RCC INSTITUTE OF INFORMATION TECHNOLOGY
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A UNIT OF RCC INSTITUTE OF TECHNOLOGY AN AUTONOMOUS SOCIETY OF DEPARTMENT OF HIGHER EDUCATION, GOVT. OF WEST BENGAL

COURSE BOOKLET
B.TECH,2ND YEAR
2017-2021 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.

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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 andwrite effective 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(III)

Sl.No.	Paper Code	Paper Name	Credit
1.	M(CS)301	Numerical Methods	4
2.	EC301	Circuit Theory & Networks	4
3.	EC302	Solid State Devices	4
4.	EC303	Signals &Systems	4
5.	EC304	Analog Electronic & Circuits	4
6.	EC391	Circuit Theory & Networks Lab	3
7.	EC392	Solid State Devices Lab	3
8.	EC393	Signals & SystemsLab	3
9.	EC394	Analog Electronic & Circuits Lab	3
10.	M(CS)391	Numerical Lab	3

EvenSemester(IV)

Sl.No.	Paper Code	Paper Name	Credit
1.	HU401	Values and Ethics in Profession	3
2.	PH401	Physics-II	4
3.	CH401	Basic Environmental Engineering & Elementary Biology	3
4.	EC401	E.M.theory& Transmission lines	4
5.	EC402	Digital Electronics& Integrated Circuits	4
6.	HU481	Technical Report Writing & Language Lab Practice	6
7.	PH491	Physics-II Lab	2
8.	EC491	E.M.theory& Transmission lines Lab	2
9.	EC492	Digital Electronics & Integrated Circuits Lab	2

Odd Semester(III) Articulation Matrix

Paper Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
M(CS) 301	3	3	1	2.66	1	1	0	0	0	0	1	2	3	1	1
M 302	3	2.66	2.16	1.33	0	0	0	0	0	0	0	0	2.16	0	0
EC 301	3	3	3	0	0	2	1.66	0	0	0	0	2.166	3	1.66	1.33
EC 302	3	3	2.33	1.5	1	0	0	1	0	0	0	1	2.33	1	1
EC 303	3	2.83	2.5	2	2.5	2	0	0	0	0	0	3	3	1	2
EC 304	3	3	3	0	0	2.16	1.83	0	0	0	0	2.66	3	1.83	1.66
M(CS) 391	3	2.83	1.16	2.5	3	1	0	0	2	0	1	2	3	1	1
EC 391	3	3	1	0	2.33	1	2	0	3	3	0	3	2	2	3
EC 392	3	3	3	1.33	2	0	0	1	3	1		1	3	1	1
EC 393	3	2.67	1.6	3	1	1	1	0	2	3	2	2.5	2.23	1.5	2.44
EC 394	3	3	3	3	0	2.16	2.33	0	3	0	0	2.66	3	2.5	1.66

EvenSemester(IV) Articulation Matrix

Paper Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO 2	PSO 3
EC401	3	3	1.83	1		2	1	1				2	2.83	1.33	1.16
EC402	3	2.16	2	0	0	1	1	0	0	0	0	2.33	2.83	1	2.5
PH401	1.8	2.3	1.8	1	0	0	0	0	0	0	0	0	2	0	0
CH401	0	1.66	1.66	0	0	1.16	1.16	0	0	0	0	0	1	1	0
HU401	0	0	0	0	0	0	0	0	3	0	0	3	0	1	1
EC491	3	3	2	1	2	1.33	1.75	1	2	1	0	1	2	1	1
EC492	3	3	3	2	0	0	1	0	2	2	1	1	2	1.167	2.67
PH491	3	1.7	1	1	0	0	0	0	0	0	0	0	1.67	0	0
HU481	0	0	0	0	0	0	0	0	0	3	0	3	0	0	2

Course Title: Circuit Theory & Network	**Code: EC-301**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 3L/week**
Continuous Assessment: 25 marks **Attendance: 5 Marks**	**Final Marks: 70**
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Basic Electrical Engineering

Course Outcomes (CO's) of Circuit Theory & Network

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC-301.CO1	**Explain**theconcept of Resonance circuit to compute the criteria for different Resonance circuit and their disparate parameters.	**K2: Explain**
EC-301.CO2	**Apply** circuit analysis theorems and node or loop analysis methods to exercise simplicity in real life practical circuits.	**K3: Apply**
EC-301.CO3	**Appraise** the effect of Transient response and different types of magnetic couplings to design real life circuits in a proper manner.	**K5: Apprise**
EC-301.CO4	**Apply the** Laplace and Inverse Laplace transform to evaluate the time domain and frequency domain response of the electrical network.	**K3: Apply**
EC-301.CO5	**Discuss** the concept ofGraph Theory to design mathematical model for a given complicated network structure.	**K6: Discuss**
EC-301.CO6	**Analyze** simple two-port network to categorize and inspect their behavior for interconnection of several such networks.	**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	3	3	-	-	2	1	-	-	-	-	2	3	1	1
CO2	3	3	3	-	-	2	1	-	-	-	-	1	3	1	1
CO3	3	3	3	-	-	2	2	-	-	-	-	3	3	2	2
CO4	3	3	3	-	-	2	2	-	-	-	-	2	3	2	1
CO5	3	3	3	-	-	2	2	-	-	-	-	3	3	2	1
CO6	3	3	3	-	-	2	2	-	-	-	-	2	3	2	2
AVG	3	3	3	0	0	2	1.66	0	0	0	0	2.166	3	1.66	1.33

University Syllabus:

Module 1	a) Resonant Circuits: Series and Parallel resonance [1L], Impedance and Admittance Characteristics, Quality 4 Factor, Half Power Points, Bandwidth [2L], Phasor diagrams, Transform diagrams [1L], Practical resonant and series circuits, Solution of Problems [Tutorial - 1L]. b) Mesh Current Network Analysis: Kirchoff's Voltage law, Formulation of mesh equations [1L], Solution of mesh 6	10

	equations by Cramer's rule and matrix method [2L], Driving point impedance, Transfer impedance [1L], Solution of problems with DC and AC sources [1L]	
Module 2	a) Node Voltage Network Analysis: Kirchoff's Current law, Formulation of Node equations and solutions [2L], driving 4 point admittance, transfer Admittance [1L], Solution of problems with DC and AC sources [1L]. b) Network Theorems: Definition and Implication of Superposition Theorem [1L], Thevenin's theorem, Norton's 6 theorem [1L], Reciprocity theorem, Compensation theorem [1L], maximum Power Transfer theorem [1L], Millman's theorem, Star delta transformations [1L], Solutions and problems with DC and AC sources [1L]	10
Module 3	Graph of Network: Concept of Tree and Branch [1L], tree link, junctions, (*) Incident matrix, Tie set matrix [2L], 4 Determination of loop current and node voltages [2L]. Coupled Circuits: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual 4 inductance, Coefficient of coupling, Solution of Problems. Circuit transients: DC transients in R -L and R-C Circuits with and without initial charge, (*) R-L-C Circuits, AC 2 Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems [2L]	10
Module 4	Laplace transform: Concept of Complex frequency [1L], transform of f(t) into F(s) [1L], transform of step, 8 exponential, over damped surge, critically damped surge, damped and un -damped sine functions [2L], properties of Laplace transform [1L], linearity, real differentiation, real integration, initial value theorem and final value theorem [1L] , inverse Laplace transform [1L], application in circuit analysis, Partial fraction expansion, Heaviside's expansion theorem, Solution of problems [1L]. (*) Laplace transform and Inverse Laplace transform [2L]. Two Port Networks: Relationship of Two port network variables, short circuit admittance parameters, open cir cuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder 4 network and general network.	12

Reference Books:

1. A.B.Carlson-Circuits- Cenage Learning
2. John Bird- Electrical Circuit Theory and Technology- 3/e- Elsevier (Indian Reprint)
3. Skilling H.H.: "Electrical Engineering Circuits", John Wiley & Sons.
4. Edminister J.A.: "Theory & Problems of Electric Circuits", McGraw-Hill Co.
5. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.
6. R.A.DeCarlo & P.M.Lin- Linear Circuit Analysis- Oxford
7. P.Ramesh Babu- Electrical Circuit Analysis- Scitech
8. Sudhakar: "Circuits & Networks:Analysis & Synthesis" 2/e TMH
9. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
10. Sivandam- "Electric Circuits and Analysis", Vikas

Course Title: Solid State Device	**Code: EC302**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 3rd	**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 on Physics and Electronics

Course Outcome (CO's) of Solid State Device:

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC302:CO1	**Calculate** position of Fermi Level and Density of States for a given semiconductor to estimatethe carrier distribution	**K3:**Applying
EC302:CO2	**Compute** carrier transport properties under external conditions for determination of conductivity of a given semiconductor device	**K3:**Applying
EC302:CO3	**Investigate** electrical properties of two-terminal junction devices based on specific design parameters and external biasing conditions for characterization	**K4:**Analyzing
EC302:CO4	**Determine**opticalpropertiesof two-terminal semiconductor junction devices for analyzing optical transmitter and receiver	**K4:**Analyzing
EC302:CO5	**Estimate** electrical characteristics of three-terminal two-junction active devices for applying in amplifier circuit	**K4:**Analyzing
EC302:CO6	**Evaluate** electrical performance of multi-junction three-terminal devices for designing VLSI circuits	**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**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**2**	**--**	**--**
CO2	**3**	**3**	**3**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**2**	**--**	**--**
CO3	**3**	**3**	**3**	**2**	**1**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**3**	**--**	**--**
CO4	**3**	**3**	**2**	**1**	**1**	**--**	**--**	**--**	**--**	**--**	**--**	**1**	**2**	**--**	**--**
CO5	**3**	**3**	**2**	**2**	**1**	**--**	**--**	**--**	**--**	**--**	**--**	**1**	**3**	**1**	**1**
CO6	**3**	**3**	**2**	**1**	**1**	**--**	**--**	**1**	**--**	**--**	**--**	**1**	**2**	**1**	**1**
AVG	**3.00**	**3.00**	**2.33**	**1.5**	**1.00**	**--**	**--**	**1.00**	**--**	**--**	**--**	**1.00**	**2.33**	**1.00**	**1.00**

University Syllabus:

Module	Content	Hrs/Unit
Module 1: Energy Bands	Recapitulation of Conductor, Insulator & Semiconductor with special emphasis on the concept of energy bands and band-gaps, E-k diagramsfor direct and indirect band-gap	08

and Charge Carriers in Semiconductor	semiconductors [**1L**] Concept of the effective mass & crystal momentum, concept of wave-vector 'k'; Intrinsic & extrinsic semiconductors, idea about degeneracy and nondegeneracy [**2L**] Carrierconcentration in terms of bulk Density of states and Fermi-Dirac distribution (no derivation, expression and significance only); Concept ofFermi level, F.L. shift with doping & temperature [**2L**] Non-equilibrium condition: Drift & diffusion of carriers with simple expressions; Hall effect & Piezo-electric effect, Carrier scattering (basic ideaonly). Generation and re-combination, quasi-Fermi energy level (concept only) [**3L**]	
Module 2: Rectifier and detector diodes	Details: Homo- and Hetero-junctions – examples of semiconductor-semiconductor junction (Homo) & Metal-metal, Metal-S.C. junctions (Hetero-) [**1L**] Homo-junction – Semiconductor-semiconductor p-n junction & rectification [**1L**] Plot of junction voltage, field and depletion charge with distance by solving simple 1D Poisson's Equation (GradualChannel& Depletion Approximations) [**1L**] Schottky contact & Schottky diode [**1L**] Junction capacitances in p-n diodes (recapitulation) and theirexpressions; Application of Diode capacitance in Varactor Diodes [**1L**] Derivation for Forward and Reverse current, piece-wise linear diodecharacteristics,concept of Diode resistance & Differential diode resistance[**1L**] Diode switching & diode switch, properties of rectifier andswitching diodes [**1L**] Importance of reverse current in optical detectors, photo-diodes, solar cells [**1L**] Spontaneous emission &Stimulatedemission - optical devices (basic idea only) [**1L**] Tunnel diode -(basic principle only - importance of negative resistance) [**1L**]	10
Module 3: Bipolar Junction Transistors	Emphasis on BJT as a current controlled device, amplification property of BJT [**1L**] I-V characteristics (input & output) with derivation,input& output characteristics for CB. CE & CC mode, current amplification factors a for CB mode and ß for CE mode [**2L**] Eber's Moll model forStatic behavior& Charge controlled model (without derivation) for dynamic behavior, equivalent circuits [**2L**] Basic idea about Photo-transistors& Power transistors (only their features Vis-à-vis the ordinary transistors) [**1L**] PNPN transistors - simple working principle, I-V characteristics,triggering, mention of Triacs, Diacs& Thyristors. [**2L**]	08
Module 4: Field Effect Transistors	Concept of Field effect device (recapitulation), channel modulation & channel isolation [**1L**] JFET - behavior, characteristics [**1L**] MOSFET - channel inversion, Ideal Threshold voltage [**1L**] MOS capacitances, depletion width, surface field and potential (by solving Poisson's equation with gradual channel & depletion approximations) [**2L**] Real MOSFET & Threshold voltage for real MOSFET [**1L**] I-V characteristicswith expressions for saturation and non-saturation regions (concepts but no detail derivations, empirical relations to be used for solving problems) [**1L**] Equivalent circuit for MOSFET [**1L**] MOSFET for VLSI - scaling issues (basic concept of Short Channel Effects only) [**1L**]	09

RESOURCES:

1. Physics of Semiconductor Devices – S. M. Sze – Wiley
2. Semiconductor Devices – D. A. Neamen – TMH
3. https://nptel.ac.in/courses/115102103/3
4. Solid State Electronic Devices – Streetman – PHI
5. SolidState Electronic Devices – Bhattacharyya & Sharma – Oxford
6. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-772-compound-semiconductor-devices-spring-2003/lecture-notes/lecture3.pdf
7. Optoelectronic Devices -P. Bhattacharyya – PHI
8. https://www.youtube.com/watch?v=Gwyi2brc0QQ

Course Title: Signals & Systems	**Code: EC303**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 3th	**Contact Hours: 3L/week**
Continuous Assessment: 25 marks	
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Basic mathematics – vector, linear algebra, calculus

Course Outcomes (CO's) of Signals & Systems

On completion of the course students will be able to

CO#	CO Statements	Bloom's Revised Knowledge Level
EC303.CO1	**Apply** the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to model signals and systems.	K3:Apply
EC303.CO2	**Analyse** the Fourier techniques to examine the spectral characteristics of continuous-time periodic and aperiodic signals.	K4:Analyse
EC303.CO3	**Classify** systems based on their properties and demonstrate convolution to infer the response of LTI system.	K2:Classify
EC303.CO4	**Examine** impulse response and Fourier analysis to inspect system properties.	K4:Examine
EC303.CO5	**Apply** the Laplace transform and Z- transform to construct continuous-time and discrete-time systems.	K3:Apply
EC303.CO6	**Develop** the idea of sampling, random signal and system properties to solve real life signal processing applications.	K6:Develop

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	3	-	3
CO2	3	3	-	2	3	-	-	-	-	-	-	3	3	-	3
CO3	3	3	1	-	2	-	-	-	-	-	1	3	3	-	3
CO4	3	3	-	-	3	-	-	-	-	-	-	3	3	-	3
CO5	3	3	-	-	3	-	-	-	-	-	-	3	3	-	3
CO6	3	2	3	3	2	2	-	-	-	-	-	3	3	2	3
AVG	3	2.8	2	2.5	2.3	2	0	0	0	0	1	3	3	2	3

University Syllabus:

Unit	Content	Hrs/Unit
1: Introduction to signal and systems	Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – periodicity –unit impulse – unit step – Transformation of independent variable of signals: time scaling, time shifting. System properties: Linearity, Causality, time invariance and stability. Dirichlet's conditions, Determination of Fourier series coefficients of signal.	8
2: Signal Transformation	Fourier transformation of continuous and discrete time signals and their properties. Laplace transformation- analysis with examples and properties. Parseval's theorem; Convolution in time (both discrete and continuous) and frequency domains with magnitude and phase response of LTI systems.	8
3: Laplace Transform:	Recapitulation, Analysis and characterization of LTI systems using Laplace transform: Computation of impulse response and transfer function using Laplace transform.	2
4: Sampling Theorem	Representation of continuous time signals by its sample –Types of sampling, Sampling theorem. Reconstruction of a Signal from its samples, aliasing – sampling of band pass signals.	4
5: Z-Transforms	Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion.	6
6: Random Signals & Systems	Definitions, distribution & density functions, mean values & moments, function of two random variables, concepts of correlation, random processes, spectral densities, response of LTI systems to random inputs.	4

RESOURCES:

1. A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson
2. S.Haykin&B.V.Veen, Signals and Systems- John Wiley
3. A.NagoorKani- Signals and Systems- McGraw Hill

Course Title: Analog Electronic Circuits	**Code: EC304**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 4P/week**
Continuous Assessment: 25 Marks	**Final Exam :70 Marks**
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Basic Electronics

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

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC304.CO1	**Identify**theIdeal OPAMP, its internal structure, characteristics and basic configurations to construct different OPAMP based circuits for analogapplications	**K3:Applying**
EC304.CO2	**Design** different circuits with 555 timer operating in astable and monostable mode	**K6:**Creating
EC304.CO3	**Apply** concept of biasing, stability, h-model, high frequency model of transistor to develop the expressions of voltage gain, current gain, input and output impedance, trans-resistance & trans-conductance	**K3: Applying**
EC304.CO4	**Analyze** transistor amplifier and oscillator circuits toexaminevoltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, condition for sustained oscillation etc.	**K4:Analyzing**
EC304.CO5	**Define**the Filters , Regulators to correlate their ripple factor, percentage regulation respectively and some special functional circuits.	**K1:defining**
EC304.CO6	**Understand**differentPower amplifiers to illustrate their working principle and Conversion efficiency	**K2:Understanding**

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

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	-	-	2	2	-	-	-	-	3	3	2	2
CO2	3	3	3	-	-	2	1	-	-	-	-	2	3	1	1
CO3	3	3	3	-	-	2	2	-	-	-	-	3	3	2	2
CO4	3	3	3	-	-	2	2	-	-	-	-	3	3	2	2
CO5	3	3	3	-	-	3	3	-	-	-	-	3	3	3	2
CO6	3	3	3	-	-	2	1	-	-	-	-	2	3	1	1
AVG	3	3	3	0	0	2.16	1.83	0	0	0	0	2.66	3	1.833	1.66

University Syllabus:

Unit	Content	Hrs/Unit
Module 1	Filters and Regulators: Capacitor filter, π-section filter, ripple factor, series and shunt voltage regulator, percentage regulation, 78xx and 79xx series, concept of SMPS	4
	Transistor Biasing and Stability: Q-point, Self Bias-CE, Compensation techniques, h-model of transistors. Expression for voltage gain, current gain, input and output impedance, trans-resistance & trans-conductance; Emitter follower circuits, High frequency model of transistors.	6
Module 2	Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier.	6
	Feedback Amplifiers & Oscillators: Feedback concept, negative & positive feedback, voltage/ current, series/shunt feedback, Berkhausen criterion, Colpitts, Hartley's, Phase shift, Wein bridge and crystal oscillators.	4
Module 3	Operational Amplifier: Ideal OPAMP, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), inverting & noninverting amplifiers, voltage follower/buffer circuit.	6
	Applications of Operational Amplifiers: adder, integrator & differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Trans-conductance multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running oscillator.	6
Module 4	Power amplifiers – Class A, B, AB, C, Conversion efficiency, Tuned amplifier	4
	Multivibrator – Monostable, Bistable, Astable multivibrators; Monostable and astable operation using 555 timer.	2
	Special Functional Circuits: VCO and PLL.	2

GATE syllabus mapping:

GATE syllabus content	Mapping unit of university syllabus
Small signal equivalent circuits of diodes, BJTs and MOSFETs;	Module1
Simple diode circuits: clipping, clamping and rectifiers;	Module1
Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response;	Module 1, Module 2
BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational;	Module 2
Simple op-amp circuits; Sinusoidal oscillators: criterion for oscillation, single-transistor and opamp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage	Module 3, Module 4
Active filters;	Not available in University syllabus

RESOURCES:

Text Books:

1. Sedra& Smith-Microelectronic Circuits- Oxford UP
2. Franco—Design with Operational Amplifiers & Analog Integrated Circuits , 3/e, McGraw Hill
3. Boylested&Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI

Reference Books:

1. Millman &Halkias – Integrated El;ectronics, McGraw Hill.
2. Rashid-Microelectronic Circuits-Analysis and Design- Thomson (Cenage Learning)
3. Schilling & Belove—Electronic Circuit:Discrete& Integrated , 3/e , McGraw Hill
4. Razavi- Fundamentals of Microelectronic s- Wiley

Course Title:NUMERICAL METHODS	Code: M(CS)301
Type of Course: Theory	Course Designation: Compulsory
Semester: 3rd	Contact Hours: 2P+1T
Continuous Assessment: 25 marks	Final Exam:70Marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Basic Engineering Mathematics knowledge

Course Outcomes (CO's) of Numerical Methods

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
M(CS)301.CO1	**Understand**the different types of errors and real number representation to select the suitable numerical technique.	KL2: Understanding
M(CS)301.CO2	**Apply** different interpolation techniques and numerical integration techniques to solve practical problems numerically.	KL3: Applying
M(CS)301.CO3	**Choose** suitable numerical technique for obtaining the numerical solutions of System of linear equations.	KL5: Evaluating
M(CS)301.CO4	**Analyze** different numerical techniques to find solutions of algebraic equations.	KL4: Analyzing
M(CS)301.CO5	**Solve** ordinary differential equations using different numerical techniques.	KL3: Applying
M(CS)301.CO6	**Estimate** the various errors and approximations to justify theselection of numerical technique.	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	1	2	1	1	-	-	-	-	1	2	3	1	1
CO2	3	3	1	3	1	1	-	-	-	-	1	2	3	1	1
CO3	3	3	1	3	1	1	-	-	-	-	1	2	3	1	1
CO4	3	3	1	3	1	1	-	-	-	-	1	2	3	1	1
CO5	3	3	1	3	1	1	-	-	-	-	1	2	3	1	1
CO6	3	3	1	2	1	1	-	-	-	-	1	2	3	1	1
AVG	3	3	1	2.667	1	1	0	0	0	0	1	2	3.00	1	1

University Syllabus:

Unit	Content	Hrs/Unit
1: Approximation in numerical computation:	Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.	4
2: Interpolation:	Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	5
3: Numerical integration:	Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms	3
4: Numerical solution of a system of linear equations:	Gauss elimination method,Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.	6
5. Numerical solution of Algebraic equation:	Bisection method, Regula-Falsi method, Newton-Raphson method.	4
6. Numerical solution of ordinary differential equation:	Euler's method, Runge-Kutta methods,Predictor-Corrector methods, Finite Difference method.	6

RESOURCES:

Text Books:

T1. Dutta& Jana: Introductory Numerical Analysis.
T2. D. C. Sanyal and K. Das: A text book of numerical analysis
T3. Jain, Iyengar ,& Jain: Numerical Methods (Problems and Solution).

Reference Books:

R1. S.A. Mollah ,NumericalAnalysis& Computational Procedures
R2. C.Xavier: C Language and Numerical Methods.

