:**Creating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	2	2	2	2	3	3	2		1	1
CO2	1	1	2	2	2	1	1	2	2	3		2	2	3	2
CO3	2	2	2	2	2	1	1	2	3	3	3	2	2	3	2
CO4	2	1	2	1	1	2	2	2	3	3	2	2	1	2	2
CO5	1		1	2	2	2	2	2	3	3	1	1	2	3	3
CO6	1	1		2	2			2	2	3		2	1	3	1
AVG	1.33	1.2	1.8	1.83	1.83	1.6	1.6	2	2.5	3	2.25	1.83	1.60	2.50	1.83

University Syllabus:

Module	Content	Hrs/Unit
Module 1: Conversational Skills	General Conversation Warm-up sessions Basics of Communication, verbal and non-verbal communication how to be a	06

	good speaker, effective body language. Practice sessions on: Introducing oneself↔ Debates on topics like Is India really developing, Indian culture VS↔ western culture, whether robots will overtake humans one day. Just a Minute Sessions (JAMS)↔ Situational Dialogues and Role play : where students can enact everyday↔ situations in their personal and professional lives	
Module 2: Intensive Practice Sessions	Group Discussion on topics like dangers of social media, is internet killing the print media, Artificial Intelligence, IOT, Cloud Computing, Cyber security	06
Module 3: Organisational and Academic Writing	Job application letter and CV writing E-Mail writing	04
	Techniques for good Technical Writing: Academic Writing and Thesis writing Avoiding plagiarism Project Proposal Statement of Purpose Journal Articles	08
Module 4: Principles and practices of Personal Interview	Do's and Don'ts of facing an interview SWOC Analysis Rigorous practices of mock-interviews	06
Module 5:Presentations	Fundamentals of presentation skills Presentation sessions on Technical topics	04
Module 6: Preparation for T.O.E.F.L. and IELTS	Guidance and Practice sessions	06

List of Learning Resources:

1. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma, Oxford University Press, 2015
2. Thesis Writing: A Manual for Researches , F. Abdul Rahim, New Age International Limited, 1996
3. Professional Presentation, Malcolm Goodale, Cambridge University Press, 2005
4. Academic Writing: a Practical Guide for Students, Stephen Bailey London: Routledge Falmer
5. Barron's TOEFL IBT 2016 Guide (with DVD) Pamela J.Sharpe, New Delhi: Galgotia, 2013

Course Title: Control System and Instrumentation	**Code: EC601**
Type of Course: Theory	**Course Designation: Theory**
Semester: 6th	**Contact Hours: 3L/week**
Continuous Assessment: 25 marks(CA1,CA2,CA &CA4) Attendance: 5 marks	**University Exam:70 marks**
Writer: Course Coordinator	**Approved by HoD (Convenor of DAB)**

Course Outcomes (CO's)

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC601.CO1	**Define** the transfer function of open loop and closed loop feedback control System.	L1: Remember
EC601.CO2	**Explain** the concept of stability analysis of feedback control system.	L2: Understand
EC601.CO3	**Apply**P,PI and PID controller to attain particular performance criteria for any control system.	L3: Apply
EC601.CO4	**Examine** the stability for any given system in time domain and frequency domain with the help of various analysis methods.	L4: Analyze
EC601.CO5	**Model** a control system using state space method and comment on the controllability and observability for the same.	L3: Apply
EC601.CO6	**Relate** application of basic instrumentation in control system.	L2: Understand

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										1	3	1	1
CO2	3	3										1	3	1	1
CO3	3		2		3	1						1	3	2	1
CO4	3	3			2							1	3	1	1
CO5	3	2										1	3	1	1
CO6	3	2	2							1		1	3	2	1
AVG	3	2.4	2		2.5	1			1	1		1	3	1.33	1

University Syllabus:

