Curriculum and Syllabus for Dual Degree

B.Tech in Electronics and Communication Engineering and M.Tech in VLSI Design

From The Academic Year 2023

(Approved in Senate 51)

Indian Institute of Information Technology, Design and Manufacturing, Kancheepuram

Chennai-600 127

Semester 1							
S.No	Course Code	Course Name	Category	L	T	P	C
1	MA1000	Calculus	BSC	3	1	0	4
2	PH1000	Engineering Electro Magnetics	BSC	3	0	0	3
3	EC1000	Electrical Circuits for Engineers	BEC	3	1	0	4
4	CS1000	Problem Solving and Programming	BEC	3	0	0	3
5	ME1000	Materials for Engineers	BEC	3	0	0	3
6	DS1000	Foundation for Engineering and Product Design	DSC	1	2	0	3
7	PH1001	Engineering Electro Magnetics Practice	BSC	0	0	3	1.5
8	CS1001	Problem Solving and Programming Practice	BEC	0	0	3	1.5
9	HS1000	Effective Language and Communication Skills	HSC	1	0	2	2
10	NC1000	NSO	NC	0	0	2	0
	NC1002	NCC					
	NC1004	SSG					
							25
	Semester 2						
S.No	Course Code	Course Name	Category	L	T	P	C
1	MA1001	Differential Equations	BSC	3	1	0	4
2		Science Elective Course 1	SEC	3	1	0	4
3	ME1001	Engineering Graphics	BEC	2	0	4	4
4	CS1002	Elementary Data Structures and Logical Thinking	ITC	3	0	0	3
5	DS1001	Sociology of Design	DSC	1	2	0	3
6	ID1000	Design and Manufacturing Lab	ITC	0	0	2	1
7	EC1001	Digital Circuits	PCC	3	1	0	4
8	CS1003	Elementary Data Structures and Logical Thinking Practice	ITC	0	0	4	2
9	NC1001	NSO	NC	0	0	2	0
	NC1003	NCC					
	NC1005	SSG					
10	NC1008	Earth, Environment and Design	NC	1	0	0	0
							25
Semester 3							
S.No	Course Code	Course Name	Category	L	T	P	C
1		Science Elective Course 2	SEC	3	1	0	4
2	DS2000	Systems Thinking for Design	DSC	1	2	0	3
3	EC2000	Solid State Electronic Devices	PCC	3	1	0	4
4	EC2001	Network Theory	PCC	3	1	0	4
5	EC2002	Signals and Systems	PCC	3	1	0	4
6	EC2003	Microprocessors and Microcontrollers	PCC	2	0	3	3.5
7	EC2004	Digital Circuits Practice	PCC	0	0	3	1.5
8	NC2000	Indian Constitution, Essence of Indian Traditional Knowledge	NC	1	0	0	0
							24

Semester 4							
S.No	Course Code	Course Name	Category	L	T	P	C
1		Science Elective Course 3	SEC	3	1	0	4
2	DS2001	Smart Product Design	DSC	1	2	0	3
3	EC2007	Digital Signal Processing	PCC	3	1	0	4
4	EC2008	Electromagnetic Waves	PCC	3	1	0	4
5	EC2009	Analog Circuits	PCC	3	1	0	4
6	EC2010	Sensing and Instrumentation Practice	PCC	1	0	3	2.5
7	EC2011	Embedded Systems Practice	PCC	1	0	3	2.5
8	NC2001	Human Values and Stress Management	NC	1	0	0	0
							24
Semester 5							
S.No	Course Code	Course Name	Category	L	T	P	C
1	CS3006	Introduction to Data Science for Engineers	ITC	3	0	2	4
2	DS3000	Entrepreneurship and Management Functions	DSC	1	2	0	3
3	EC3000	Control Systems	PCC	3	1	0	4
4	EC3001	Communication Systems	PCC	3	1	0	4
5		Professional Elective Course 1	PEC	3	1	0	4
6	EC3002	Digital Signal Processing Practice	PCC	0	0	3	1.5
7	EC3003	Analog Circuits Practice	PCC	0	0	3	1.5
8	NC3000	Professional Ethics and Organizational Behaviour	NC	1	0	0	0
							22
Semester 6							
S.No	Course Code		Category	L	T	P	C
1	DS3001	Prototyping and Testing	DSC	1	2	0	3
2	EC3004	Digital Communication	PCC	3	1	0	4
3		Professional Elective Course 2	PEC	3	1	0	4
4		Free Elective Course 1	ELC	3	1	0	4
5		Free Elective Course 2	ELC	3	1	0	4
6	EC3005	Communication Systems Practice	PCC	0	0	2	1
7	HS3000	Professional Communication	HSC	1	0	2	2
8	NC3001	Intellectual Property Rights	NC	1	0	0	0
							22
Semester 7							
S.No	Course Code		Category	L	T	P	C
1	EC5014	Digital IC Design	PCC	3	1	0	4
2	EC5009	MOSFET Modeling for VLSI Circuits	PCC	3	1	0	4
3	EC5011	VLSI Testing and Testable Design	PCC	3	1	0	4
4		Professional Elective Course 3	PEC	3	1	0	4
5	EC5034	Device Modeling and Simulation Practice	PCC	0	0	4	2
6	EC5035	VLSI Testing Practice	PCC	0	0	4	2
7		Free Elective Course 3	ELC	3	1	0	4
							24

Semester 8							
S.No	Course Code		Category	L	T	P	C
1		Free Elective Course 4	ELC	3	1	0	4
2		Professional Elective Course 4	PEC	3	1	0	4
3		Professional Elective Course 5	PEC	3	1	0	4
4	EC5010	Analog IC Design	PCC	3	1	0	4
5	EC5018	High level Verification with system Verilog and UVM	PCC	2	0	4	4
6	EC5017	IC Design Practice	PCC	0	0	4	2
							22
Semester 9							
S.No	Courses Code	Course Name	Category	L	T	P	C
1	EC6009	DD-EC-VS- Project Phase I (May-July) (Internship)	PCD	0	0	8	4
2	EC6010	DD-EC-VS- Project Phase II (Aug – Nov)	PCD	0	0	12	6
							10
Semester 10							
S.No	Courses Code	Course Name	Category	L	T	P	C
1	EC6011	DD- EC-VS- Project Phase III (Dec – May)	PCD	0	0	20	10
							10

$ All NC courses are Pass/Fail courses for which the letter grade H/L shall be awarded.

1. Professional Elective Course is an elective course offered or prescribed by the parent department. Free Elective Course is an elective course offered by any department, including the parent department. For example: - A ME student, based on his/her choice, can register the elective course offered by ME department or CSE department as free elective course.

Semester wise Credit Distribution

Semester												
Category	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Total	%
Basic Science Course (BSC)	8.5	4	0	0	0	0	0	0	0	0	12.5	6.01
Science Elective Course (SEC)	0	4	4	4	0	0	0	0	0	0	12	5.77
Basic Engineering Course (BEC)	11.5	4	0	0	0	0	0	0	0	0	15.5	7.45
Design Course (DSC)	3	3	3	3	3	3	0	0	0	0	18	8.65
IT Skill Course (ITC)	0	6	0	0	4	0	0	0	0	0	10	4.81
Professional Core Course (PCC)	0	4	17	17	11	5	16	10	0	0	80	38.46
Professional Elective Course (PEC)	0	0	0	0	4	4	4	8	0	0	20	9.62
Elective Course (ELC)	0	0	0	0	0	8	4	4	0	0	16	7.69
Humanities and Social Science Course (HSC)	2	0	0	0	0	2	0	0	0	0	4	1.92
Professional Career Development (PCD)	0	0	0	0	0	0	0	0	10	10	20	9.62
Total	25	25	24	24	22	22	24	22	10	10	208	100
	25	50	74	98	120	142	166	188	198	208		

Course Name	Calculus	Course Code	MA1000			
Offered by Department	SH -Mathematics	Structure (LTPC)	3	1	0	4
To be offered for	B.Tech	Course type	Core			
Pre-requisite	NIL	Approved In	Senate-43			
Learning Objectives	The course will introduce the student to basic concepts in Calculus such as convergence, differentiation & integration and its applications.					
Contents of the course	• Limit and Continuity of functions defined on intervals, Intermediate Value Theorem, Differentiability, Rolle's Theorem, Mean Value Theorem, Taylor's Formula (5) • Sequences and series (7) • Definite integral as the limit of sum – Mean value theorem – Fundamental theorem of integral calculus and its applications (9) • Functions of several variables – Limit and Continuity, Geometric representation of partial and total increments Partial derivatives – Derivatives of composite functions (8) • Directional derivatives – Gradient, Lagrange multipliers – Optimization problems (7) • Multiple integrals – Evaluation of line and surface integrals (6)					
Essential Reading	1.Thomas. G.B, and Finney R.L, Calculus, Pearson Education, 2007.					
Supplementary Reading	1. Piskunov. N, Differential and Integral Calculus, Vol. I & II, Mir. Publishers, 1981. 2. Kreyszig. E, Advanced Engineering Mathematics, Wiley Eastern 2007. 3. J Hass, M D Weir, F R Giordano, Thomas Calculus, 11th Edition, Pearson.					

Course Name	Engineering Electromagnetics	Course Code	PH1000			
Offered by Department	SH -Physics	Structure(LTPC)	3	0	0	3
To be offered for	B. Tech	Course Type	Core			
Pre-requisite	NIL	Approved In	Senate-43			
Learning Objectives	The objective of this course is to give an idea how the electromagnetic wave behaves. This alsoprovides an understanding of theories of electrostatics, magnetism and electrodynamics with theirapplications.Itwillenhance theproblemsolvingcapacityofthestudent.					
Contents of thecourse	• Vectors - an introduction;Unit vectors in spherical and cylindricalpolarco-ordinates;Conceptofvectorfields;Gradientofascalarfield; flux, divergence of a vector,Gauss's theorem,Continuityequation;Curl– rotationalandirrationalvectorfields,Stoke'stheorem. (12) • Electrostatics: • Electrostatic potential and field due to discrete and continuous charge distributions, boundarycondition, Energy for a charge distribution, Conductors and capacitors, Laplace's equationImageproblem, Dielectric polarization, electric displacement vector, dielectric susceptibility, energy indielectricsystems. (10) • Magneto statics: • Lorentz Force Law Bio-Savart's law and Ampere's law in magneto statics, Divergence and curl of B,Magnetic induction due to configurations ofcurrent-carryingconductors,Magnetization and boundcurrents,Energydensityinamagnetic fieldMagneticpermeability andsusceptibility. (10) • Electrodynamics: • Electromotiveforce,Time-varyingfields,Faradays'lawof electromagneticinduction, • Self and mutual inductance,displacement current, Maxwell's equations in free space. Boundarycondition, propagation in linear medium. Planeelectromagneticwaves—reflection andrefraction,electromagnetic energydensity,Pointing Vector.(10)					
Essential Reading	1.W.H.Hayt andJ.A.Buck,EngineeringElectromagnetics,TataMcGrawHillEducationPvt.Ltd, 2006.					
Supplementary Reading	1. W. H. Hayt, J. A.Buck and M.Jaleel Akhtar,Engineering Electromagnetics,McGraw Hill (India) Education Pvt. Ltd, Special Indian Edition 2020. 2. Purcell. E.M, Electricityand Magnetism BerkleyPhysics Course, V2, Tata McGraw Hill, 2008. 3. Feynman.R.P,Leighton.R.B,Sands.M,TheFeynmanLectureson Physics,Narosa Publishing House, Vol. II, 2008. Hill, 2008. 4. G.B.Arfken,H.J.WeberandF.E.Harris,MathematicalMethodsforPhysicists, Academic Press, 2013					