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

E1. https://ocw.mit.edu/courses/mechanical-engineering/2-993j- introduction-to-numerical-analysis-for-engineering-13-002j-spring2005/lecture-notes/
E2. https://www.mathcity.org/msc/notes/numerical-analysis-by-m-usman-hamid

E3. https://lecturenotes.in/notes/21863-note-for-numerical-methods- nm-by-shreyan-datta
E4. https://www.youtube.com/watch?v=88ys5ZIolSg&t=965shttps://www.youtube.com/watch?v=e5CcyKn4ovY&list=PLwdnzlV3ogoUY43XoMwVVCWDSImC9mVQB&index=3

E5. https://www.getmynotes.com/numerical-method-notes

Course Title:NUMERICAL METHODS LAB	Code: M(CS) 391
Type of Course:Practical	Course Designation: Compulsory
Semester: 4th	Contact Hours: 2P/week
Continuous Assessment: 40 marks	Final exam:60Marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Prerequisite Courses:

- Basic Engineering Mathematics knowledge
- Basic Coding knowledge

Course Outcomes (CO's) of Numerical Methods Lab

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
M(CS) 391.CO1	**Understand** the utilization of MATLAB/C/Python in solving different problems using suitable numerical methods.	KL2: Understanding
M(CS) 391.CO2	**Apply** fundamentals of interpolation techniques to solve practical problems numerically through software tools.	KL3: Applying
M(CS) 391.CO3	**Compare** different numerical integration techniques using software tools to solve practical problems.	KL4: Analyzing
M(CS) 391.CO4	**Choose** suitable numerical technique to find the numerical solutions of System of linear equations through software tools.	KL5: Evaluating
M(CS) 391.CO5	**Analyze** different numerical techniques to find solutions of algebraic equations through software tools.	KL4: Analyzing
M(CS) 391.CO6	**Solve** ordinary differential equations using different numerical techniques through software tools.	KL3: 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	1	3	1	-	-	2	-	1	2	3	1	1
CO2	3	3	1	3	3	1	-	-	2	-	1	2	3	1	1
CO3	3	3	1	3	3	1	-	-	2	-	1	2	3	1	1
CO4	3	3	1	3	3	1	-	-	2	-	1	2	3	1	1
CO5	3	3	1	3	3	1	-	-	2	-	1	2	3	1	1
CO6	3	3	1	2	3	1	-	-	2	-	1	2	3	1	1
AVG	3	2.8333333	1.167	2.5	3	1	0	0	2	0	1	2	3.00	1	1

University Syllabus:

Unit	Content	Hrs/Unit
Assignment I	Assignments on 1. Newton forward /backward, 2. Lagrange's interpolation.	4
Assignment II	Assignments on numerical integration using 1. Trapezoidal rule, 2. Simpson's 1/3 rule, 3. Weddle's rule.	6
Assignment III	Assignments on numerical solution of a system of linear equations using 1. Gauss elimination 2. Gauss-Seidel iterations.	4
Assignment IV	Assignments on numerical solution of Algebraic Equation by 1. Regular-Falsimethod 2. Newton Raphson'smethod	4
Assignment V	Assignments on ordinary differential equation: 1. Euler's Method 2. Runga-Kutta method.	4
Assignment VI	Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.	2

RESOURCES:

Text Books:

T1. R.S. Salaria, Computer Oriented Numerical Methods, Khanna Publishing House.
T2. Jain, Iyengar ,& Jain: Numerical Methods (Problems and Solution).

Reference Books:

R1. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

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

E1. https://www.mathworks.com

Course Title: Circuits and Networks Lab	Code: EC-391
Type of Course: Lab	Course Designation: Compulsory
Semester: 3rd	Contact Hours: 3P/week
Continuous Assessment: 40 marks	Final Exam: 60 marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Basic Electrical Engineering lab

Course Outcomes (CO's) of Circuits and Networks Lab

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC-391.CO1	Analyze the resonant circuits to inspect the characteristics of series and parallel resonant circuit.	K4: Analyze
EC-391.CO2	Measure the node and loop voltages & current to verify the network theorems.	K5: Evaluate
EC-391.CO3	Analyze the R-L , R-C, RLC series& RLC parallel circuit to study the transient responses using hardware and simulation software.	K4: Analyze
EC-391.CO4	Evaluate the two port network to determine the Impedance (Z), and Admittance (Y) parameters.	K5: Evaluate
EC-391.CO5	Apply MATLAB simulation tools to generate different signals, represent poles & zeroes and solve partial fraction expansion in s-domain.	K3: Apply
EC-391.CO6	Determine LaplaceTransform,Inverse Laplace and different time domain functions using MATLAB .	K5: Evaluate

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	-	1	1	2	-	3	3	-	3	2	2	3
CO2	3	3	1	-	1	1	2	-	3	3	-	3	2	2	3
CO3	3	3	1	-	3	1	2	-	3	3	-	3	2	2	3
CO4	3	3	1	-	3	1	2	-	3	3	-	3	2	2	3
CO5	3	3	1	-	3	-	-	-	3	3	-	3	2	2	3
CO6	3	3	1	-	3	-	-	-	3	3	-	3	2	2	3
AVG	3	3	1	0	2.33	1	2	0	3	3	0	3	2	2	3

University Syllabus:

1. Characteristics of Series & Parallel Resonant circuits .

2. Verification of Network Theorems .

3. Transient Response in R-L & R-C Networks ; simulation / hardware .

4. Transient Response in RLC Series & Parallel Circuits &Networks ; simulation / hardware .

5. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks .

6. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB .

7. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB .

8. Determination of Laplace Transform, different time domain functions, and Inverse Laplace.

9. Transformation using MATLAB .

Course Title: Analog Electronic Circuits Lab	**Code: EC394**
Type of Course: Lab	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 3P/week**
Continuous Assessment: 40 marks	**Final Exam:60Marks**
Writer: (Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Basic Electronics

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

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC394.CO1	**Design** of transistor based circuits to estimate their characteristics, gain and efficiency.	**K6:Creating**
EC394.CO2	**Determine** the operation of power amplifiers to estimate their efficiency	**K5:Evaluating**
EC394.CO3	**Justify**pndiodebasedcircuits to estimate their related performance factors.	**K5: Evaluating**
EC394.CO4	**Evaluate**zener diode operation to interpret its performance of as voltage regulator.	**K5:Evaluating**
EC394.CO5	**Construct** OPAMP circuits to solve specific problem.	**K6:Creating**
EC394.CO6	**Design** of 555 timer based circuit to solve different real life problems.	**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	3	3		2	3		3			3	3	3	2
CO2	3	3	3	3		2	2		3			2	3	2	1
CO3	3	3	3	3		2	2		3			3	3	2	2
CO4	3	3	3	3		1	1		3			2	3	2	1
CO5	3	3	3	3		3	3		3			3	3	3	2
CO6	3	3	3	3		3	3		3			3	3	3	2
AVG	3	3	3	3		2.1666	2.333		3			2.666	3	2.5	1.666

University Syllabus:
Any 8 experiments. A College has to design a new design oriented experiment.