Unit	Content	Hrs/Unit
Module 1	Introduction to control problem- Industrial control examples, Transfer function, open loop and closed loop (Feedback) control systems, Block diagram and Signal Flow Graph (SFG) analysis.	6
Module 2	Feedback control systems- Stability concept- relative stability, Routh stability criteria, steady state error (SE), steady state accuracy, disturbance rejection, insensitivity and robustness, proportional (P), integral (I) and derivative (D)controller, Realization of PID controllers with op-amp and digital implementation. Feed forward and multi loop control configurations	6

Module 3	Time response of second order systems, Steady state Error (SE) and error constants, Performance specifications in time domain. Root locus method of design. Lead and Lag compensations.	4
Module 4	Frequency response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency domain.	6
Module 5	State Variable Analysis- Concepts of state, state variable, State Transition Matrix (STM), Solution for state variable of homogeneous and nonhomogeneous state equations, Transfer function with state space approach, Concepts of controllability and observability of systems.	4
Module 6	Nonlinear control systems- Basic concepts and analysis- Describing function. Introduction to optimal control problem, regulator problem, output regulator, tracking problem.	2
Module 7	CRO- measurement with it and its function with block diagram representation. Wave and Spectrum analyzers , requirements of these instruments and their functions with block diagrams. LVDT. DC and AC servomotors, tacho generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators.	6

RESOURCES:

1.Modern Control Engineering, Katsuhiko Ogatha, PHI, 5e
2.Control System Engineering, I.J.Nagrath, M.Gopal, New Age, 5e.
3.A Course In Electronic Measurements And Instrumentation,by A.K. Sawhney,Dhanpat Rai & Co.

Course Title: Computer Network	**Code: EC602**
Type of Course: Theory	**Course Designation: Theory**
Semester: 6th	**Contact Hours: 3P/week**
Continuous Assessment: 25 (CA1, CA2, CA3, CA4) and 5 (Class Attendance)	**University Exam - 70**
Writer: Course Coordinator	**Approved by HoD (Convenor of DAB)**

Pre-requisites: C programming and Data Structure, Mathematics

Course Outcomes (CO's) of Computer Network

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC602.CO1	**Build** an understanding of the fundamental concepts of computer networking, Data Communications System and its components.	K3: Applying
EC602.CO2	**Explain** the function(s) of each layer of the OSI model and TCP/IP protocol.	K2: Understanding
EC602.CO3	**Identify** the different types of network topologies, protocols, networking devices and their functions within a network.	K3: Applying
EC602.CO4	**Understand** and building the skills of subnetting and routing mechanisms.	K2: Understanding
EC602.CO5	**Analyze**and evaluate different system component part of data communication**.**	K4: Analyzing
EC602.CO6	To gain expertise in some specific areas of networking such as the design and maintenance of individual networks.	K5: Evaluating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	--	1	--	2	2	1	--	1	2	1	1
CO2	3	3	3	1	--	1	--	2	2	1	--	1	2	1	1
CO3	3	3	3	1	--	1	--	2	2	1	--	1	2	1	1
CO4	3	3	3	1	--	1	--	2	2	1	--	1	2	1	1
CO5	3	3	3	1	--	1	--	2	2	1	--	1	2	1	1
CO6	3	3	3	1	--	1	--	2	2	1	--	1	2	1	1
AVG	3.00	3.00	3.00	1.00	--	1.00	--	2.00	2.00	1.00	--	1.00	2.00	1.00	1.00

University Syllabus:

Module	Content	Hrs/Module
Module I	Overview of Data Communication and Networking: Introduction; Data communications: components, data representation (ASCII,ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their	10

	comparative study. Physical Level: Overview of data(analog& digital), signal(analog& digital), transmission (analog& digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;	
Module II	Data link Layer: Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC; Medium Access sub layer: Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet(in brief);	10
Module III	Network layer: Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6;. Transport layer: Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,	12
Module IV	Application Layer Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls. Modern topics: ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief Wireless LAN: IEEE 802.11, Introduction to blue-tooth.	10