Course Name	ElectricalCircuitsforEngineers	Course Code	EC1000			
Offered by Department	ElectronicsandCommunication Engineering	Structure(LTPC)	3	1	0	4
To be offered for	BTECH	Course Type	Core			
Pre-requisite	NIL	Approved In	Senate-43			
Learning Objectives	Thiscourseaimstoequipthestudentswithabasicunderstandingofelectricalcircuitsandmachinesforspecifictypesofapplications. Thiscoursealsoequipsstudentswithanabilitytounderstandbasicsofanaloganddigital electronics.					
LearningOutcomes	Thestudentsshalldevelopanintuitiveunderstandingofthecircuitanalysis,basicconceptsofelectricalmachines,andelectronicdevicesandcircuitsandbeabletoapplytheminproductdesignanddevelopment					
Contentsofthecourse *(Withapproximatebreak-upofhours)*	Elementsinelectricalcircuits:R,L,C,voltageandcurrentsources,Ohm'slaw,Kirchoff'sLaws**(4)** Networkanalysis:Nodalandmeshanalysiswithonlyindependentsources**(4)** Networktheorems:Superposition,Thevenin's&Norton's,Maximumpowertransfertheorems**(4)** DCcircuits:ResponseofRC,RLandRLCcircuits**(6)** ACcircuits:ACsignalmeasures,Phasoranalysisofsingle-phaseACcircuits,ThreephaseACcircuits**(6)** Machines:Transformers,DCgenerator,DCmotor,ACinductionmachines**(8)** Diodes:V-Icharacteristics,applications-rectifiers,clippers,clampers**(2)** Op-amps:gain,feedback,applications-inverting/non-invertingamplifiers,sumanddifferenceamplifier,comparators **(4)** Logicgatesandcombinationalcircuits–Basicgates,Karnaughmaps,Fulladder,halfadder **(4)**					
Essential Reading	1. EdwardHughes,IanMcKenzieSmith,JohnHiley,KeithBrown,'Hughe'sElectricalandElectronicTechnology',10th edition,Pearson,2010					
Supplementary Reading	1. CharlesAlexanderandMatthewSadiku'FundamentalsofElectricCircuits'7th Edition,McGrawHill,2021 2. C.H.Roth,Jr.,LarryRKinney,'FundamentalsofLogicDesign',7th Edition,CengageLearning,2013. 3. JacobMillman,ChristosCHalkais,SatyabrataJit,'Millman'sElectronicDevicesandCircuits',4th Edition,McGrawHillIndia,2015 4. StephenDUmans,'Fitzgerald&Kingsley'sElectricMachinery',McGraw-Hill,7th ed.2020.					

Course Name	Problem Solving and Programming	Course Code	CS1000			
Offered by Department	Computer Science	Structure (LTPC)	3	0	0	3
To be offered for	B.Tech	Course type	Core			
Prerequisite	NIL	Approved In	Senate -43			
Learning Objectives	Focus is on problem solving using computers with C programming as the language. Data representation, base conversions, arithmetic in fixed and floating point representations, and problems related to this shall be covered. The sequence, selection and repetition statements in C programming language shall be discussed with case studies. The practice component of this course shall supplement theory by providing hands-on experience.					
Learning Outcomes	The teaching and assessment shall ensure that given a computational problem, students can use computers as a tool to model and solve the problem. Writing pseudo codes and C programming using basic programming constructs are expected out of the students. Students are expected to be conversant in number conversions and representations.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Computing Machine - Need and Applications - Evolution of Computing Machines (Calculators through Computers) Number Representation - Fixed and Floating Point - Base Conversions: Binary, Decimal, Octal, Hexa decimal number systems and conversions. (8 hours) • Basic programming constructs in C – Data types in C – Input and output statements – Formatted input/output - Control strings - return types - Case studies involving sequence statements (4hours) • Operators - Arithmetic, logical, relational, shift, unary operators - Precedence and Associativity (3 hours) • Selection Statements: IF-ELSE, SWITCH-CASE - Programs involving sequence and selection - GOTO statements - break statement - Nested IF - Switch inside if and vice-versa (5 hours) • Repetition Statements: FOR, WHILE - Programs involving sequence, selection and repetition - continue statement - Nested loops (5 hours) • Introduction to Arrays and Strings - Array manipulation - string manipulation - string operations - multi-dimensional arrays (6 hours) • Functions in C – Function declaration, definition – scope -storage Class-Built and user defined functions –Recursive functions (7 hours) • Introduction to Pointers, Dynamic Memory Allocation, Structures and File processing (7 hours)					
Essential Reading	1.Deitel P J and Deitel H M, C : How To Program, Prentice Hall, 7th Edn, 2012.					
Supplementary Reading	1. Kernighan, Ritchie D, The C Programming Language, Prentice Hall, 2 Edn,					

	1988

Course Name	Materials for Engineers	Course Code	ME1000			
Offered by Department	Mechanical Engineering	Structure (LTPC)	3	0	0	3
To be offered for	B. Tech	Course Type	Core			
Pre-requisite	NIL	Approved In	Senate- 43			
Learning Objectives	• To provide overview of microstructure and properties of various engineering materials • To explore relations between performance of engineering products and microstructure, properties of materials that are used to construct them.					
Learning Outcomes	After the completion of the course, students will be able: • To explain the microstructure and properties of materials like steels, polymers, ceramics, and composites. • To understand the correlation of microstructure-properties-performance of materials so as to select suitable materials for engineering products.					
Contents of the course	• Classification and evolution of engineering materials, crystal structure, defects, crystallographic planes, directions, slip, deformation mechanical behavior, strengthening mechanisms, microstructure and properties of metal alloys (12) • Properties and processing of polymers, ceramics and composite materials, microstructure-property relationships (9) • Electrical, electronic and magnetic properties of materials, microstructure-property relationships (6) • Introduction to Nano, Bio, Smart and Functional materials. (3) • Introduction to selection of materials, Product based case studies on microstructure-property-performance of materials in the design of automobile; aircraft structures; e-vehicles; energy storage; electronic, optical and magnetic devices; and biomedical devices. (12)					
Essential Reading	1. William D. Callister Jr., David G. Rethwisch, "Materials Science and Engineering: An Introduction", 10th Edition, Wiley, 2018. 2. Michael Ashby, Hugh Shercliff, David Cebon, "Materials – Engineering, Science, Processing and Design", 4th Edition, Butterworth-Heinemann, 2018.					
Supplementary Reading	1. V Raghavan, "Materials Science and Engineering: A First Course, 5th Ed, 2007, PHI India. 2. Donald R. Askeland K Balani, "The Science and Engineering of Materials," 7th Edition, Cengage Learning, 2016. 3. Michael Ashby, "Materials Selection in Mechanical Design", 5th Edition, Butterwoth-Heinemann, 2016.					

Course Name	Foundation for engineering and product design	Course Code	DS1000			
Offered by Department	SIDI	Structure (LTPC)	1	2	0	3
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate -43			
Learning Objectives	The objective of this foundation program is to help students coming from +2 background to: • Unlearn limiting assumptions, risk avoidance, fear of failure • Awaken their senses & rediscover their creative selves • Experience the impact of design and technology in everyday objects					
Learning Outcomes	At the end the course, the student should ● demonstrate qualities of immersion in a task; ● unlearn key limiting assumptions; ● become comfortable with sketch-thinking and develop skills in design sketching; ● be excited by the potential of technology and design in improving lives;					
Contents of the course (With approximate break up of hours)	**Module-1: Induction: (5 hrs.)** • History of the place; the industrial ecosystem; institution • Exercises to improve interaction; local visits; **Module-2: Learn to observe nature and self (12 hrs)** ● Know your context - physical and social; ● Unlearning activities; Start journaling ● Observe wholes-parts (trees-leaves); variety of leaves; colors ● Document in a variety of ways - collage; sketch, paint, photograph, video **Module-3: Learn to observe everyday objects (15 hrs)** ● Unbundle everyday objects, observe, reorganize ● Whole-part relations; System physics; ● Observe interplay of art, design, culture, technology in everyday objects **Module-4: Visualize and Realize 3D objects (15 hrs)** ● Introduction to design sketching-1 (paper/pencil) ● Concepts of perspective drawing and product sketching. ● Introduction to color theory - mixing of colors to get different shades ● Explore variations on the form of chosen objects ● Realize designs with tools/materials (Origami; Clay; Foam cutting; Laser cutting; Glues) ● Introduction to digital sketching & 3D printing Evaluation: Continuous assessment (80%); Final Form Designs Presentation (20%)					
Essential & Supplementary Reading	1. Kevin Henry, Drawing for Product Designers, Laurence King Publishing, 2012, ISBN:9781856697439 2. KoosEissen and RoselienSteur, Sketching – The Basics, BIS Publishers, 2011, ISBN:9789063695347 3. Thomas C Wang, Pencil Sketching, John Wiley, 2002, ISBN:9780471218050 4. Wucius Wong, Principles of Color Design: Designing with Electronic Color, John Wiley, 2nd Edition, 1996, ISBN:9780471287087					

Course Name	EngineeringElectromagneticsPractice	Course Code	PH1001			
Offered by Department	SH-Physics	Structure(LTPC)	0	0	3	1.5
To be offered for	B.Tech	Course Type	Core			
Pre-requisite	NIL	Approved In	Senate-43			
Learning Objectives	The objective of this course is to give a hand on experience how the electromagnetic wave behavesin different situations. The students will be able to relate the knowledge they have got in the theoryclass with their experience. This course will enhance their skill of handling instruments and thepresentationof the results obtainedfromtheexperiments.					
Contents of thecourse	Electricalandmagneticpropertiesofmaterialsbasedontheconceptofelectricalpolarization,magnetizationofmaterialswillbe studiedin variousexperiments. Experimentsbasedonthe conceptof phenomenasuchasinterference,diffractionetc.relatedtoelectromagneticwaveswillbedoneherean dthesemethodswillbeappliedtomeasuresomeunknown physical quantities such as wavelength of a light, diameter of a very thin wire, very smallaperture forlightetc.					
Essential Reading	1.IIITD&MLaboratorymanualforElectromagneticWavePractice					
Supplementary Reading	1.W.H.Hayt andJ. A.Buck,EngineeringElectromagnetics,TataMcFrawHill EducationPvt. Ltd,2006.					