Unit	Content	Hrs/Unit
Experiment No.1	Study of Diode as clipper & clamper	6
Experiment No.2	Study of Zener diode as a voltage regulator	3
Experiment No.3	Study of ripple and regulation characteristics of full wave rectifier without and with capacitor filter	3
Experiment No.4	Study of characteristics curves of B.J.T & F.E.T	6
Experiment No.5	Design a two-stage R-C coupled amplifier & study of it's gain & Bandwidth	3
Experiment No.6	Study of class A & class B power amplifiers	6
Experiment No.7	Study of class C & Push-Pull amplifiers	6
Experiment No.8	Realization of current mirror & level shifter circuit using Operational Amplifiers.	6
Experiment No.9	Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.	6
Experiment No.10	Design a Bistable multivibrator using NE 555.	3
Experiment No.11	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.	6
Experiment No.12	Design a simple function generator using IC.	9
Experiment No.13	Realization of a V-to-I & I-to-V converter using Op-Amps.	6
Experiment No.14	Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO). 15. Study of D.A.C & A.D.C.	6

Course Title: Solid State Device Lab	Code: EC392
Type of Course: Lab	Course Designation: Compulsory
Semester: 3rd	Contact Hours: 3P/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, Basic Electronics, Programming software

Course Objectives of Solid State Device Lab:

EC392: COb1: Be able to design of two-terminal active devices for required specification
EC392: COb2: Be able to compute electrical characteristics of three-terminal active devices
EC392: COb3: Be capable to construct RC-coupled amplifier using three-terminal active devices and estimation of their performance for application in analog circuits
EC392: COb4: Be able to estimate design parameters of three-terminal active devices for particular biasing
EC392: COb5: Be proficient to evaluate small-signal parameters of three-layerjunction devices
EC392: COb6: Be accomplished to evaluate performance of hybrid equivalent circuit under various operating modes for three-layerjunction devices

Course Outcomes (CO's) of Solid State Device Lab:

On completion of the course, students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC392: CO1	**Design** of two-terminal active devices for required specification for estimating electrical performance	**K3:**Applying
EC392:CO2	**Compute**electricalcharacteristicsofthree-terminalactivedevicesforamplifierdesign	**K3:**Applying
EC392:CO3	**Design**ofRC-coupledamplifierusingthree-terminalactivedevicesforanalogamplifierdesign athigheroperatingfrequency	**K3:**Applying
EC392:CO4	**Calculate**structuralparametersofthree-terminaljunctiondevicesforconstantcurrentsource design atspecificinput conditions	**K4:**Analyzing
EC392:CO5	**Estimate**small-signalparametersforthree-terminaljunctiondevicesfordifferentialamplifier design	**K5:**Evaluating
EC392:CO6	**Evaluate**performanceofthree-terminalactivedevicesfromhybridequivalentcircuitunder specific operatingmode	**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	2	-	-	1	3	1	-	-	3	1	-
CO2	3	3	3	1	2	-	-	1	3	1	-	-	3	1	-
CO3	3	3	3	1	2	-	-	1	3	1	-	-	3	1	-
CO4	3	3	3	2	2	-	-	1	3	1	-	1	3	1	1
CO5	3	3	3	1	2	-	-	1	3	1	-	1	3	1	1
CO6	3	3	3	2	2	-	-	1	3	1	-	1	3	1	1
AVG	3.00	3.00	3.00	1.33	2.00	-	-	1.00	3.00	1.00		1.00	3.00	1.00	1.00

University Syllabus:

Module	Content	Hrs/Unit
Module 1	**Ex 1:** Study input characteristics of BJT in common-emitter configuration. **Ex 2:** Study output characteristics of BJT in common-emitter configuration for different base currents and hence determine hybrid parameters. **Ex 3:** Study output characteristics of BJT in common-emitter configuration and find performance parameters (Voltage Gain, Current Gain, InputImpedance, Output Impedance). **Ex 4:** Study the variation of small-signal voltage gain with frequency of a common-emitter RC coupled amplifier. **Ex 5:** Study of drain characteristics and transfer characteristics of a JFET and hence determine the FET parameters (drain resistance, transconductance& amplification factor). **Ex 6:** Study the variation of small-signal voltage gain with frequency of a JFET.	3 3 3 3 3 3
Module 2	**Ex 1:** Study of C-V characteristics of a Varactor diode by appropriate software. **Ex 2:** Study of C-V characteristics of a MOS structure by appropriate software. **Ex3:** Study of drain characteristics and transfer characteristics of a MOSFET and hence determine the FET parameters (drain resistance,transconductance& amplification factor).	3 3 3

RESOURCES:

1. Mastering MATLAB – Hanselman& Littlefield – Pearson
2. Integrated Electronics – Millman &Halkias – TMH
3. Introduction to PSPICE using ORCAD for Circuits and Electronics – M. Rashid – Pearson

Course Title: Signals and Systems Laboratory	**Code: EC393**
Type of Course: Lab	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 3P/week**
Continuous Assessment: 40 marks	**Final Exam: 60 marks**
Writer:(Course Coordinators)	**Approved by HoD (Convenor of DAB)**

Pre-requisites: Matlab/Python programming

Course Outcomes (CO's) of Signals and Systems Laboratory

On completion of the course students will be able to

CO#	**CO Statements**	**Bloom's Revised Knowledge Level**
EC393.CO1	**Make use of** MATLABprogramming tool to simulate different signals, systems and their interactions.	**K3: Applying**
EC393.CO2	**Analyze**signal frequency components using Fourier technique.	**K4: Analyzing**
EC393.CO3	**Determine** system function of continouous time linear system by Laplace tranform.	**K5: Evaluating**
EC393.CO4	**Evaluate** system function of discrete time linear system by Z tranform.	**K5: Evaluating**
EC393.CO5	**Inspect** the effect of different sampling rate on continuous time signal sampling.	**K4: Analyzing**
EC393.CO6	**Examine** the characteristics of different filters using RC circuit via simulation.	**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	-	1	-	1	-	2	-	-	2	2	1.5	2
CO2	3	3	1	-	1	-	1	-	2	-	-	2	2	1.5	2
CO3	3	3	2	-	1	-	1	-	2	-	-	2	2.25	1.5	2
CO4	3	3	2	3	1	-	1	-	2	-	-	3	2.4	1.5	3
CO5	3	1	-	3	-	1	-	-	2	3	2	3	2.33	1.5	2.67
CO6	3	3	2	3	1	1	-	-	2	3	-	3	2.4	1.5	3
AVG	3	2.67	1.60	3.00	1.00	1.00	1.00	0	2	3	2	2.50	2.23	1.5	2.44

Course Title: VALUES & ETHICS IN PROFESSION	Code: HU401
Type of Course: Theory	Course Designation: Core
Semester: 4th	Contact Hours: 3L /week
Continuous Assessment: 30 marks	Semester Exam:70 marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
CO1	Understand Basics of Social and Professional Ethics as used in Engineering Profession	K2
CO2	Apply Basics of Social and Professional Ethics in Electronics	K3
CO3	Apply Constitutional Values in Electronic Engineering	K3
CO4	Apply Professional Ethics in Technical Operationin Electronics & related fields	K3
CO5	Apply Team Work Professionalism in Technical domainin Electronics & related fields	K3
CO6	Analyze Social Values and Professional Ethics in in Electronics Engineering	K4

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	1	1
CO2	-	-	-	-	-	-	-	-	3	-	-	3	1	1	1
CO3	-	-	-	-	-	-	-	-	3	-	-	3	1	1	1
CO4	-	-	-	-	-	-	-	-	3	-	-	3	1	1	1
CO5	-	-	-	-	-	-	-	-	3	-	-	3	1	1	1
CO6	-	-	-	-	-	-	-	-	3	-	-	3	1	1	1
AVG	0	0	0	0	0	0	0	0	3	0	0	3	1.00	1.00	1.00

University Syllabus:

Unit	Content
Module 1	Science, Technology and Engineering as knowledge and as Social and Professional Activities Effects of Technological Growth: Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics Appropriate Technology Movement of Schumacher; later developments Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.