GATE syllabus mapping:

GATE syllabus content	Mapping unit of university syllabus
Modulation schemes (ASK, PSK, FSK, QAM)	Module1
Fundamentals of error correction, CRC	Module 2
Not available	Module 3
Not available	Module 4

RESOURCES:

1. B. A. Forouzan - “Data Communications and Networking (3rd Ed.) “ - TMH
2. A. S. Tanenbaum - “Computer Networks (4th Ed.)” - Pearson Education/PHI
3. W. Stallings - “Data and Computer Communications (5th Ed.)” - PHI/ Pearson Education

4. Kurose and Rose - " Computer Networking -A top down approach featuring the internet" - Pearson Education
5. Leon, Garica, Widjaja - "Communication Networks" - TMH
6. Walrand - "Communication Networks" - TMH.

Course Title: CMOS VLSI Design	**Code: PE-EC603C**
Type of Course: Theory	**Course Designation: Elective**
Semester: 6th	**Contact Hours: 3P/week**
Continuous Assessment: 25 marks	**Final Exam:70Marks**
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Basic Electronics, Digital Electronics

Course Outcomes (CO's) of CMOS VLSI Design

On completion of the course students will be able to

CO Number	**CO statements**	**Revised Knowledge level**
PE-EC603C.CO1	**Understand** the VLSI design flow, hierarchy to illustrate the principle of different VLSI design styles [**K2**]	**K2: Understand**
PE-EC603C.CO2	**Apply** electrical properties of three-terminal junction field effect device for investigating short-channel effects [**K3**]	**K3: Apply**
PE-EC603C.CO3	For a given unit level device, theoretically **illustrate** fundamental process steps for fabrication [**K4**]	**K4: illustrate**
PE-EC603C.CO4	**Apply** the concept of CMOS logic to develop different CMOS based sequential, combinational circuits with power, delay estimation [**K3**]	**K3: Apply**
PE-EC603C.CO5	**Identify** the design rules for constructing the layout, stick diagrams [**K2**]	**K2:Understand**
PE-EC603C.CO6	For a given layout of the complex circuit, **synthesize** building blocks for optimum performance [**K5**]	**K5:Synthesize**

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO 1	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	1	1	-	1	-	-	1	-	-	-	-	1	1	1	1
CO 2	3	3	2	2	-	2	2	-	-	-	-	2	3	2	1
CO 3	3	3	3	2	2	1	2	-	-	-	-	3	3	2	2
CO 4	3	3	3	2	-	2	3	-	-	-	-	3	3	2	2
CO 5	2	3	2	1	2	-	2	-	-	-	-	2	2	1	1
CO 6	3	2	2	2	2	-	2	-	-	-	-	2	2	1	1
AV G	2.5	2.5	2.4	1.66	2	1.66	2	0	0	0	0	2.166	2.33	1.5	1.33

University Syllabus:

Unit	Content	Hrs/Unit
Module1	VLSI Methodologies: Introduction to VLSI design, Moore's Law, VLSI Design flow, Design hierarchy, VLSI .Design style: Full custom, Gate array, standard-cell, Macro cell based design, Field programmable devices, design quality	6
Module 2	MOSFET: Electrical characteristics of MOSFET, Threshold voltage, Body effect, current expression (gradual channel approximation method), Channel length modulation, MOSFET scaling: constant field and constant voltage scaling, Short-channel effects	6
Module 4	Unit process in VLSI and IC fabrication: Unit process in VLSI: Wafer preparation, Oxidation,Diffusion, Ion implantation, Deposition, Metallization, Etching and Lithography. nMOS fabrication, n-well and p-well process	5
Module 5	CMOS Logic Circuits: General CMOS logic structure, VTC of inverter, noise margin, Different types of inverter (resistive load, enhancement and depletion nMOS load and CMOS), Switching characteristic (propagation delay and parasitic capacitance estimation), NAND, NOR and other complex CMOS logic circuits, Sizing of CMOS logic circuits, CMOS Power: static and dynamic power dissipation, latch-up, sizing for large capacitive load,. Dynamic CMOS logic circuits,charge leakage and charge sharing problem, dynamic gate cascading problem, Domino and NORA logic, Introduction of sequential CMOS logic circuits, Stick diagram. Layout and Layout design rules.	18
Module 6	Physical Design Automation: Objectives and goals of partitioning, floor planning and placement, Global routing.	5