<table>
<tr><td></td><td>Problem Solving and Programming Practice</td><td>Course Code</td><td colspan="4">CS1001</td></tr>
<tr><td>Offered by Department</td><td>Computer Science</td><td>Structure (LTPC)</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>To be offered for</td><td>B.Tech</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>NIL</td><td>Approved In</td><td colspan="4">Senate-43</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">Focus is on problem solving using computers with C programming as the language. The sequence, selection and repetition statements in C programming language shall be discussed with case studies.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">The teaching and assessment shall ensure that given a computational problem, students can use computers as a tool to model and solve the problem. Writing pseudo codes and C programming using basic programming constructs are expected out of the students. Students are expected to be conversant in number conversions and representations.</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">Introduction to text editors - basic text processing - case studies involving office software - doc and ppt creation
Introduction to Linux commands - file/directory creation - copy, move, pdf creation, zip commands
Case studies using sequence statements - input/output statements - arithmetic with precedence and associativity.
Case studies involving selection and repetition statements - functions – recursion</td></tr>
<tr><td>Essential Reading</td><td colspan="6">Deitel P J and Deitel H M, C : How To Program, Prentice Hall, 7th Edn, 2012.</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">Kernighan, Ritchie D, The C Programming Language, Prentice Hall, 2 Edn., 1988</td></tr>
</table>

	Effective Language and Communication Skills	Course Code	HS1000			
Offered by Department	SH-English	Structure(LTPC)	1	0	2	2
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-43			
Learning Objectives	• Hone LSRW and practice critical thinking • Enable students to speak and write grammatically acceptable sentences • Train students in technical communication • Cultivate interest to learn language and to build the confidence to communicate in English • Develop an interest in updating their language skills through continuous learning • Connecting personal growth with improvement in their proficiency in English					
Learning Outcomes	• Able to communicate effectively with grammatically acceptable constructions and appropriate wordsin formal and informal situations • Can extract information effectively and able to think critically • Able to present technical content confidently					
Course Contents(with approximatebreakup of hours forlecture/ tutorial/ be donepractice)	• Introduction: Language, effective communication, ethics and aesthetics of communication (L1) • Phonetics – sounds, pronunciation of words, stress, intonation, listening, Varieties of English (L3, P4) • Sentence structure, concord, punctuation, stylistic errors, common errors (L3, P4) • Reading and comprehension (L2, P5) ➢ Different types of reading, analyzing the organization of the text ➢ Critical thinking- thesis statement, argument, hypothesis, order, reason, evidence, consistency,tautology, conclusion • Exercises for vocabulary enrichment (for daily practice) • Speaking (L2, P5) ➢ Barriers to effective communication, technical presentation and presentation skills, self-introduction, ➢ Requests, enquiry, suggestion in formal and informal situations, reporting an event, grouppresentation – debate • Writing (L3, P8) ➢ Writing formal letters, email, résumé, ➢ Data interpretation, reports, product description/requirements/ technical instructions, recordingobservations ➢ The language of content strategy - voice and tone strategy - the language of localization – textanalysis tools ➢ Plagiarism – the importance of documentation, different methods of note-taking ➢ Essays/story/ book & movie reviews/writing for social media/blogging/ journaling • Life lessons through stories and activities (P2)					
Essential & Supplementary Reading	1. Tebeaux, Elizabeth, and Sam Dragga. *The Essentials of Technical Communication*. OUP, 2018. 2. Rizvi, M Ashraf. *Effective Technical Communication*. McGraw-Hill, 2017 3. Hancock, Mark. *English Pronunciation in Use: Intermediate Self-study and Classroom Use*.CUP,2012. 4. Cottrell, Stella. *Critical Thinking Skills: Developing Effective Argument and Analysis*. Palgrave,2005. 5. Gower, Roger. *Grammar in Practice*. CUP, 2005. 6. Paterson, Ken. *Oxford Living Grammar*. OUP, 2014. 7. Sabin, William A. *The Gregg Reference Manual:A Manual of Style, Grammar, Usage, andFormatting*. McGraw-Hill, 2011. 8. Fitikides, T. J. *Common Mistakes in English*. London: Orient Longman, 1984.					

	Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Routledge, 2013. 9. Astley, Peter and Lewis Lansford. *Oxford English for Careers: Engineering*. OUP, 2013. 10. Savage, Alice and Patricia Mayer. *Effective Academic Writing*. OUP, 2013 11. Harari, Yuval Noah. *Sapiens: A Brief History of Humankind*. Vintage, 2014. 12. https://www.ted.com/ 13. https://www.bbc.co.uk/learningenglish/features/pronunciation/tims-pronunciation-workshop-ep-13 14. https://learnenglish.britishcouncil.org/skills/listening 15. https://www.nationalgeographic.com/podcasts/overheard 16. https://www.youtube.com/user/NatureVideoChannel 17. https://www.youtube.com/watch?v=Aj-EnsvU5Q0&list=PLcetZ6gSk969oGvAI0e4_PgVnlGbm64bp 18. https://www.merriam-webster.com/word-of-the-day 19.https://www.newyorker.com/tag/book-reviews

Course Name	Differential Equations	Course Code	MA1001			
Offered by Department	SH-Mathematics	Structure (LTPC)	3	1	0	3
To be offered for	B.Tech	Course Type	Core			
Pre-requisite	NIL	Approved In	Senate-44			
Learning Objectives	To provide an exposure to the theory of ODEs & PDEs and the solution techniques.					
Contents of the course	Linear ordinary differential equations with constant coefficients, method of variation of parameters – Linear systems of ordinary differential equations (10) Power series solution of ordinary differential equations and Singular points Bessel and Legendre differential equations; properties of Bessel functions and Legendre Polynomials (12) Fourier series (6) Laplace transforms elementary properties of Laplace transforms, inversion by partial fractions, convolution theorem and its applications to ordinary differential equations (6) Introduction to partial differential equations, wave equation, heat equation, diffusion equation(8)					
Essential Readings	1. Simmons. G.F, Differential Equations, Tata McGraw Hill, 2003. 2. Kreyszig. E, Advanced Engineering Mathematics, Wiley, 2007.					
Supplementary Reading	1. William. E. Boyce and R. C. Diprima, Elementary Differential Equations and Boundary Value Problems, John Wiley, 8 Edn, 2004. 2. Sneddon. I, Elements of Partial Differential Equations, Tata McGraw Hill, 1972. 3. Ross. L.S, Differential Equations, Wiley, 2007. 4. Trench, W, Elementary Differential Equations, http://digitalcommons.trinity.edu/mono					

Course Name	EngineeringGraphics	Course Code	ME1001			
Offered by Department	MechanicalEngineering	Structure(LTPC)	2	0	4	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
LearningObjectives	• Tointroducethebasicconceptsandtechniquesoftechnicaldrawing. • 2D and 3D representation of various shapes/objects and its engineeringapplications.					
LearningOutcomes	Students will acquire visualization skills and will be able to prepare technicaldrawingsand 3Dmodels usingcomputer aidedtools.					
Course Contents(with approximatebreak up of hours forlecture/tutorial/ practice)	• Roleoftechnicaldrawinginproductdevelopmentprocess,Basicsoftechnicaldrawing,Standards, Dimensioningprinciples.*(L2+P4hrs.)* • Computeraideddrafting.*(L2+P8hrs.)* • Engineeringcurvesanditsapplications. *(L4+P8hrs.)* • Principles of orthographic projection. Orthographic projection of points, lines,planes and regular solids, Exercises related to engineering applications. *(L7+P8hrs.)* • Principlesofisometricprojections.Orthographictoisometricandisometrictoorthographictransformation ofobjects.*(L3+P8hrs.)* • Sectionandintersectionofregularsolidsandtheirlateraldevelopments. • *(L6+P12hrs.)* • Introduction to 3D modelling of shapes and objects; electrical CAD. *(L2+P4hrs.)*					
Essential Reading	1. K.Venugopal andVPrabhuRaja,EngineeringDrawing+AutoCAD,NewAgeInternational (P)Limited.5th EditionReprint:July, 2016 2. Narayana.K.L,andKannaiah.P,EngineeringDrawing,ScitechPub.Pvt.Ltd, 3. 3rdEdition.					
Supplementa ryReading	1. PIVarghese,EngineeringGraphics,McGrawHillEducation,2013. 2. Bhatt.N.D,EngineeringDrawing– PlaneandSolidGeometry,CharotarPublishingHouse Pvt. Ltd.,53 Edition 2014.					

CourseName	ElementaryDataStructures andLogicalThinking	CourseCode	CS1002			
Offered by Department	Computer Science Engineering	Structure(LTPC)	3	0	0	3
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
LearningObjectives	Thefocusisto discuss howdataisorganizedandretrievedin computers. Elementarydatastructureswithsupportingoperationsshallbediscussed.Studentswillbeexposed toart of logical thinkingthroughalgorithmicpuzzles.					
LearningOutcomes	At the end of the course, given a computational problem, students are expected tocomeupwithanalgorithmandasuitabledatastructure,andimplement thesame usingaprogramminglanguage.					
Course Contents(with approximatebreakup of hours forlecture/tutorial/practice)	• HistoryofComputingandComputers–theneedfordataorganization–introductionto abstract data types anddata structures(3L) • Introduction to logical thinking (algorithmic thinking) through simple examples.Introduction to Elementary data structures - Discussion on Stacks and Queueswithsupportingoperations–implementationusingarraysandlists–implementation of stack using queues and vice-versa – variants of stacks andqueues– algorithmic puzzles (10L) • Arraysandapplications-algorithmicpuzzlesinvolvingarrays-sortingandsearching.(8L) • Discussiononlinkedlistswithvarioussupportingoperations-algorithmicpuzzles involving lists.Types of Lists – double, circular – the need for doubleandcircular linked lists–puzzles involvinglists (10L) • Introductionto trees,binarytrees,searchtrees (7L) • Applications of elementary data structures in computer science and engineering.(7L)					
Essential Reading	1. M. A. Weiss,DataStructuresand Algorithm AnalysisinC, 2nded.,Pearson,2002. 2. AnanyLevitinandMariaLevitin,AlgorithmicPuzzles,OxfordUniversityPress,2011.					
Supplementary Reading	1.NarasimhaKarumanchi,DataStructureandAlgorithmicThinkingwithPython,CareermonkPublications, 2017					

Course Name	DesignandManufacturingLab.	Course Code	ID1000				
Offered by Department	SIDI	Structure(LTPC)	0	0	2	1	
To be offered for	B.Tech	Course Type	Core				
Pre-requisite	NIL	Approved In	Senate-44				
Learning Objectives	The objective of this course is to give an exposure on the basic practices followed in thedomainofmechanical,electrical,electronicsandcommunicationengineering.Theexercises will train the students to acquire skills which are very essential for the engineering graduates in their career.						
Contents of thecourse	Experiments will be aimed to train the students in following common engineering practices: Basic manufacturing processes: Fitting, Drilling & tapping, Material joining processes, Carpentry, Sheet metal work, Adhesive bonding and plastic welding, Arc Welding, 3D Printing. (10 hours) Familiarization of electronic components by Nomenclature, meters, power supplies, function generators and Oscilloscope – Bread board assembling of simple circuits: IR transmitter and receiver – LED emergency lamp. Communication study: amplitude modulation and demodulation. (6 hours) Domestic wiring practice: Fluorescent lamp connection, Staircase wiring – Estimation and costing of domestic and industrial wiring – power consumption by Incandescent, CFL and LED lamps. (2 Hours) Dismantle and assembly of PC, Installing OS and disk management. (4 hours)						
Essential Reading	1. Uppal S.L. "Electrical Wiring & Estimating", 5Edn, Khanna Publishers, 2003. 2. Chapman W.A.J., Workshop Technology, Part 1 & 2, Taylor & Francis.						
Supplementary Reading	1. Clyde F. Coombs, "Printed circuits hand book", 6Edn, McGraw Hill, 2007. 2. John H. Watt, Terrell Croft, "American Electricians' Handbook: A Reference Book for the Practical Electrical Man", Tata McGraw Hill, 2002.						