Module 2	Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.
Module 3	Ethics of Profession: Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. S ocial and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blow ing and beyond, Case studies.
Module 4	Profession and Human Values:Values Crisis in contemporary society Nature of values: Value Spectrum of a good life Psychological values: Integrated personality; mental health Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution. Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Resources:

Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Course Title:Physics	**Code: PH401**
Type of Course: Theory	**Course Designation: Core**
Semester: 4th	**Contact Hours: 3L+1T /week**
Continuous Assessment: 30 marks	**Semester Exam:70 marks**
Writer :Course Coordinator	**Approved by HoD (Convenor of DAB)**

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
CO1	**Apply** basic concepts of vector calculations	**K3**
CO2	**Analyse** principles of classical mechanics	**K4**
CO3	**Categorize** dielectric and magnetic properties of materials	**K4**
CO4	**Apply** Electromagnetic laws in Engineering	**K3**
CO5	**Compare** between Classical Physics and Quantum Physics	**K4**
CO6	**Classify** statistical distributionto real life problems	**K2**

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**	**2.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO2	**1.0**	**3.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO3	**3.0**	**2.0**	**1.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO4	**1.0**	**3.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO5	**1.0**	**3.0**	**2.0**	**0.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO6	**-**	**1.0**	**3.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
AVG	**1.8**	**2.3**	**1.8**	**1.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2.00**	**0**	**0**

University Syllabus:

Unit	Content
Module 1	Vector Calculus:1.1 Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates. 2L

Module 2	Electricity:2.1 Coulumbs law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form . Electrostatic potential and field, Poisson's Eqn. Laplace's eqn (Application to Cartesian, Spherically and Cylindrically symmetric systems – effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady current. 5L 2.2 Dielectrics-concept of polarization, the relation $D=\varepsilon_0 E+P$, Polarizability. Electronic polarization and polarization in monoatomic and polyatomic gases. 3L
Module 3	Magnetostatics & Time Varying Field: 3. Lorentz force, force on a small current element placed in a magnetic field. Biot-Savart law and its applications, divergence of magnetic field, vector potential, Ampere's law in integral form and conversion to differential form. Faraday's law of electro -magnetic induction in integral form and conversion to differential form. 3L
Module 4	Electromagnetic Theory:4.1 Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space. E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow, & Poynting Vector.6L
Module 5:	Quantum Mechanics:5.1 Generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion. 4L Course should be discussed along with physical problems of 1-D motion 5.2 Concept of probability and probability density, operators, commutator. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Physical interpretation of wave function ψ (normalization and probability interpretation), Expectation values, App lication of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels. 9L
Module 6:	Statistical Mechanics:3.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, c lassical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero of temperature and total number of particles, Bose-Einstein statistics – Planck's law of blackbody radiation.. 7L

Course Title: Basic Environmental Engg, & Elementary Biology	Code: CH-401
Type Of Course: Theory	Course Designation: Compulsory
Semester: 4th	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: Basic knowledge of Environmental science

COURSE OBJECTIVE:

CH401: COb1: Be able to understand the natural environment and its relationships with human activities.
CH401:COb2; Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CH401:COb3: Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
CH401:COb4: Be able to solve scientific problem-solving related to air, water, noise & land pollution

COURSE OUTCOMES (COs)
On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
CH401.CO1	**Resolve** different open-ended problems related to air pollution acquiring the detailed knowledge about source, effect and mechanism of the pollution	Application (Level III)
CH401.CO2	**Solve** various societal problems related to land pollution after detailed understanding about source, effect and mechanism of the pollution.	Application (Level III)
CH401.CO3	**Conceive** the basic of the need of natural resource management, environmental protection and population control. Extend the knowledge as well as the consciousness related to environmental issues to the society considering the related laws, acts and legislations	Synthesize (Level VI)
CH401.CO4	**Acquire** skills for scientific problem-solving related to water pollution	Developing (Level III)
CH401.CO5	**Determine** the issues related to noise pollution after studying the existing situation in detail.	Evaluate (Level V)
CH401.CO6	**Develop** awareness about the geographical feature of the country considering biodiversity and the variety of ecological systems present in the nature	Developing (Level III)

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2	1			1	1						1	1
CO2		2	1			1	1						1	1
CO3		2	2			2	2						1	1
CO4		2	1			1	1						1	1
CO5		2	1			1	1						1	1
CO6		1	1			1	1						1	1
AVG.		1.833	1.1666			1.1666	1.1666						1	1

University Syllabus :

Unit	Content	Hrs/ Unit
Module 1 General	**General[4L]** Basicideasofenvironment,basicconcepts,man,society&environment,theirinterrelationship. Mathematics of population growth and associated problems, Importance of population study in environmental engineering,definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vispopulationgrowth,SustainableDevelopmentMaterialsbalance:Steadystateconservationsystem,steadystatesystemwithnonconservativepollutants,stepfunction. Environmentaldegradation:NaturalenvironmentalHazardslikeFlood,earthquake,Landslide-causes,effectsandcontrol/management;AnthropogenicdegradationlikeAcidrain-cause,effectsandcontrol.NatureandscopeofEnvironmentalScienceandEngineering.	4
Module 2 Ecology	**Ecology [6L]** Elementsof ecology:System,opensystem,closedsystem,definitionofecology,species,population,community,definitionofecosystem-componentstypesandfunction.Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquaticecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each foodchain],Foodweb.Biogeochemical Cycle-definition, significance, flow chart of different cycles with only elementary reaction [Oxygen,carbon,Nitrogen,Phosphate,Sulphur]. Biodiversity-types,importance,Endemicspecies,BiodiversityHot-spot,Threatstobiodiversity,Conservationofbiodiversity..	6
Module 3 Air Pollution	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. 1L Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. 1L	11

	Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget. 1L Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). 2L Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. 2L Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. 2L Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modificatio n. 1L Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). 1L	
Module 4 Water Pollution	**Water Pollution [9L]** Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides , volatile organic compounds. 2L River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. 2L Lake: Eutrophication [Definition, source and effect]. 1L Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, slud ge treatment, oxidation ponds] tertiary treatment definition. 2L Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic 1L	9
Module 5 Land Pollution	Lithosphere; Internal structure of earth, rock and soil 1L Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal methodOpen dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste). 2L).	3
Module 6 Noise Pollution	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]1L Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, Noise pollution control. 1L	2
Module 7 Environmental Managem	**EnvironmentalManagement [2L]** Environmentalimpactassessment,EnvironmentalAudit,Environmentallawsandprotectionactof India,Differentinternationalenvironmentaltreaty/agreement/protocol.	2

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RESOURCES:

1. Masters,G.M.,“IntroductiontoEnvironmentalEngineeringandScience”,Prentice-HallofIndiaPvt.Ltd.,1991.
2. De,A.K.,“EnvironmentalChemistry”,NewAgeInternational.

Course Title:EM Theory and Transmission Lines	Code: EC-401
Type of Course:Theory	Course Designation: Compulsory
Semester: 4th	Contact Hours: 3L+1T=4hours/week
Continuous Assessment: 25 marks	
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-401.CO1	Solve boundary value problems related with scalar and vector functions under defined region of space in different coordinate systems as foundation of electromagnetic force field analysis	KL3: Applying
EC-401.CO2	Determine solutions for ideal and finite structures subject to electrostatic force to compute charge density and field for capacitive applications	KL3: Applying
EC-401.CO3	Calculate solutions for ideal and finite structures subject to magnetostatic force to estimate flux and field for inductive applications	KL3: Applying
EC-401.CO4	Under electromagnetic field, investigatefield properties of propagating wave in different media subject to interface boundary conditions for unbounded media	KL4: Analyzing
EC-401.CO5	Estimate equivalent circuit parameters and related wave properties for electromagnetic wave propagation in bounded media for circuit implementation	KL4: Analyzing
EC-401.CO6	Evaluate radiation of electromagnetic wave for guided to unguided media transport and vice-versa with various configurations for implementing transmission network.	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	1	1	--	2	--	--	--	--	--	2	2	1	1
CO2	3	3	2	1	--	2	1	--	--	--	--	2	3	1	1
CO3	3	3	2	1	--	2	1	--	--	--	--	2	3	1	1
CO4	3	3	2	1	--	2	--	--	--	--	--	1	3	1	1
CO5	3	3	2	1	--	1	--	--	--	--	--	2	3	2	1
CO6	3	3	2	1	--	3	1	1	--	--	--	3	3	2	2
AVG	3	3	1.83	1		2	1	1				2	2.83	1.33	1.16

University Syllabus:

Unit	Content	Hrs/Unit
ModuleI	3. Vector calculus - orthogonal Coordinate System, Transformations of coordinate systems; 4. Del operator; Gradient, Divergence, Curl -their physical interpretations; Laplacian operator.	3
ModuleII	4. Coulomb's law, electric field intensity, charge distribution; Gauss' law, flux density and electric field intensity. Divergence theorem. 5. Current Densities, Conductors, Poisson's & Laplace's equations. Uniqueness theorem, 6. Biot-Savart law, Ampere's law, Relation betweenJ & H, Vector magnetic Potential, Stokes' theorem.	5
ModuleIII	3. Faraday's law & Lenz's law. Displacement Current, J_C - J_D Relation, Maxwell's equations, Time-harmonic fields, 4. Wave Equation,Boundary Conditions between media interface; Uniform Plane wave; Plane Wave Propagation in Lossy Dielectric, Loss-less Dielectric,Good Conductor, Free space; 5. Poynting Theorem, Power flow, Poynting vector, Skin Depth, Surface Resistance; Reflection andTransmission for normal incidence.	10
ModuleIV	3. Transmission Lines; Concept of Lumped parameters and Distributed parameters. Line Parameters, Transmission line equations andsolutions, Physical significance of the solutions, Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation; 4. Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, 5. Smith Chart -Applications; LoadMatching Techniques / Quarter wave Matching, Bandwidth problem; Low loss RF transmission lines, line as circuit elements.	10
ModuleV	3. Types of transmission line (open 2-wire, coaxial line, micro strip coplanar waveguide), 4. Applications and limitations: Design principle,Power handling capacity. Power Dissipation, Breakdown with coaxial line and micro strip line as examples.	4
Module VI	Radiation of EM Waves 1. Antenna Concepts, Antenna Characteristic; 2. Hertzian dipole (Radiation Fields, Radiation Resistance,Radiation patterns, Directive Gain); 3. Properties and typical applications of Half-wave dipole, Loopantenna, Yagi-Uda array, Array Antennas	6

RESOURCES:

Text Books

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

3. Electromagnetic Waves Shevgaonkar, Tata-McGaw-Hillr –R K

Reference Books

1. Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India
2. Fields & Waves in Communication Electronics, S. Ramo, J. R. Whinnery & T. Van Duzer, John Wiley
3. Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
4. Electromagnetics, 2ed Edition – J A Edminister, Tata-McGraw-Hill. Engineering Electromagnetics, 7thEdition- W.H.Hayt & J.A.Buck, Tata-McGraw-Hill
5. Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy- Scitech

Course Title: Digital Electronics & Integrated circuit	Code: EC402
Type of Course: Theory	Course Designation: Core
Semester: 4th	Contact Hours: 3L +1T /week
Continuous Assessment: 30 marks	Semester Exam:70 marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Basic Electronics

Course Outcomes (CO's) of Digital Electronics & Integrated circuit

On completion of the course students will be able to

CO#	CO Statements	Bloom's Revised Knowledge Level
EC402.CO1	**Understand** the fundamentals of conversion methodology from one number system to another and encode symbols and numbers in binary codes to recognize the truth table of various logic circuits.	Understanding / K 2
EC402.CO2:	**Apply** the knowledge of Boolean Algebra and K-Map technique for simplification of logical expressions and derive the functions using logic gates.	Applying / K III
EC402.CO3	**Design** combinational logic circuits for different applications using suitable minimization technique.	Creating / K VI
EC402.CO4	**Understand** the concepts of Memory Systems: RAM, ROM, EPROM, EEROM, Programmable logic devices and gate arrays (PLDs and PLAs) that are required to design combinational logic circuits.	Understanding / K II
EC402.CO5	**Design** synchronous and asynchronous sequential circuits using Flip- Flops to analyze State table and state transition diagram.	Creating / K VI
EC402.CO6	**Analyze** different kinds of Memory Systems, Logic families and A/D and D/A converters and identify advantages and disadvantages of each to select a specific one for a digital system design.	Analyzing / K IV

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	1	-	-	-	-	2	3	1	2
CO2	3	3	-	-	-	1	1	-	-	-	-	2	3	1	2
CO3	3	3	2	-	-	1	1	-	-	-	-	3	3	1	3
CO4	3	2	-	-	-	1	1	-	-	-	-	2	3	1	3
CO5	3	1	2	-	-	1	1	-	-	-	-	3	2	1	2
CO6	3	2	-	-	-	1	1	-	-	-	-	2	3	1	3
AVG	3	2.167	2	0	0	1	1	0	0	0	0	2.33	2.83	1.00	2.5

University Syllabus:

Unit	Content	Hrs/Unit
Module1	a) Data and number systems; Binary, Octal and Hexadecimal representation and their conversions; BCD,ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic.	5
	b) Venn diagram, Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method .	6
Module2	a) Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, DeMultiplexer and Parity Generator.	5
	b) Memory Systems: RAM, ROM, EPROM, EEROM .	4
	c) Design of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs).	4
Module 3	Sequential Circuits- Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology.	6
Module4	a) Different types of A/D and D/A conversion techniques.	4
	b) Logic families- TTL, ECL, MOS and CMOS, their operation and specifications.	6

RESOURCES:

Text:

1. A.Anand Kumar, Fundamentals of Digital Circuits-PHI
2. A.K.Maini- Digital Electronics- Wiley-India
3. Kharate- Digital Electronics- Oxford

References:

1. Morries Mano- Digital Logic Design- PHI
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
3. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5. Givone—Digital Principles & Design, Mc Graw Hill
6. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
7. S.K.Mandal, Digital Electronics Principles and Applications- Mc Graw Hill.
8. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
9. Leach & Malvino—Digital Principles & Application, 5/e, Mc Graw Hill
10. Floyed & Jain- Digital Fundamentals-Pearson.
11. P.Raja- Digital Electronics- Scitech Publications

Course Title: Digital Electronic & Integrated Circuits Lab	Code: EC492
Type of Course: Lab	Course Designation: practical
Semester: 4th	Contact Hours: 3P/week
Continuous Assessment: 40 marks	Semester exam: 60 marks
Writer: (Course Coordinators)	Approved by HoD (Convenor of DAB)

Pre-requisites: Basic Electronics

Course Outcomes (CO's) of Digital Electronic & Integrated Circuits Lab
On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC492.CO1	**Demonstrate**the truth table of various logic expressions and combinational circuits using logic gates.	KL2: Understanding
EC492.CO2	**Design**various combinational circuits such as adders, subtractors, decoders, comparators, multiplexers and demultiplexers for testing and evaluating their functionality.	KL6: Create
EC492.CO3	**Design**various code conversion circuits such as Binary to gray, BCD to Excess-3 to verify their truth table.	KL6: Create
EC492.CO4	**Construct** various flips-flops like RS-JK and D flip-flops using Universal logic gates to verify their state table.	KL6: Create
EC492.CO5	**Design** various sequential circuits such as counters, shift registers using suitable flip-flops to test and evaluate their performance.	KL6: Create
EC492.CO6	**Simulate** full adder and up/down counters using suitable logic simulator to prepare the correct logic circuits.	KL3: 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	3	2	-	-	1	-	2	2	1	1	2	1	2
CO2	3	3	3	2	-	-	1	-	2	2	1	1	2	1	3
CO3	3	3	3	2	-	-	1	-	2	2	1	1	2	1	3
CO4	3	3	3	2	-	-	1	-	2	2	1	1	2	1	3
CO5	3	3	3	2	-	-	1	-	2	2	1	1	2	1	3
CO6	3	3	3	2	-	-	1	-	2	2	1	1	2	2	2
AVG	3	3	3	2	0	0	1	0	2	2	1	1	2	1.167	2.67

University Syllabus:

Sl.No.	Title	Contact hours
1.	Realization of basic gates using Universal logic gates.	
2.	Code conversion circuits- BCD to Excess-3 and vice-versa.	
3.	Four-bit parity generator and comparator circuits.	
4.	Construction of simple Decoder and Multiplexer circuits using logic gates.	