RESOURCES:

Text Books:

T1. CMOS Digital Integrated Circuits – S. Mo. Kang and Yusuf Leblebici, 3rd Ed, TMH 314

Reference Books:

R1. Digital Integrated Circuits A Design Perspective -Jan M. Rabaey, Prentice-Hall Publication, 2nd Edition.

R2. VLSI Design and EDA Tools – Angsuman Sarkar, Swapnadip De & Chandan Kumar Sarkar, ScitechPublication(India) PVT, LTD

E-Resource (Website link/E-book/Journal/MOOC etc.):

E1. https://nptel.ac.in/courses/108/107/108107129/

Course Title: Information Theory and Coding	Code: PE-EC603D
Type of Course: Theory	Course Designation: Theory
Semester: 6th	Contact Hours: 3L/week
Continuous Assessment: 25 marks	
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Engineering Mathematics, Basics of communication system

Course Outcomes (CO's) of Information Theory and Coding

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
PE-EC603D.CO1	**Understand** the basic concept of information theory such as information, entropy, mutual information, channel capacity for comparing various channels.	K2 : Understanding
PE-EC603D.CO2	**Analyze** various source coding techniques to compare their efficiency.	K4: Analyzing
PE-EC603D.CO3	**Construct** linear block codes to identify the error.	K3: Applying
PE-EC603D.CO4	**Design** encoding circuits to create cyclic code.	K6: Creating
PE-EC603D.CO5	**Construc**t BCH codes to solve error in coded message.	K6: Creating
PE-EC603D.CO6	**Evaluate** the distance in the Convolution code to determine error.	K5: Evaluating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	--	--	3	2	--	--	--	--	3	3	2	2
CO2	3	3	2	--	--	1	1	--	--	--	--	3	3	3	2
CO3	3	3	3	--	--	1	1	--	--	--	--	3	3	3	3
CO4	3	3	3	--	--	1	1	--	--	--	--	3	3	3	3
CO5	3	3	3	--	--	2	2	--	--	--	--	3	3	3	3
CO6	3	3	3	--	--	2	2	--	--	--	--	3	3	3	3
AVG	3	2.83	2.67	--	--	1.67	1.50	--	--	--	--	3.00	3.00	2.83	2.67

University Syllabus:

Unit	Content	Hrs/Unit
1: Module 1	1. Basics of information theory 2. Entropy for discrete ensembles 3. Shanon's noiseless coding theorem 4. Encoding for discrete sources	8
2: Module 2	1. Markov sources 2. Shannon's noisy coding theorem and converse for discrete channels 3. Calculation of channel capacity and bounds for discrete channels	10

	4. Application to continuous channels	
3: :Module 3	1. Techniques of coding and decoding 2. Huffman codes and uniquely detectable codes 3. Cyclic codes 4. Convolution Codes 5. Arithmetic codes	15

RESOURCES:

1. Information Theory, Coding and Cryptography – R. Bose (McGraw Hill)
2. An Introduction to Error control codes – S. Gravano (Oxford)
3. Information and Coding – N. Abramson (McGraw Hill)
4. Introduction to Information Theory – M. Mansurpur (McGraw Hill)
5. Error Control Coding – S. Lin and D.J. Costello Jr. (Prentice Hall)
6. https://nptel.ac.in/courses/117101053/
7. https://nptel.ac.in/courses/108/102/108102117/