Course Name	SociologyofDesign
Offered by Department	SIDI
Pre-requisite	NIL
To be offered for	B.Tech
Course Type	Core
Course Code	DS1001
Approved In	Senate-44
Structure (LTPC)	1 2 0 3
Prerequisite	FoundationProgram
Learning objectives	The objective of the course is to introduce engineering students tothe importance of understanding the social context of technologyandproductdesign.
CourseOutcomes	At the end of the course, the students should be in position to: • Understand the need and the process of doing an ethnographic study • Surface unstated needs and articulate the high level product requirements • Connect with people, form teams and collaborate towards a common goal
Contents of the course(With approx. mate breakup of hours)	Module1:Technology,DesignandSociety[9hrs] • Observe the way people interact with objects • Understanding the relationship between people and a variety of objects • Actor Network Theory, History of Technology and Design, 2-3 Case studies • Discover your passion and domain of interest & network to identify partners Module2:Understandinguser/customercontexts[21hrs] • Ethnography-immersioninaproblemcontext • Learningtoobserve-seeandlisten; • Developingrichpictures;Gigamapping • Introductiontosignsandsemioticanalysis Module3:Understandinggroups(multicultural/cross-functionalteams)[12hrs] • Learningteamformationanddynamicsthroughamovie; • Introduction to sociological imagination - Functionalism, ConflictTheory,SymbolicInteractionism;InteractionRitualChains • Values,culture, methodsofengineersanddesignersandhowtheyshapethequalityof our lives; • Groupdynamicswithinorganizationsandacrossorganizationsandim plications for innovationandchange Evaluation:Continuousassessment(40%);Finalethnographyreport(20%);End Semester(40%)
Essential & Supplementary Readings	1. TrevorPinch(Editors)(2012),TheSocialConstructionofTechnologicalSyste ms:Newdirections inthesociologyandhistoryoftechnology, MITPress,AnniversaryEdition 2. WendyGunn,TonOttoandRachelSmith(2013),DesignAnth ropology:Theoryand practice,Bloomsbury 3. AdrianForty(2014),Objectsofdesire:Designand societysince1750s,Thames&Hudson 4. BernhardEBurdek(2015),History,theoryandpracticeofproductdesign,seco nd revisededition 5. KeriSmith(2008),Howto beanExplorer oftheWorld:PortableLifeMuseum,PenguinGroup

Course Name	DigitalCircuits	Course Code	EC1001			
Offered by Department	Electronics & CommunicationEngineering	Structure(LTPC)	3	1	0	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
LearningObjectives	Thekeyobjectiveofthiscourseistoprovideagoodunderstandingonthedesign andimplementationofdigitalcircuitsandsystems					
LearningOutcomes	Thecoursewouldequipthestudents to • UnderstandDigitalLogicsandcircuitsdesign. • DesignCombinational&Sequentialdigitalcircuits. • DevelopDigitalCircuits/Systemsforpracticalproblems.					
Course Contents(with approximatebreakup of hours forlecture/tutorial/practice)	• IntroductiontoDigitalSystems:IntroductiontoDigitalLogic,DataRepresentations,Numbersystems,Code conversion (L5+T1) • Boolean Algebra & Logic: Laws and theorems of Boolean Algebra, Truth Tableandalgebraicform,BooleanLogicMinimization,DesignusingMSIComponents,KMaps,QMmethod,SOP,POS;NANDandNORimplementations,DigitalCircuit Characterization(L7+T2) • CombinationalCircuitDesign:DesignProcedure,Multiplexer,Decoder,Encoder, Comparator, Seven-segment display, Parity generator, Design of largecircuits.(L8+T2) • SequentialCircuitDesign:AsynchronousandSynchronousDesign,FlipFlops&Latches,Designofsequentialmodules–SR,D,TandJ-KFlip-flops,applications,Clockgeneration, RegistersandCounters. (L10+T3) • State Machine Design: Moore and Mealy Machines, State Table and Diagram,StatemachineDesign Approach,DigitalImplementationofStateMachine.(L8+T3) • IntroductiontoHDLandDesignExamples: (L3+T1)					
Essential Reading	1. C.H.Roth,Jr.,FundamentalsofLogicDesign,7thEdition,CengageLearning,ISBN: 9781133628477,2013. 2. S.BrownandZ.Vranesic,FundamentalsofDigitalLogicwithVHDLDesign,3rdEdition,TMH,ISBN: 9780077221430, 2008.					
Supplementary Reading	1. R.J.Tocci,N.S.Widmer,andG.L.Moss,DigitalSystemsPrinciplesandapplications,10th Edition,PearsonPrenticeHallEdition,ISBN:9780131725799,2006. 2. V.A.Pedroni,DigitalElectronicsandDesignwithVHDL,1st Edition,Elsevier,ISBN:978-0-12-374270-4,2008. 3. TaubandSchilling,DigitalPrinciplesandApplications,7th Edition,TMH,ISBN:978-0-07-014170-4.,2011. 4. J.F.Wakerly,DigitalDesign-PrinciplesandPractices,3rd Edition,Pearson,ISBN:9332508135,2008. 5. MMorris Mano,Digital Design,5th Edition, Pearson, ISBN:9332535763,2014. 6. MMorrisMano,DigitalDesignwithanIntroductiontotheVerilogHDL,VHDL&SystemVerilog,6th Edition,Pearson,ISBN:9353062019,2018. 7. T.L.FloydandR.P.Jain,DigitalFundamentals,8th Edition,Pearson,ISBN:9332584600,2017.					

	Elementary Data Structures And Logical Thinking Practice	Course Code	CS1003			
Offered by Department	Computer Science Engineering	Structure(LTPC)	0	0	4	2
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
LearningObjectives	• Thefocusistodiscuss howdataisorganizedandretrievedin computers. • Elementarydatastructureswithsupportingoperationsshallbediscussed.Studentswillbe exposed toart of logical thinkingthroughalgorithmicpuzzles.					
LearningOutcomes	Attheendofthecourse,givenacomputationalproblem,studentsareexpectedto comeupwithanalgorithmandasuitabledatastructure,andimplement thesameusinga programminglanguage.					
Course Contents(with approximatebreakup of hours forlecture/tutorial/practice)	• Case studies that motivates logical thinking (algorithmic thinking) – implementationusingCprogramming • Case studies involving arrays and implementation - Arrayswith varioussupporting operations- algorithmic puzzles involving arrays – sorting andsearching • Examples on linked listswith various supporting operations- algorithmicpuzzlesinvolvingsingly,doublyandcircularlinkedlists.– puzzlesinvolvinglists • Case studies on Stacks and Queues with supporting operations – implementationusing arrays and lists – implementation of stack using queues and vice-versa –variantsof stacks andqueues– algorithmic puzzles • Applications of elementary data structures in computer science and engineeringandimplementation					
Essential Reading	1. M. A. Weiss,DataStructuresand Algorithm AnalysisinC, 2nded.,Pearson,2002. 2. AnanyLevitinandMariaLevitin,AlgorithmicPuzzles,OxfordUniversityPress,2011					
Supplementary Reading	1. NarasimhaKarumanchi,DataStructureand AlgorithmicThinkingwithPython,CareermonkPublications, 2017					

Course Name	Earth, Environment and Design	Course Code	NC1008			
Offered by Department	SIDI	Structure(LTPC)	1	0	0	P/F
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	The course aims to provide an understanding of systems and processes in aquatic and terrestrial environments, and to explore changes in the atmosphere, lithosphere, hydrosphere, biosphere, and the evolution of organisms, since the origin of life on earth.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Introduction to environment and ecology – Ecosystems Impacts of natural and human activities on ecosystems • Environmental policies, acts and standards, Environmental Impact Assessment Prediction and assessment of the impacts on air, water, land, and biological environments Assessment of impacts of the cultural, socioeconomic and eco sensitive environments					
Essential Reading	1. Rubin. E. S, Introduction to Engineering and the Environment, McGraw Hill, 2000. 2. Masters. G. M., Introduction to Environmental Engineering & Science, Prentice Hall, 1997.					
Supplementary Reading	1. Henry. J. G, and Heike, G. W, Environmental Science & Engineering, Prentice Hall International, 1996. 2. Dhameja. S. K, Environmental Engineering and Management, S. K. Kataria and Sons, 1999. 3. Shyam Divan and Armin Rosancranz, Environmental Law and Policy in India, Cases, Materials and Statutes, Oxford University Press, 2001.					

Course Name	SystemsThinkingforDesign	Course Code	DS2000			
Offered by Department	SIDI	Structure(LTPC)	1	2	0	3
To be offered for	B.Tech	Course Type	Core			
Pre-requisite	Sociology of Design	Approved In	Senate-43			
Learning Objectives	Designforeffectiveness –Level 1					
Learning Outcomes	Thiscoursewillhelpstudentsunderstand • Theimportanceofmodelingsystemstorealizeeffectivedesigns • Abstractionof keyelements fromproblemsituations Useofspecifictechniquestomodel problemsinaholisticmanner					
Contents of thecourse	•Real-worldproblems&theneedforinter-disciplinaryapproaches [2] •Basicconceptsofsystemsthinking(parts,relations,patterns)[6] •Technique#1:RichPictures •Technique#2:MappingStakeholder,Needs,Alterables,Constraints[6] •Technique#3:StructuralModeling(Hierarchicaldecomposition)[6] Technique#4:InfluenceDiagrams(Self-regulatingsystems)[6]					

Essential Reading	1. Hitchins,DerekK. (2007) SystemsEngineering:A21st CenturySystemsMethodology ,JohnWiley,ISBN:978-0-470-05856-5. 2. Wilson,Brian(1991)Systems:Concepts,MethodologiesandApplications.2nd Edition, Wiley.ISBN:0471927163. Hutchinson,William;SystemsThinkingandAssociatedMethodologies,PraxisEducation.ISBN:0 646 34145 6.
Supplementary Reading	1. GeraldWienberg(2001),Anintroductiontogeneralsystemsthinking,DorsetHousePublishing. 2. Sage,A.P.(1977);MethodologyforLargeScaleSystems,McGrawHill,New York.