5.	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using	
6.	Construction of simple arithmetic circuits-Adder, Subtractor.	**Total 30 Hrs**
7.	Realization of RS-JK and D flip-flops using Universal logic gates.	
8.	Realization of Universal Register using JK flip-flops and logic gates.	
9.	Realization of Universal Register using multiplexer and flip-flops.	
10.	Construction of Adder circuit using Shift Register and full Adder.	
11.	Realization of Asynchronous Up/Down counter.	
12.	Realization of Synchronous Up/Down counter.	
13.	Design of Sequential Counter with irregular sequences.	
14.	Realization of Ring counter and Johnson's counter.	

RESOURCES:

Text:

1. A.Anand Kumar, Fundamentals of Digital Circuits-PHI
2. A.K.Maini- Digital Electronics- Wiley-India
3. Kharate- Digital Electronics- Oxford

References:

1. Morries Mano- Digital Logic Design- PHI
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
3. H.Taub&D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5. Givone—Digital Principles & Design, Mc Graw Hill
6. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
7. S.K.Mandal, Digital Electronics Principles and Applications- Mc Graw Hill.
8. J.Bignell&R.Donovan-Digital Electronics-5/e- Cenage Learning.
9. Leach &Malvino—Digital Principles & Application, 5/e, Mc Graw Hill
10. Floyed& Jain- Digital Fundamentals-Pearson.
11. P.Raja- Digital Electronics- Scitech Publications

Course Title: Electromagnetic Wave and Transmission Lines Lab	**Code: EC491**
Type of Course: Lab	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 3P/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 and Transmission Lines Lab:

On completion of the course, students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
EC491: CO1	**Determine** unbounded wave characteristics with varying terminal properties	**K5: Evaluating**
EC491:CO2	**Examine** electrical properties of unbounded transmission line using graphical techniques	**K4: Analyzing**
EC491:CO3	**Analyze** electrical properties of bounded transmission line	**K4: Analyzing**
EC491:CO4	**Evaluate** field characteristics of transmitting/receiving active elements for determining coverage area	**K5: Evaluating**
EC491:CO5	**Estimate** field characteristics of multi-element transmitting device for determining region of maximum power	**K5: Evaluating**
EC491: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 loadend.. **Ex 2:**Input Impedance of a terminated coaxial line using shift in minima technique. **Ex 3:**Study of Smith chart on Matlab platform. **Ex 4:**Simulation study of Smith chart - Single and double stub matching.	3 3 3 3

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 4:** Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna. **Ex 5:** Study of Spectrum Analyzer.	3 3 3 3 3

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: Physics Lab-2	**Code: PH491**
Type of Course: Lab	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 3P/week**
Continuous Assessment: 40 marks(PCA1 & PCA2)	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by HoD (Convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

CO	Outcome	Knowledge Level of revised Bloom's Taxonomy
CO1	**Evaluate** Rydberg constant by studying Hydrogen spectrum to visualize visible spectra and to assess this empirical fitting parameter as a fundamental physical constant	K5
CO2	**Determine** Band Gap of a given intrinsic semiconductor and distinguish between different intrinsic semiconductor.	K5
CO3	**Determine** the dielectric constant of different capacitors to correlate their usage like insulator and limitation of their usage as a dielectric material.	K5
CO4	**Determine** Hall coefficient of a given intrinsic semiconductor and distinguish between different intrinsic semiconductors.	K5
CO5	**Apply** concepts of quantum mechanics to verify Bohr's atomic orbital theory	K3
CO6	**Determine** Planck's constant and Stefan's constant applying modern Physics	K5

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**	**2.0**	**1.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**		
CO2	**3.0**	**2.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**		
CO3	**3.0**	**2.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**		
CO4	**3.0**	**2.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**		
CO5	**3.0**	**1.0**	**1.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**		
CO6	**3.0**	**1.0**	**1.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**		
AV	**3.0**	**1.7**	**1.0**	**1.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1.67**	**0**	**0**

University Syllabus

Group 1: Experiments on Electricity and Mangentism

1. Determination of dielectric constant of a given dielectric material.

3. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.

4. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
5. Determination of specific charge (e/m) of electron by J.J. Thomson's method.
Group 2: Quantum Physics
6. Determination of Planck's constant using photocell.
7. Determination of Lande'g factor using Electron spin resonance spetrometer.
8. Determination of Stefan's radiation constant
9. Verification of Bohr's atomic orbital theory through Frank -Hertz experiment.
10. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum
Group 3: Modern Physics
11. Determination of Hall co-efficient of semiconductors.
12. Determination of band gap of semiconductors.
13. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.
a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the
Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the
data taken.
b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above
experiments or the experiment mentioned in c] into electrical voltage and collect the data in a computer using phoenix or similar
interface.
c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.
Note:
i. Failure to perform each experiment mentioned in b] and c] should be compensated by two experiments mentioned in the above list.
ii. At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b] and c]
iii. Experiment in b] and c] can be coupled and parts of a single experiment.

Resources:

Recommended Text Books and Reference Books:
For Both Physics I and II

1. B. Dutta Roy (Basic Physics)

2. R.K. Kar (Engineering Physics)

3. Mani and Meheta (Modern Physics)

4.. Arthur Baiser (Perspective & Concept of Modern Physics)

Course Title: TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE	**Code: HU481**
Type of Course: sessional	**Course Designation: Sessional**
Semester: 4th	**Contact Hours: 2P/week**
Continuous Assessment: 100	
Writer: Course Coordinator	**Approved by HoD (Convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

CO	Outcome	Knowledge Level of revised Bloom's Taxonomy
CO1	Understand Advanced Spoken variety of English Language	K2
CO2	Apply Advanced Rules of English Vocabulary Skill for Listening and Speaking in Electronics & related fields	K3
CO3	Apply AdvancedRules of English Grammar Skill for Presentation in Electronics & related fields	K3
CO4	Apply AdvancedRules of English Grammar Skill for Technical Communication	K3
CO5	Apply Advanced English Language Skill for Responding Verbally & Nonverbally in Formal and Informal situation	K3
CO6	Demonstrate AdvancedEnglish Language Skills for Technical Report Writingin Electronics & related fields	K2

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	1	1
CO2	-	-	-	-	-	-	-	-	-	3	-	3	1	1	1
CO3	-	-	-	-	-	-	-	-	-	3	-	3	1	1	1
CO4	-	-	-	-	-	-	-	-	-	3	-	3	1	1	1
CO5	-	-	-	-	-	-	-	-	-	3	-	3	1	1	1
CO6	-	-	-	-	-	-	-	-	-	3	-	3	1	1	1
AV	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	3	0	3	1.00	1.00	1.00

University Syllabus

Guidelines for Course Execution:

Objectives of this Course: This course has been designed:

1. To inculcate a sense of confidence in the students.
2. To help them become good communicators both socially and professionally.
3. To assist them to enhance their power of Technical Communication.

Detailed Course Outlines:

A. Technical Report Writing : 2L+6P

1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

B. Language Laboratory Practice

I. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory

Practice Sessions 2L

2. Conversation Practice Sessions: (To be done as real life interactions) 2L+4P

a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed

b) Introducing Role Play & honing over all Communicative Competence

3. Group Discussion Sessions: 2L+6P

a) Teaching Strategies of Group Discussion

b) Introducing Different Models & Topics of Group Discussion

c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure

Interview Sessions; 2L+6P

a) Training students to face Job Interviews confidently and successfully

b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for

effective communication

4. Presentation: 2L+6P

a) Teaching Presentation as a skill

b) Strategies and Standard Practices of Individual /Group Presentation

c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids

5. Competitive Examination: 2L+2P

a) Making the students aware of Provincial /National/International Competitive Examinations

b) Strategies/Tactics for success in Competitive Examinations

c) SWOT Analysis and its Application in fixing Target

Resources:

Books – Recommended:

Nira Konar: English Language Laboratory: A Comprehensive Manual

D. Sudharani: Advanced Manual for Communication Laboratories &

Technical Report Writing

Pearson Education (W.B. edition), 2011

PHI Learning, 2011

References:

Adrian Duff et. al. (ed.): Cambridge Skills for Fluency 23

A) Speaking (Levels 1-4 Audio Cassettes/Handbooks)