Course Title: Object Oriented Programming (C++)	Code: OE-EC604C
Type of Course: Theory	Course Designation: Open Elective II
Semester: 6th	Contact Hours: 3L/week
Continuous Assessment: 100 marks	
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Programming practice with C

Course Outcomes (CO's) of
On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
OEEC604C.CO1	**Understanding** of the object-oriented paradigm	K2: **Understanding**
OEEC604C.CO2	**Understanding** of creation and variations of class and objects	K2:**Understanding**
OEEC604C.CO3	**Applying** operators with different functionalities	K3:**Applying**
OEEC604C.CO4	**Identification** of basic object-oriented programming properties	K3:**Applying**
OEEC604C.CO5	**Understanding** the usefulness of files and its processing techniques	K2:**Understanding**
OEEC604C.CO6	**Identification**causes, and effects of Exceptions and their handling mechanism	K3:**Applying**

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	-	-	-	-	-	-	1	1	-	1
CO2	3	2	2	1	3	-	-	1	1	-	1	1	2	2	2
CO3	3	2	2	1	3	-	-	1	-	-	1	-	2	1	2
CO4	3	2	2	1	3	-	-	1	-	-	1	1	2	1	2
CO5	3	2	2	1	3	-	-	1	1	-	1	-	2	1	2
CO6	3	2	2	1	3	-	-	1	-	-	1	1	2	1	2
AVG	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1.83**	**1.2**	**1.83**

University Syllabus:

Unit	Content	Hrs/Unit
Paradigm	Evolution of programming paradigm, structured versus object-oriented development, Introduction to Object oriented programming concepts: Objects, classes, encapsulation and abstraction, inheritance, polymorphism, dynamic binding, message passing.	**4**
Moving from C to C++	Introduction to C++, streams based I/O, name space, scope resolution operator (::), variable declaration at the point of use, variable aliases-reference variables, strict type checking, parameter passing by reference, inline function, function overloading, default arguments.	**4**
Object and Classes	Specifying and using classes, access specifies: private, public, functions and data members, default arguments, function overloading, friend functions, static members. Objects: memory considerations for objects, new and delete operators.	**4**
Constructors	Default constructor, parameterized constructor, constructor with dynamic allocation, copy constructor, destructors.	**4**
Operator Overloading	Overloading through friend and member functionsBinary operators: arithmetic, relational, assignment, insertion, extractionUnary operators: unary minus, post and pre-increment, post and pre- decrement, Conversion functions: class to basic, basic to class, class to class.	**4**
Inheritance	Derived and base classes, Class hierarchies, public, private, and protected derivations, constructors in derived classes, destructors in derived classes, constructors' invocation and data members initialization in derived classes, classes within classes, virtual base class	**4**
Polymorphism	Pointer to objects, pointer to derived class object, this pointer, run time and compile time polymorphism, virtual functions, pure virtual functions, abstract class, virtual destructor.	**4**
Files and Streams	Introduction to file handling, hierarchy of file stream classes, opening and closing of files, file modes, file pointers and their manipulators, sequential access, random access.	**4**
Exception handling and Templates	Introduction to exception handling, throw point outside try, Multiple catch, Catch-all, throwing objects. Introduction to templates, class templates, function templates	**4**

RESOURCES:

Text Book

1. Object Oriented Programming with C++, E. Balaguruswamy, 6th Edition, 2013 TMG Hill

Reference Book

1. Object Oriented Programming with C++, Reema Thareja, OXFORD University Press, 1st Edition, 2015.
2. C++ completes reference, Herbert Schildt, TMG Hill, 4th Edition, 2002.
3. C++ How to Program, Deitel and Deitel, Pearson Education Asia, 8th Edition, 2011.
4. Object Oriented Programming with Ansi and Turbo C++, Ashok N Kamthane, Pearson Education, 1stEdition, 2003.
5. Object-Oriented Programming in C++, Robert Lafore, CourseSams Publishing, 4th Edition