Course Name	Solid State Electronic Devices	Course Code	EC2000			
Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	3	1	0	4
Offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	The course is an introduction to semiconductor fundamentals and applications to the electronic devices. Students will understand the internal workings of the most basic solid state electronic devices. Course creates the background in semiconductor-based electronic devices and also prepares students for advanced courses in nano- and quantum electronics.					
Learning Outcomes	At the end of the course, the students would be able to • Understand and explain the fundamental principles of modern semiconductor devices. • Understand and describe the impact of semiconductor device capabilities and limitations on electronic circuit performance. • Develop semiconductor devices based sensors. • Design FET based circuits and devices.					
Course Contents (with approximate breakup of	• **Solid state devices** – History and its relevance in the modern world. formation of energy bands in semiconductors, Density of states and Fermi level. (L3+T1)					

hours for lecture/ tutorial/practice)	• **Charge carriers in Semiconductors**- Equilibrium Carrier concentration, Recombination and Generation of carriers, Carrier transport – Drift, Diffusion and their modelling in MATLAB. (L9+T2) • **pn junction** – derivation of dc and ac characteristics, Forward and reverse biasing, Static analysis, Breakdown processes; Transient analysis, metal semiconductor junction. Modelling of p-n junction. (L9+T3) • **Bipolar junction transistors**– Fundamentals and characteristics, biasing, switching, Modelling of BJT. (L4+T1) • **Field Effect Transistors (JEFT, MESFET, MOSFET, HEMT), MOS capacitor,MOSFET** – device physics, operation, characteristics and modelling. (L10+T3) • **Optoelectronic Devices**- Fundamentals of Photodiodes, Light emitting devices, Semiconductor LASERs, Solar cells, CCDs along with Nanoelectronic devices. (L6+T1)
Essential Reading	1. Robert Pierret, Semiconductor Device Fundamentals ,1st Edition, Pearson Education, ISBN:9788177589771, 2006. 2. B. G. Streetman and S. K. Banerjee, Solid State Electronic Devices, 7th Edition, Pearson, ISBN: 9780133356038, 2015. 3. Neamen, Donald A., Semiconductor Physics and Devices: Basic Principles, 4th Edition, NY: McGraw-Hill, ISBN:978-0-07-352958-5, 2012.
Supplementary Reading	1. S. M. Sze., K. K. Ng, Physics of Semiconductor Devices, 3rd Edition, United Kingdom, Wiley, ISBN: 978-0471143239, 2021. 2. M. S. Tyagi, Introduction to Semiconductor Materials and Devices, 1st Edition, John Wiley, ISBN: 9788126518678, 2008.

Course Name	Network Theory	Course Code	EC2001			
Offered by Department	Electronics & Communication Engineering	Structure (LTPC)	3	1	0	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	• To build capability in students to analyse and solve problems related networks. • To build capability in students to design networks and circuits for different applications. • To introduce network related concepts which can be directly related to industry applications. • To introduce network related concepts which can be directly related to research applications.					
Learning Outcomes	At the end of the course, the students will be able to • Analyse and solve problems related to networks. • Design networks and circuits for different applications.					

Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Network topology and graph concepts (4L + 1T) • Network theorems using dependent sources, Tellegen's theorem (5L+3T) • Linearity, time invariance and causality; Time-domain representation and analysis of LTI systems (3L+1T) • Laplace transforms, Poles and Zeros, Impulse and Step response, Solution of RL, RC and RLC Circuits for Step Input and Sinusoidal Excitations using Laplace Transform method; Resonance (14L+4T) • Coupled circuits (6L+2T) • Two-port networks, z, y, h and transmission parameters, cascading; Network functions (10L+3T)
Essential Reading	1. DeCarlo R. and Lin P., Linear Circuit Analysis: Time Domain, Phasor, and Laplace Transform Approaches, 2nd edition, Oxford University press, ISBN: 978-0195136661, 2001. 2. Van Valkenburg, Network Analysis, 3rd Edition, Pearson, ISBN: 9789353433123, 2019 3. Seshu and Balabanian, Linear Network Analysis, 1st edition, John Wiley & Sons, 1959. 4. Sudhakar A. and Shyammohan S. Pillai, Circuits and Networks Analysis and Synthesis, 5thEdition,McGraw Hill, New Delhi, ISBN:9339219604, 2017.
Supplementary Reading	1. Alexander C. and Sadiku M. N. O., Fundamentals of Electric Circuits , 7th Edition, Tata McGraw Hill, New Delhi, ISBN: 9781260226409, 2013. 2. W. H. Hayt and T. E. Kimmerley, Engineering Circuit Analysis, 9thEdition , TMH, ISBN: 9780073545516, 2019. 3. Smarajit Ghosh, Network Theory Analysis and Synthesis, 8thEdition ,Prentice Hall of India, New Delhi, ISBN:9332511040,2011.

Course Name	Signals and Systems	Course Code	EC2002			
Offered by Department	Electronics & Communication Engineering	Structure (LTPC)	3	1	0	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	The key objectives of this course are to understand the fundamentals characteristics of signals and systems, mathematical skills to solve the operations like convolution, correlation, sampling, etc.					
Learning Outcomes	At the end of the course, the students would be able to ● Represent continuous time and discrete time signals mathematically ● Classify systems based on their properties and determine the response of LTI system using convolution. ● Analyse the characteristics of continuous-time signals in frequency domain using Fourier series and Fourier transform. ● Apply the Laplace transform for analysing continuous-time systems.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	**Signals**: Signal classification, standard signals, transformations of the independent variable. Discrete functions and properties. Discrete unit step and impulse signals and their properties. (L8+T3) **Systems**: System classifications, Continuous and discrete time convolution, System					

	properties via impulse response. (L6+T2) **Fourier series**: Fourier series representation of continuous-time periodic signals, Convergence, Properties, Fourier series and LTI systems, Filtering, Examples of continuous-time filters described by differential equations (L9+T3) **Fourier Transform**: Representation of aperiodic signals, Properties of the continuous-time Fourier transform, Convolution/multiplication property and their effect in the frequency domain, magnitude and phase response. (L8+T3) **Laplace Transform**: Introduction to Laplace transform; region of convergence. Inverse Laplace transform. Properties of Laplace transforms, initial/final value theorems. Laplace transforms and LTI systems, causality/stability. Laplace transforms and block system diagrams. (L9+T2) **Sampling theorem**: Introduction to the sampling theorem and its implications (L2+T1)
Essential Reading	1. Oppenheim, Willsky and Nawab, Principles of Linear Systems and Signals, 2nd Edition, Pearson, ISBN:9788120312463, 1997. 2. B P Lathi, Principles of Linear Signals and Systems, 2nd edition, ISBN:978-0198062271, 2009.
Supplementary Reading	1. S. S. Soliman & M.D. Srinath, Continuous and Discrete Signals and Systems, 2nd Edition,Prentice- Hall, ISBN:0-13-774308-4,1990.

Course Name	Microprocessors and Microcontrollers Practice	Course Code	EC2003			
Offered by Department	Electronics & Communication Engineering	Structure (LTPC)	2	0	3	3.5
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	The goal of this course is to help the students have thorough understanding with the programming and usage of microprocessors and microcontrollers so as to build simple systems.					
Learning Outcomes	At the end of the course, students would be able to: • program and use microprocessor 8086 for real time applications • Interface ARM controller with external devices					

Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Intel 8086 Microprocessor: Introduction, Internal architecture, Hardware description, Segmentation, Instruction set, addressing modes, Assembly Language Programming, Interfacing with Programmable Peripheral Interface. (18) • ARM Microcontroller: Architecture, Hardware description, Register and Memory organization, Structure and interrupt priorities, Interfacing with external devices. (10) • Practice includes experiments from following topics: • Programming with 8086 and ARM processors • Arithmetic operations, Sorting, Operations on Matrices and String, Number conversion, Interfacing-LED, LCD, Stepper motor and 7-segment display
Essential Reading	1. Kenneth J. Ayala, the 8086 Microprocessor: Programming and Interfacing The PC, 1st Edition, Delmar Publishers, ISBN: 9780314012425, 2007. 2. J. W. Valavno, Embedded Systems: Introduction to Arm® Cortex(TM)-M Microcontrollers, 5th Edition, Create Space, ISBN: 978-1477508992, 2012.
Supplementary Reading	1. K. Ray, K. M. Bhurchandi, Advanced Microprocessors and Peripherals, 3rd Edition, Tata McGraw Hill, ISBN:007014022, 2007. 2. A. N. Sloss, D. Symes, C. Wright, ARM System Developer's Guide,1st Edition, Morgan Kaufmann,ISBN:9781493303748, 2004.

Course Name	Digital Circuits Practice	Course Code	EC2004			
Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	0	0	3	1.5
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Course Objectives	• The goal of this course is to provide a hands on experience in design and implementation of digital circuits and systems. • This includes formulating the logic for a given problem, minimizing or optimizing the logic using different approaches and realizing it using gates and other digital ICs. This is done in three phases: Spice simulation of circuit, experimental verification and Verilog/VHDL implementation					
Course Outcomes	The course would equip the students to • Understand digital circuits • Design Combinational circuits • Design sequential circuits • Formulate logic and design circuits for practical problems					

Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• HDL implementation and digital design flow practice • Formulating Boolean expressions and truth tables from practical statements, designing logic diagrams, simplifying using k-map, designing NAND-NAND & NOR-NOR diagrams & verifying the same by simulation and experiment. • Combinational Circuits: Code Converters, Arithmetic Circuits, Mux/Demux, Encoder/Decoder, Comparators etc. • Sequential circuits including flip flops, shift registers, counters, sequence generators etc. • Simple design examples with Moore and Mealy machines • Digital implementation of practical problems with HDL
Essential Reading	1. R. J. Tocci, N. S.Widmer, and G. L.Moss Digital Systems Principles and applications, 12th Edition, Pearson Prentice Hall Edition ISBN : 9780134220215, 2017.
Supplementary Reading	1. V.A.Pedroni, Digital Electronics and Design with VHDL, 2nd Edition, Denise E.M. Penrose, ISBN 97801237042704. 2008. 2. Taub and Schilling, Digital Principles and Applications, 7th Edition, TMH, ISBN: 978-0-07-014170-4., 2011. 3. J. F. Wakerly, Digital Design- Principles and Practices, 4th Edition, Pearson, ISBN: 9780131863897, 2006. 4. M. Morris. Mano, Digital Design, 5thEdition , Pearson, ISBN : 9780132774208, 2013. 5. M. Morris.Mano, Digital Design With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson, ISBN : 9780134549903, 2018. 6. T. L. Floyd and R. P. Jain, Digital Fundamentals, 10th Edition, Pearson, ISBN: 978-8131734483, 2017.