Course Title: Economics for Engineers	Code: HS-HU601
Type of Course: Theory	Course Designation: Compulsory
Semester: 6th	Contact Hours: 3L/week
Continuous Assessment: 25 marks	Final Exam:70Marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Course Outcomes (CO's) of Analog Communication

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
HS-HU601.CO1	Recall the concepts of Accounting and Recognize different systems used in industrial applications.	K1 :Remembering
HS-HU601.CO2	Discuss on the design of appropriate accounting tool required for real life problems.	K6: Discuss
HS-HU601.CO3	Apply and demonstrate the use of Economical concepts.	K3: Applying
HS-HU601.CO4	Analyze and Simulate a sequential accounting tool for a system or process appropriate for required accuracy.	K4: Analysing
HS-HU601.CO5	Design a sequential economic policy that can work according to the required specifications.	K5: Evaluating
HS-HU601.CO6	Justify a specific accounting technique for an specific purpose.	K5: Evaluating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CO2	0	3	0	0	0	0	1	0	0	0	0	0	1	1	0
CO3	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0
CO4	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
CO5	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
CO6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVG	3	3	3	0	3	0	1	0	1	0	0	0	1.00	1.00	0.00

University Syllabus

Unit	Content
Module-I	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life -Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.
Module-II	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest. 4. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio

	Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.
Module-III	5. Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. 6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. 7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.
Module-IV	8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight -Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances. 9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. 10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Resources:

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case,David B.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

Course Title: Control and Instrumentation Laboratory	Code: EC691
Type of Course: Lab	Course Designation: Sessional
Semester: 6th	Contact Hours: 2P/week
Continuous Assessment: 100 marks	
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Control System

Course Outcomes (CO's) of Control Lab

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC691.CO1	**Identify** the MATLAB control system toolbox for representation of pole zero and transfer function of control system.	K2: Understanding
EC691.CO2	**Determine** of impulse and step response for 2nd order under damped system for calculates of control system specifications.	K3: Applying
EC691.CO3	**Determine**of root Locus from transfer function to evaluate different system parameters.	K3: Applying
EC691.CO4	**Analyze**the different stability criterion for different controllers (Nyquist, Bode) toEstimateof relative system parameters.	K4: Analyzing
EC691.CO5	**Design**different controllers for specified system requirements.	K5: Evaluating
EC691.CO6	**Evaluate** differentstaticand dynamic characteristics of a measuring instrument to locate different electrical signal.	K5: Evaluating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	-	-	-	-	-	-	2	2	-	-
CO2	3	2	1	1	3	-	-	-	-	-	-	2	2	-	-
CO3	3	2	1	1	3	-	-	-	-	-	-	2	3	-	-
CO4	3	3	2	2	3	-	-	-	-	-	-	2	2	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	2	3	1	1
CO6	3	2	3	-	1	-	-	-	-	-	-	2	2	1	1
AVG	3.00	2.50	1.83	1.40	2.66	-	-	-	-	-	-	2.00	2.33	1.00	1.00

University Syllabus:

Unit	Content	Hrs/Unit
1: Introducing Matlab	1. Familiarization with MATLAB control system toolbox 2. Construct closed loop control system using simulink	8
2: Determine Transfer function	1. Representation of pole zero and transfer function of control system. 2. Determination of transfer functions of a given system from its state model and its vice-versa.	8
3: Study 2 nd order system	1. Determination of impulse & step response for 2nd order under damped system on CRO & calculation of control system specifications for variation of system design.	8
4: Root locus, Bode plot	1. Determination of root Locus from transfer function and evaluation of system parameters like marginal value of gain, frequency etc. of a given control system. 2. Drawing of Nyquist plot and Bode plot from transfer function of a control system and estimation of relative system parameters like gain margin, phase margin etc	8
5: Design different controllers	1. Design PI, PD and PID controller for specified system requirements. 2. Study of static (accuracy, precision, repeatability, linearity) and dynamic (fidelity, speed of response) characteristics of a measuring instrument. 3. Design and study of Instrumentation Amplifier. 4. Study and analysis of electrical signal with CRO.	8