<table>
<tr><td>Course Name</td><td>Smart Product Design</td><td>Course Code</td><td colspan="4">DS2001</td></tr>
<tr><td>Offered by Department</td><td>SIDI</td><td>Structure(LTP C)</td><td>1</td><td>2</td><td>0</td><td>3</td></tr>
<tr><td>To be offered for</td><td>B.Tech</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>Systems Thinking for Design</td><td>Approved In</td><td colspan="4">Senate-43</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">The objective of this course to help the students understand and apply the concepts of designing smart/intelligent products, i.e., information intensive and context sensitive</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, the students will:
• Identify and define the right type of intelligent behaviour for a chosen product concept
• Design high-level functional and component (structural) architecture for intelligent behaviour using appropriate metaphor and analogy
• Evaluate and select the right AI technique for the proposed functional and component architecture and vice versa</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">Module 1: Introduction to intelligence behaviour (9 hours)
• Definition of intelligence
• Dimensions of intelligence
• Levels of intelligence

Module 2: Architecture for intelligent behaviour (15 hours)
• Functional arch for Intelligent Behaviour (Intelligence and information
• intensity relation (equilibrium, amplification))
• Biological metaphors for cyber-physical systems (Bio-inspired adaptive
• systems (Positive and negative feedback)
• Theory of living systems (Self evolve, self-improve, self-aware (e.g., self-configuration, -organization, -optimization) properties)

Module 3: Selection of appropriate AI Techniques (18 hours)
Rule-based systems - Fuzzy inferencing - Artificial neural networks -
• Evolutionary computation -
• determine which type of intelligent system methodology would be suitable
• for a given type of application problem
• Demonstrate a working prototype, in the form of a major project work, the
• ability to design and develop an intelligent system for a selected application.
• Poster Session
• Evaluation: Continuous assessment (40%); Final concept presentation (20%); End Sem (40%)</td></tr>
<tr><td>Essential & Supplementary Reading</td><td colspan="6">References:
1. Donald A Norman (2007), The design of future things, Basic Books, New York
2. Dario Floreano and Claudio Mattiussi (2008), Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, MIT Press
3. Michael Negnevitsky (2005), Artificial Intelligence: A Guide to Intelligent Systems, Second Edition, Addison Wesley</td></tr>
</table>

Course Name	Digital Signal Processing	Course Code	EC2007			
Offered by Department	Electronics & Communication Engineering	Structure (LTPC)	3	1	0	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	Signals and Systems	Approved In	Senate-44			
Course Objectives	The primary goal of this course is to introduce discrete-time signals and systems: their analysis and characterizations. This course is a foundation for various other courses such as Analog and Digital Filters, Digital Communications, Control theory, Image processing, Power spectral estimations, etc.					
Course Outcomes	At the end of the course, the students are expected to • Understand various properties of discrete-time signals • Analyse discrete time LTI systems, and their impulse responses • Synthesize discrete signals from analog signals • Reconstruct analog signals from discrete signals • Analyse systems commonly used in Communications, Control, and Signal Processing					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• **Review of Signals and Systems:** Basic signals, system properties (linearity, time-invariance, memory, causality, BIBO stability) (L3+T2) • **Discrete-time Signals and Systems:** Discrete-time signals, discrete-time systems, LTI systems, Linear constant-coefficient difference equations (LCCDE), Frequency domain representation of discrete-time signals and systems, Fourier Series, Fourier transforms, properties of Fourier transform (L12+T3) • **Transform Analysis of Linear Time Invariant Systems:** The frequency response of LTI systems, System functions for systems characterized by LCCDE (L3+T1) • **Discrete-time Fourier Transform:** Introduction to DTFT, Properties (L3+T1) • **Sampling Theorem:** Periodic sampling, Frequency domain representation of sampling, Reconstruction of bandlimited signals from its samples (L3+T1) • **Discrete Fourier Transform:** Introduction to DFT, Properties of DFT, Linear convolution using the DFT, Fast Fourier Transform, DIT and DIF algorithms (L10+T4) • **The Z-transform:** Introduction, Properties of z- transform, inverse z-transform (L8+T2)					
Essential Reading	1. A.V. Oppenheim, R.W. Schafer, and J. R. Buck, Discrete-Time Signal Processing, 3rd Edition, Pearson Education , ISBN:9780132158176, 2010.					
Supplementary Reading	1. S. K. Mitra, Digital Signal Processing: A Computer-Based Approach, 4th Edition, Tata Mcgraw Hill Publication, ISBN:9781259098581 ,2013. 2. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles,Algorithms 3. and Applications, Fourth edition, Pearson,ISBN9780132341998, 2007.					

<table>
<tr><td>Course Name</td><td>Electromagnetic Waves</td><td>Course Code</td><td colspan="4">EC2008</td></tr>
<tr><td>Offered by Department</td><td>Electronics & Communication Engineering</td><td>Structure(LTP C)</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>To be offered for</td><td>B.Tech</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>Engineering Electromagnetics</td><td>Approved In</td><td colspan="4">Senate-44</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">This course is designed to be an application oriented course in Electromagnetics for Communication Engineers. This should serve as a bridge course between a first level Electromagnetics course and advanced level courses such as Antenna Theory and Design, Computational Electromagnetics etc.</td></tr>
<tr><td>Learning outcomes</td><td colspan="6">At the end of the course, the learners are expected to do the following:
Analyse the propagation of uniform plane electromagnetic waves in free space, unbounded media and at interfaces
Determine the characteristics of electromagnetic waves in bounded media
Apply the electromagnetic wave theory to transmission lines, antennas and guided wave communication</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">Transmission Lines – Concept of Distributed elements – Transmission line parameters and equations – Line terminated by an arbitrary load - Impedance transformation – Transmission line matching – Transmission line discontinuities - Transients on Transmission Lines (L10+T3)
EM waves - Review of Maxwell’s equations - Wave equation and uniform plane-wave solution – Polarization – Power flow and Poynting vector (L5+T2)
EM Wave propagation in unbounded media – dielectrics and conductors - Skin effect - Plane wave at media interface – Boundary conditions - normal and oblique incidence (L10+T3)
EM Wave propagation in bounded media - Parallel plane waveguide - TEM mode - Rectangular waveguides – Dispersion and attenuation – TE and TM modes – Surface current and attenuation - Cavity Resonators - Dielectric waveguides (L9+T3)
Antennas and Electromagnetic Radiation – Potential functions - Hertzian dipole – Fundamental antenna parameters – Dipole and Monopole antennas - Antenna arrays (L8+T3)</td></tr>
<tr><td>Essential Reading</td><td colspan="6">R K Shevgaonkar, Electromagnetic Waves, 1ST Edition, Tata McGraw Hill, ISBN: 9780070591165, 2006.
C. A. Balanis, Antenna Theory and Design, 3rd Edition, John Wiley & Sons, ISBN- 047166782X, 2005.</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">David K. Cheng, Field and Wave Electromagnetics, 2nd Edition, Pearson Education, ISBN: 9781292026565 2014.
Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, 6th Edition, Pearson Education, ISBN: 978 0131139619, 2013.
Fawwaz T. Ulaby Eric Michielssen and Umberto Ravaioli, Fundamentals of Applied Electromagnetics, 7th Edition, Pearson Education, ISBN: 9781292082486, 2015.
David. M. Pozar, Microwave Engineering, 4th Edition, John Wiley, ISBN: 9781118298138, 2011.
J. D. Kraus and R. J. Marhefka, Antennas for All Applications, 3rd Edition, Tata McGraw Hill,ISBN:978-0071122405 , 2002.</td></tr>
</table>

Course Name	Analog Circuits	Course Code	EC2009			
Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	3	1	0	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	• This course introduces how to build amplifiers using transistors • How to realize different controlled sources using same transistor • Frequency compensation techniques to stabilize higher order systems • How to build an opamp and use it for applications with negative and positive feedback					
Learning Outcomes	• Students should be able to identify the biasing arrangements and amplifier configurations in transistor circuits • Perform dominant-pole compensation for higher order amplifiers and stabilize them • Build analog systems with opamp and other components for different applications					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Analysis of circuits with nonlinear elements, incremental analysis, ideal and real MOSFET for amplification (L2+T1) • Synthesis of Common Source Amplifier: biasing, AC coupling, swing limits, negative feedback biasing, bias stabilization for NMOS and PMOS (L7+T2) • MOSFET based VCVS, VCCS, CCCS, CCVS with NMOS and PMOS (L5+T2) • Frequency Response of Amplifiers (L3+T1) • Differential Circuits: differential pair, active load, small and large signal analysis, CM and DM, 1-stage and 2-stage opamp (L7+T2) • Miller compensation, Stability, frequency compensation (L6+T2) • Opamp circuits with negative feedback: Arithmetic, linear and nonlinear, Filters (L6+T2) • Opamp circuits with positive feedback: Sinusoidal oscillators, Comparators, Schmitt Trigger, Multi-vibrators (L6+T2)					
Essential Reading	1. Behzad Razavi, Fundamentals of Microelectronics, 2nd Edition, Wiley, ISBN 9781119695141, 2021. 2. Sergio Franco, Design With Operational Amplifiers And Analog Integrated Circuits, 4th Edition, McGraw Hill, ISBN: 9789352601943, 2016.					
Supplementary Reading	1. Adel S. Sedra, Kenneth C. Smith & Arun N. Chandorkar, Microelectronic Circuits, Theory and Application, 7th Edition, Oxford University Press, ISBN 9780199476299, 2017. 2. Donald A. Neamen, Electronic Circuits: Analysis And Design, 4th Edition, McGraw Hill, ISBN : 9780073380643, 2010.					

Course Name	Sensing and Instrumentation Practice	Course Code	EC2010			
Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	1	0	3	2.5
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	To familiarize the students with different sensors and their signal conditioning circuits required for different applications.					
Learning Outcomes	By the end of the course, the students would be able to • build systems which would sense the different physical signals • process the signals in the required analog or digital formats.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Transducers, transducer sensing and functions, Passive and active – Resistance, inductance and capacitance, Strain Gauges, Hall Effect sensors, Optical sensors • Measurement of non-electrical quantities such as displacement/velocity/ • acceleration, pressure, force, flow and temperature • Calibration of sensors, Data acquisition and detection techniques, Signal conversion, • PC-based Instrumentation Systems Practice includes experiments from following topics: • Signal generation, Instrumentation amplifiers, Signal conversion and processing, Characteristics of Transducers, Calibration of sensors, Measurement of physical quantities.					
Essential Reading	1. Alan S. Morris, Measurement and Instrumentation Principles, 3rd Edition, Elsevier, ISBN-9780080496481, 2001. 2. A. K. Sawhney, Course in Electrical & Electronics Measurement & Instrumentation, Dhanpat Rai, 2012.					
Supplementary Reading	1. Bruce Mihura, LabVIEW for Data Acquisition (National Instruments Virtual Instrumentation Series), Prentice Hall, ISBN: 9780130153623, 2001. 2. Howard Austerlitz, Data acquisition techniques using PCs, 2nd edition, Academic Press, ISBN:9780080530253, 2002.					

Course Name	Embedded Systems Practice	Course Code	EC2011

Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	1	0	3	2.5
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	To familiarize with the design and implementation of different embedded systems with real time applications.					
Learning Outcomes	The course would equip the students to • Design embedded systems using ARM SoC platform • Use RTOS for system design and IoT systems design.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Implementation of embedded systems • TivaLaunchpad and TM4C microcontroller setup and Parallel I/O: LEDs and switches. • Embedded systems design using ARM Cortex, • Hardware-software co-design, • Real-time operating systems in embedded systems					
Essential Reading	1. J. W. Valvano, Embedded Systems: Introduction to Arm® Cortex (TM)-M Microcontrollers, 5th Edition, Create Space, ISBN: 978-1477508992, 2012. 2. S. Berger, Embedded Systems Design: An Introduction to Processes, Tools, and Techniques, CMP, ISBN: 1578200733, 2002. 3. J. W. Valvano, Embedded Microcomputer Systems: Real Time Interfacing, 2nd Edition, Create Space, ISBN: 9780534551629, 2006.					
Supplementary Reading	1. J. W. Valvano, Embedded Systems: Real-Time Interfacing to Arm® Cortex (TM)-M Microcontrollers, 2nd Edition, Create Space, ISBN: 9781463590154, 2011. 2. J. W. Valvano, Embedded Systems: Real-Time Operating Systems for Arm Cortex M, 2nd Edition, Create Space, ISBN: 9781466468863, 2012.					

Course Name	Introduction to Data Science for Engineers	Course Code	CS3006			
Offered by Department	Computer Science and Engineering	Structure(LTP C)	3	0	2	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	This course covers the basic concepts of Data Science to help the student to learn, understand and practice data analytics encompassing concepts from descriptive, inferential statistics and predictive techniques and big data concepts.					
Learning Outcomes	• Ability to identify the characteristics of datasets; Ability to select and implement machine learning techniques suitable for the respective application; • Ability to solve problems associated with big data characteristics such as high dimensionality; • Ability to integrate machine learning libraries and mathematical and statistical tools					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Introduction to relevant industry applications and analytics – Descriptive Statistics – Data Visualization & Interpretation -Measures of Central Tendency & Dispersion - Basic and advanced plots such as Stem-Leaf Plots, Histograms, Pie charts, Box Plots, Violin Plots etc. – Merits of Demerits & Interpretation (10) • Inferential Statistics – Hypothesis Testing - Tests of Significance – Analysis of Variance - Regression – Linear and Logistic (8) • Predictive Analytics – Supervised and Unsupervised – Association Rules, Classification, Clustering, Outlier Analysis, Time Series Modelling (14) • Big Data Characteristics – Map Reduce – Deduplication, Distributed Storage, Implementation using Hadoop / Pyspark platforms (8) • Practice Component**:** Concepts from Descriptive Statistics, Inferential and Predictive Analytics would be test driven using platforms such as Python, R etc. ML support in these platforms for rule mining and application, classification & clustering algorithms etc. would also be test driven as part of the practice exercises. Modern technologies for big data handling such as Pyspark – support for Map reduce would also be test driven. Applications relevant to the student's stream of Offered by Department would be explored for exercises / course project as case studies. (14 sessions – weekly exercises)					
Essential Reading	1. J Han, M Kamber, Data Mining Concepts & Techniques, Elsevier, 3rd Edition, 2007, ISBN 9780123814791					
Supplementary Reading	1. Joel Grus, Data Science from Scratch, Orielly, 2nd Edn, 2019, ISBN 9781492041139 2. Leskovec, Anand Rajaraman,, Ullmann, Mining of Massive Data Sets, Cambridge University Press, Open Source free version , ISBN 9781107015357 3. P Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017, iSBN 9789352135653					

Course Name	EntrepreneurshipandManagement Functions	Course Code	DS3000			
Offered by Department	SIDI	Structure(LTPC)	1	2	0	3
To be offered for	B.Tech	Course Type(Core/Elective)	Core			
Prerequisite	SystemsThinkingandDesign	Approved In	Senate-43			
Learning objectives	The objective of this course is toprovide engineering students an exposure tothe basic conceptsofentrepreneurshipandmanagement,withaspecificfocusontheprocessofturninganideaint oacommerciallyviableventure.					
Learning Outcomes	Attheendofthecourse,thestudentswilllearnhowto • Understand the market & competition • Prepareabusinesscaseforthe product/idea					
Contentsofthe course	Module1:Introduction • Divisionoflaborandcreationofvalue • Evolutionoforganizations,industriesandsectors,forprofitandnon-profit • RoleofEntrepreneursandManagersinvaluecreation • PrinciplesofManagement-Planning,Organizing,Resourcing,Directing (4) Module2:Strategy&Planning • Understandingindustrydynamics&competition(Porter'sFramework) • Understandingtheindustryvaluechainandfirmpositioning (6) Module3:Organizing • Typicalorganizationalfunctions(R&D,Marketing&Sales,HR,Operations) • Cyberneticsoforganizationalfunctions(StaffordBeer'sviablesystemsmodel) • Typesoforganizationstructures(product,functional,matrix,global) (6) Module4:ResourceManagement • Financialmanagement(Sourcesoffunding,howtoreadaP&L,balancesheet) • Humanresourcemanagement(Interviewing,compensation,motivation) • Globalsourcingandsupplychainmanagement (8) Module5:ManagementInformation&DecisionMaking (4) Module6:LegalandRegulatoryenvironment (4)						
Essential Reading	1. PeterFDrucker,*ThePracticeofManagement*,HarperCollins,2006,ISBN:978-0060878979 2. HentryMintzberg,*Managing*,Berret-KoehlerPublishers,2009,ISBN:978-1605098746 3. MichaelPorter,*Oncompetition:UpdatedandExpandedEdition*,HBS,2008,ISBN:978-1422126967 4. VasantaDesai,*DynamicsofEntrepreneurialDevelopmentandManagement*,HimalayaPublishingHouse,ISBN:9788183184113.					
Supplementary Reading	1. WalterIsaacson,*SteveJobs*,2011,ISBN:978-1451648539 2. EricRies,*TheLeanStartup*,PortfolioPenguin,2011,ISBN:978-0307887894 3. VineetBajpai,Buildfromscratch,Jaicobooks,2013,ISBN:9788184952919.					

<table>
<tr><td>Course Name</td><td>Control Systems</td><td>Course Code</td><td colspan="4">EC3000</td></tr>
<tr><td>Offered by Department</td><td>Electronics & Communication Engineering</td><td>Structure(LTP C)</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>To be offered for</td><td>B.Tech</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>Preliminary Mathematics</td><td>Approved In</td><td colspan="4">Senate-44</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">This course develops the fundamentals of feedback control using linear transfer function and state space system models. Topics covered include analysis in time and frequency domains; design in the s-plane and in the frequency domain. Students have to complete an extended design case study.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">This course will teach fundamentals of control design and analysis using state-space methods. By the end of the course, a student should be able to design controllers using classical and modern control methods and evaluate whether these controllers are robust to some types of modelling errors and nonlinearities. They will learn to:
Design controllers and analyse using classical tools.
Understand impact of implementation issues (nonlinearity, delay).
Indicate the robustness of control design.
Linearize a nonlinear system, and analyse stability</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/

tutorial/practice)</td><td colspan="6">Introduction: Scope of control, Parts of a control system, Multidisciplinary nature, Scope of present course (L2)
Mathematical modelling of physical systems: Differential equation, Transfer function, and State variable representations; Equivalence between the elements of different types of systems (L6+T2)
Linear systems and their s-domain representations: Linearity and linearization, Transfer function and its interpretation in terms of impulse and frequency responses, Block-diagram and signal flow graph manipulations. (L8+T3)
Characterization of systems: Stability - concept and definition, poles, Routh array, internal stability of coupled systems, Time domain response and Frequency domain response; Link between time and frequency domain response features. (L8+T3)
Closed loop operation - Advantages: Sensitivity, Disturbance and noise reduction, Structured and unstructured plant uncertainties. (L3)
Analysis of closed loop systems: Stability and relative stability using root-locus approach, Nyquist stability criterion, Steady state errors and system types (L7+T2)
Compensation techniques: Performance goals, specifications, PID, lag-lead and algebraic approaches for controller design. (L8+T3)
Case study of a closed loop system to design controller for any system.</td></tr>
<tr><td>Essential Reading</td><td colspan="6">1. N. S. Nise, Control Systems Engineering, 7th edition, Wiley, ISBN: 978-1-118-17051-9, 2015.
2. Kuo, Golnaraghi:, Automatic Control Systems, 9th Edition, John Wiley, ISBN: 978-8126552337, 2014.</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">1. J. Nagrath and M. Gopal, Control System Engineering, 6th edition, New Age International publishers, ISBN: 978-9386070111, 2018.
2. J. J. Distefano, A. R. Stubberud, and I. J. Williams, Control Systems, Schaum's outline Series, 2nd Edition, McGraw Hill, ISBN: 9780071829489, 2014.</td></tr>
</table>

Course Name	Communication Systems	Course Code	EC3001			
Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	3	1	0	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	Signals & Systems	Approved In	Senate-44			
Learning Objectives	The objectives of this course are to • Review the fundamentals of the signal and probability theory • Introduce various modulation techniques such as AM, FM etc. • Analyse different parameters of analog communication techniques and study the super heterodyne receiver structure • Investigate the quantization process in depth and study the pulse modulation techniques					
Learning Outcomes	After successful completion of the course students will able to • Recollect the fundamentals and apply those fundamentals in the subject • Understand the transmitter and receiver structures and operation of the various modulation techniques • Identify different performance metrics and formula and use them to solve the problems • Understand the delta modulation and investigate its associated noises					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parseval's Relation. (L3+T2) • Basics of Probability, Random Variables, Random Process, Filtering of random signals through LTI systems. Additive White Gaussian Noise(L5+T3) • Amplitude Modulation (AM), Double Sideband Suppressed Carrier (DSB-SC), Quadrature Carrier Multiplexing (QCM), Costas Receiver, Single Sideband Modulation (SS), Hilbert Transform, Vestigial Sideband Modulation (VSB), Super heterodyne Receivers(L12+T4) • Frequency Modulation (FM), Phase Modulation (PM), Spectral Analysis, Carson's Rule, Narrowband/Wideband FM Generation, Slope detector, Noise in AM/FM systems (L10+T3) • Review of Sampling concepts, Pulse Amplitude Modulation, Quantization, Uniform/Non-UniformQuantizer, Quantization Noise, Lloyd Max Quantization Algorithm(L8+T2) • Differential Pulse Code Modulation (DPCM), Delta Modulation(L4+T1)					
Essential Reading	1. Simon Haykin, Communication Systems, 4th Edition, John Wiley,ISBN: 9780471178699,2001. 2. B. P. Lathi, Modern Digital and Analog Communication Systems, 3rd Edition, Oxford Univ. press, ISBN: 0195110099, 2006.					
Supplementary Reading	1. A Bruce Carlson, PB Crilly, JC Rutledge, Communication Systems, 4th Edition, McGraw Hill New York,ISBN: 978-0071210287, 2002.					

Course Name	Digital Signal Processing Practice	Course Code	EC3002			
Offered by Department	Electronics & Communication Engineering	Structure(LT PC)	0	0	3	1.5
To be offered for	B. Tech	Course Type	Core			
Prerequisite	Signals and Systems, Digital Signal Processing	Approved In	Senate-44			
Learning Objectives	• The objective of this practice is to provide a hands-on experience in the implementation of signal processing tools. • This begins with basics such as discretizing a signal, transforming it across time and frequency domains, applying Fourier series, Fourier transform, and takes the students through some real time applications etc.					
Learning Outcomes	The practice would equip students to • Understand digital signals and analyse them • Implement signal processing tools on various applications					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Basics of MATLAB (Signal Processing Toolbox) and Code Composer Studio • Generation of Basic signals and basic operations • Convolution • Fourier Series • DTFT • Z-transform • Sampling • Applications (Image Processing, Speech Processing, Communication, Control systems etc.)					
Essential Reading	1. Vinay K. Ingle and John G Proakis, Digital Signal Processing Using MATLAB, 3rd Edition, Cengage Learning, ISBN: 9781111427375, 2012. 2. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Fourth edition, Pearson, ISBN: 9780131873742, 2007.					
Supplementary Reading	1. A.V. Oppenheim, R.W. Schafer, and J. R. Buck, Discrete-Time Signal Processing, 3rd Edition, Pearson Education, ISBN: 9780131988422, 2010.					