RESOURCES:

1. Automatic Control System: Benjamin Kuo, PHI

2. Modern Control Engineering, Katsuhiko Ogatha, PHI, 5e

3. A.D. Helfrick and W. D. Cooper., "Modern Electronic Instrumentation and Measurement Techniques",PHI (EEE).

Course Title: Computer Network Lab	**Code: EC692**
Type of Course: Lab	**Course Designation: Compulsory**
Semester: 6th	**Contact Hours: 2P/week**
Continuous Assessment: 40 marks	**Final exam: 60 marks**
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Basic Python programming, Basics of computer networking

Course Outcomes (CO's) of Computer Network Lab

On completion of the course students will be able to

CO#	**CO Statements**	**Bloom's Revised Knowledge Level**
EC692.CO1	**Inspect** different networking cables and components for undetstanding the functions.	**K4:Analyzing**
EC692.CO2	**Choose** a technique to build inter process communication.	**K3: Applying**
EC692.CO3	**Distinguish** TCP and UDP socket programming to classify the type of services.	**K4: Analyzing**
EC692.CO4	**Build** server/multi-threaded server/broadcast server to develop communication between multiple systems.	**K6: Creating**
EC692.CO5	**Demostrate** Cyclic Redundancy Check to illustrate the data link layer error detection mechanism	**K2: Understanding**
EC692.CO6	**Demostrate** Stop and Wait, Sliding Window, Selective Repeat, Go Back N protocols to illustrate the data link layer flow control and error control mechanism	**K2: Understanding**

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	-	3	-	-	-	2	1	-	2	3	2	2
CO2	3	3	1	-	1	-	-	-	2	1	-	2	3	2	2
CO3	3	3	2	-	1	-	-	-	2	1	-	2	3	2	2
CO4	3	3	2	3	1	1	-	-	2	1	-	3	3	2	3
CO5	3	3	2	3	3	1	-	-	2	1	-	3	3	2	3
CO6	3	3	2	-	1	-	-	-	2	1	-	3	3	2	3
AVG	3	3.00	1.67	3.00	1.67	1.00	0	0	2	1	0	2.50	3	2	2.5

University Syllabus:

Unit	Content	Hrs/Unit
1	IPC (Message queue)	2
2	NIC Installation & Configuration (Windows/Linux)	2
3	Familiarization with - Networking cables (CAT5, UTP), Connectors (RJ45, T-connector), Hubs, Switches	2
4	TCP/UDP Socket Programming	2
5	Multicast & Broadcast Sockets	2
6	Implementation of a Prototype Multithreaded Server	2
7	Implementation of Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)	2
8	Implementation of Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)	2
9	Implementation of Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)	2

RESOURCES:

1. B. A. Forouzan - "Data Communications and Networking (3rd Ed.) " - TMH
2. A. S. Tanenbaum - "Computer Networks (4th Ed.)" - Pearson Education/PHI
3. W. Stallings - "Data and Computer Communications (5th Ed.)" - PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Course Title: Mini Project/ Electronic Design Workshop	**Code: EC 681**
Type of Course: Practical	**Course Designation:** Sessional
Semester: 6th	**Contact Hours: 4P/week**
	Final Exam: 100 Marks
Writer: (Course Coordinator)	**Approved by HoD (Convenor of DAB)**

Course Outcomes (CO's) of Mini Project/ Electronic Design Workshop:

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC681.CO1	**Apply** engineering knowledge to define problem statement through literature survey and socital need.	K3:Applying
EC681.CO2	**Design** the prototype/algorithm in order to solve the conceived problem.	K6:Creating
EC681.CO3	**Measure** the project outcomes for evaluation of accomplishment.	K5:Evaluate
EC681.CO4	**Analyze** the performance of the project work.	K4:Analyzing
EC681.CO5	**Summarize** the entire project work in terms of report.	K2:Understanding
EC681.CO6	**Defend** the outcomes to justify the findings.	K5:Evaluating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1		2	2	2	3		3	2	2	3	3
CO2	3		3	3	3				3			3	3	3	3
CO3				3	2							2	3		2
CO4		3		2								3	2		3
CO5									3	3		3		3	3
CO6	3							3	2	3		3	2	3	3
AVG	3.0	3.0	2.5	2.3	2.5	2.0	2.0	2.5	2.8	3.0	3.0	2.7	2.40	3.00	2.83

Course Title: UNIVERSAL HUMAN VALUES	Code: MC 681
Type Of Course: Theory	Course Designation: Sessional
Semester: 6th	Contact Hours: 2L/week/0T/0P
Continuous Assessment: 95	Attendance : 5 Marks
Writer: Course Coordinator	Approved by HoD (Convenor of DAB)

Pre-requisites: Fundamentals of Value Education at school level

Course Objective (COb's) of UHV:

MC681:COb1: Be able to appreciate the essential complementarity between values and skills to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

MC681:COb2: Be able to facilitate the development of a holistic perspective among their peers and family members towards life and profession as well as towards happiness and prosperity based on a correct understanding of the human reality and the rest of existence.

MC681:COb3: Be able to highlight plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction in nature.

Course Outcome (CO's) of UHV:

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
MC681:CO1	To develop the process of self-exploration by verifying on the basis of natural acceptance and validating experimentally through proposal in our day to day life	**K3:**Applying
MC681:CO2	To develop from animal consciousness to human consciousness at each level of our living by means of right understanding and fulfillment of relationship	**K3:**Applying
MC681:CO3	To examine the needs of Self and Body on the basis of common activities of Desire,Thoughts and Expectation in order to ensure harmony at all levels of our being.	**K4:**Analyzing
MC681:CO4	To inspect the existence of harmony in human-to-human relationships through a correct appraisal of values inherent in these relationships which leads to a harmonious family and undivided Society.	**K4:**Analyzing
MC681:CO5	To list the interconnectedness among all the orders,their	**K4:**Analyzing

	recyclability and self-regulation in Nature and to introspect the role of oneself in existence only to understand the co-existence.	
MC681:CO6	To justify meaningful participation in the larger order including society and nature in pursuance of comprehensive human goal and develop the ethical competence in one's profession.	**K5:**Evaluating

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1					1	1				1	1	1	1
CO2		1					1	1				1	1	1	1
CO3		1					1	1				1	1	1	1
CO4		1					1	1				1	1	1	1
CO5		1					1	1				1	1	1	1
CO6		1					1	1				1	1	1	1
AVG	0	1	0	0	0	0	1	1	0	0	0	1	1	1	1

University Syllabus:

Module	Content	Hrs/Unit
Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education	1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experimental Validation- as the process for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking	10
Module 2: Understanding Harmony in the Human Being -	7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and	10

Harmony in Myself!	enjoyer) 10. Understanding the characteristics and activities of 'I' and harmony in 'I' 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease	
Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship	13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 14. Understanding the meaning of Trust; Difference between intention and competence 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals 17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives	08
Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence **Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics**	18. Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and selfregulation in nature 20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space 21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. 22. Natural acceptance of human values 23. Definitiveness of Ethical Human Conduct 24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of peoplefriendly and eco-friendly production	05 07

	systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. 26. Case studies of typical holistic technologies, management models and production systems 27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations 28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.	

RESOURCES:

Text Book:

Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999 .
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.

6. Slow is Beautiful - Cecile Andrews

7. Economy of Permanence - J C Kumarappa

8. Bharat Mein Angreji Raj – PanditSunderlal

9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11. India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)