<table>
<tr><td>Course Name</td><td>Analog Circuits Practice</td><td>Course Code</td><td colspan="4">EC3003</td></tr>
<tr><td>Offered by Department</td><td>Electronics & Communication Engineering</td><td>Structure(LTP C)</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>To be offered for</td><td>B.Tech</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>NIL</td><td>Approved In</td><td colspan="4">Senate-44</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To build amplifiers for real world applications
• To build simple analog systems using transistors, R, L, C and Opamps
• To generate multiple signals using analog circuits and process them suitably for an application</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">● Students should be able to build amplifiers for any load and interface
● Generate signals, process them using circuits and analyse results
● Building substituent blocks and coupling them together to build bigger systems</td></tr>
<tr><td>Course Contents with approximate breakup of hours for lecture (L)/

tutorial (T) /practice (P)</td><td colspan="6">Diode Circuits (2P), MOSFET Amplifiers (2P), Opamp Circuits (8P), 555 Timer-based circuits (1P)

Note:

● The lab should include both simulation and hardware.
● Simulation could be done in any SPICE software like LT Spice.
● Components would be issued to the students one week before; they should build the circuit and come to the lab.
● Lab time is to be utilized for applying input, verifying output, trouble shooting, thorough analyses and report submission.</td></tr>
<tr><td>Essential Reading</td><td colspan="6">1. Behzad Razavi, Fundamentals of Microelectronics, 2nd Edition, Wiley, ISBN: 9781119695141, 2021
2. Sergio Franco, Design With Operational Amplifiers And Analog Integrated Circuits, 4th Edition, McGraw Hill, ISBN: 9789352601943, 2016</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">1. Adel S. Sedra, Kenneth C. Smith & Arun N. Chandorkar, Microelectronic Circuits, Theory and Application, 7th Edition, Oxford University Press, ISBN: 9780199476299, 2017
2. Donald A. Neamen, Electronic Circuits: Analysis And Design, 4th Edition, McGraw Hill, ISBN : 9780073380643, 2010</td></tr>
</table>

<table>
<tr><td>Course Name</td><td>Prototyping & Testing</td><td>Course Code</td><td colspan="4">DS3001</td></tr>
<tr><td>Offered by Department</td><td>SIDI</td><td>Structure(LT PC)</td><td>1</td><td>2</td><td>0</td><td>3</td></tr>
<tr><td>To be offered for</td><td>B.Tech</td><td>Course Type</td><td colspan="4">Elective</td></tr>
<tr><td>Prerequisite</td><td>NIL</td><td>Approved In</td><td colspan="4">Senate-43</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">The objective of the course is to help students develop rapid prototyping skills andrealize aminimumviableproduct</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">● Students will develop skills in rapid prototyping; project management and focusingondeliveringoutcomes</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">1. Minimumviableproductplan(3hours)
● Markets andNeeds
● Business Goals
● Keyfeatures
2. CoreProductArchitecture(6hours)
● Storyboardingofthe product core.
● Frameworkformechanical,electronicsandcomputingparadigm
3. DesignforManufacture&Assembly(3hours)
● ManufacturingProcess:Form
● Assemblyconstraints:Fit
4. DevelopingtheProofofConcept(30hours)
● Build
● Assemble
● Iterate
● Validate
● Pitch
Evaluation:Continuousassessment(80%);FinalPoCdemo (20%)
2 one-day hackathons may be organized during this period (one weekends) toacceleratePoC development</td></tr>
<tr><td>Essential & Supplementary Readings</td><td colspan="6">1. How to Solve Big Problems and Test New Ideas in Just Five Days by Jake Knapp,JohnZeratsky,BradenKowitz
2. TheTotalInventorsManual: Transform YourIdeaintoaTop-SellingProduct by SeanMichaelRagan
3. PrototypingandModel makingforProductDesignbyBjarkiHallgrimsson
Bringing a Hardware Product to Market: Navigating the Wild Ride from ConcepttoMassProductionby ElaineChen</td></tr>
</table>

Course Name	Digital Communication	Course Code	EC5001			
Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	3	1	0	4
To be offered	B.Tech	Course Type	Core			
Prerequisite	Communication Systems	Approved In	Senate-44			
Learning Objectives	The objectives of this course is to ● learn the fundamentals of digital transmissions, noise and line coding techniques ● analyse receiver structures and probability of error calculations for various modulation techniques ● study the modulator and demodulator blocks of various digital modulation techniques. ● introduce the information theory concepts and study channel coding techniques in depth.					
Learning Outcomes	After successful completion of the course students will able to ● describe a digital communication system and its performance metrics ● understand the receiver structure and derive the BER expressions for various modulation techniques ● explain the blocks of the digital modulator/demodulators and also compare their performances ● appreciate the significance of information theoretic science in communication theory and learn the different channel coding techniques					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	● Basic tools of Digital communication, Line Coding, Transmission Pulse Shaping, Power Spectral Density, Additive White Gaussian Noise (AWGN) (L7+T2) ● Optimal Receiver Design, Signal-to-Noise Power Ratio (SNR), Matched Filtering (MF), Maximum Likelihood (ML) and MAP Receiver, general Probability of Error (L8+T2) ● Signal Space Theory, Binary Phase Shift Keying and associated Prob. of Error, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) and associated Prob. of Error (L8+T2) ● M-ary Phase Shift Keying (MPSK) and associated Prob. of Error, Quadrature Amplitude Modulation (QAM) (L3+T1) ● Introduction to Information Theory, Mutual Information, Differential Entropy (DE), Conditional, Joint Conditional DE, Capacity of Gaussian Channel (L6+T3) ● Hamming Weight and Distance Properties, Syndrome Decoding, Convolutional Codes: Trellis Structure and Viterbi Decoding (L5+T2) ● Pulse Shaping Filter Design, Nyquist Pulse Shaping Criterion, Raised-Cosine Filter, Passband-Baseband Equivalence (L4) ● Basics of TDMA, FDMA and CDMA (L2+T2)					
Essential Reading	1. Simon Haykin, Digital Communications, 1st Edition, John Wiley & Sons, ISBN: 9789971512057, 2009. 2. B.Sklar, Digital Communications, 2nd Edition, Pearson Education, ISBN:9780130847881, 2009.					
Supplementary Reading	1. J. G. Proakis, Digital Communications, 5 th edition, McGraw-Hill, ISBN: 978-0072957167, 2014. 2. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, 4 th edition, Oxford University Press, ISBN: 978-0195331455, 2013.					

<table>
<tr><td>Course Name</td><td>Communication Systems Practice</td><td>Course Code</td><td colspan="4">EC3005</td></tr>
<tr><td>Offered by Department</td><td>Electronics & Communication Engineering</td><td>Structure(LTP C)</td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>To be offered for</td><td>B.Tech</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>Communication Systems</td><td>Approved In</td><td colspan="4">Senate-44</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">The primary goal of this course is to have hands on experience with the analog and digital communication systems.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">After successful completion of the course students will able to
● analyse different analog and digital modulation schemes
● evaluate the performance of various communication systems
● analyse error probability of various digital communication systems</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/
tutorial/practice)</td><td colspan="6">● Analog Modulation: AM, DSB-SC, SSB, FM, white noise analysis
● Digital Modulation: PCM, PAM, MPSK (M=2,4, M), MQAM, MFSK(M=2,4), modulation and demodulation/detection, PSD and BER computation</td></tr>
<tr><td>Essential Reading</td><td colspan="6">1. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, 4th edition, Oxford University Press, ISBN: 978-0195331455, 2013.
2. B.Sklar, Digital Communications, 2nd Edition, Pearson Education, ISBN: 9780130847881,New Delhi, 2009</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">1. J. G. Proakis, Digital Communications, 5th edition, McGraw-Hill, ISBN: 978-0072957167, 2014
2. Simon Haykin, Digital Communications, 1st Edition, John Wiley & Sons, ISBN: 9789971512057, 2009.</td></tr>
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<tr><td>Course Name</td><td>Professional Communication</td><td>Course Code</td><td colspan="4">HS3000</td></tr>
<tr><td>Offered by Department</td><td>SH- English</td><td>Structure(LTP C)</td><td>1</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td>To be offered for</td><td>B.Tech.</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>NIL</td><td>Approved In</td><td colspan="4">Senate-44</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• Develop the capability to apply for a job and participate in selection process
• Acquire interview skills
• Gain proficiency in language skills indispensable for a successful professional
• Develop emotional intelligence</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Prepare résumé and cover letter
• Ready to perform at different levels of the interview process
• Able to use interpersonal skills in challenging situations
• Competent to draft various documents for specific purposes</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">• Preparing cover letter, résumé, digital profile; video profile; Email etiquette (L2, P4)
• Interview skills, Group discussion and impromptu speech (L2, P6)
• Social communication skills (L4, P6)
➢ Conversational English appropriateness, context based speaking in general situations, discussion and associated vocabulary in professional situations)
➢ Non-verbal communication – relevance and effective use of paralinguistic features – body language, chronemics, haptics, proxemics
➢ Emotional intelligence (EI) and social intelligence at workplace – theoretical perspectives and their application in relevant workplace situations – EI and leadership skills – assessments and best practices in organizations
• Conflict management and communication at workplace (L4,P6)
➢ Cross-cultural communication, Argumentation, negotiation, persuasion, decision making, case study of challenging situations
➢ Organizing a meeting, working as part of a team, briefing
➢ Business presentations – Preparing effective presentations, delivering presentations and handling questions
• Writing proposals, statement of purpose, research article, agreements, summary Proofreading (L1,P4)
• Training for proficiency assessment (L1,P2)</td></tr>
<tr><td>Essential & Supplementary Readings</td><td colspan="6">1. Tebeaux, Elizabeth, and Sam Dragga. The Essentials of Technical Communication. OUP, 2018.
2. Sabin, William A. The Gregg Reference Manual: A Manual of Style, Grammar, Usage, and Formatting. McGraw-Hill, 2011, pp 408-421.
3. Raman, Meenakshi and Sangeeta Sharma. Technical Communication: Principles and Practice. OUP, 2015.
4. Caruso, David R. and Peter Salovey. The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership. John Wiley and Sons, 2004.
5. https://learnenglish.britishcouncil.org/business-english/youre-hired/episode-01
6. https://www.youtube.com/watch?v=HAnw168huqA
7. https://www.youtube.com/watch?v=azrqlQ_SLW8
8. https://owl.purdue.edu/owl/purdue_owl.html
9. Turabian,Kate L. Student's Guide to Writing College Papers. University of Chicago Press, 2010.</td></tr>
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