Curriculum for B.Tech.

Electronics and Communication Engineering

(From The Academic Year 2020)

Approved in Senate 43 & 44

Indian Institute of Information Technology, Design and Manufacturing, Kancheepuram

Chennai-600 127

Curriculum & Syllabus

Semester 1							
S.No	Course Code	Course Name	Category	L	T	P	C
1	MA1000	Calculus	BSC	3	1	0	4
2	PH1000	Engineering Electromagnetics	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 Electromagnetics 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	HS1001	NSO/NCC/SSG/NSS	HSC	0	0	2	P/F
							25.0
	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	CS1004	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	HS1001	NSO/NCC/SSG/NSS	HSC	0	0	2	P/F
10	HS1002	Earth, Environment and Design	HSC	1	0	0	P/F
							25.0
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	HS2000	Indian Constitution, Essence of Indian Traditional Knowledge	HSC	1	0	0	P/F
							24.0
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

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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	HS2001	Human Values and Stress Management	HSC	1	0	0	P / F
							24.0
Semester 5							
S.No	Course Code	Course Name	Category	L	T	P	C
1	CS2005	Introduction of 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	HS3000	Professional Ethics and Organizational Behaviour	HSC	1	0	0	P/F
							22.0
Semester 6							
S.No	Course Code		Category	L	T	P	C
1	DS3001	Prototyping and Testing	DSC	1	2	0	3
2	EC5001	Digital Communication	PCC	3	1	0	4
3		Professional Elective Course 2	PEC	3	1	0	4
4		Elective Course 1	ELC	3	1	0	4
5		Elective Course 2	ELC	3	1	0	4
6	EC3005	Communication Systems Practice	PCC	0	0	2	1
7	HS3001	Professional Communication	HSC	1	0	2	2
8	HS3002	Intellectual Property Rights	HSC	1	0	0	P/F
							22.0
Semester 7							
S.No	Course Code		Category	L	T	P	C
1		Elective Course 3	ELC	3	1	0	4
2		Elective Course 4	ELC	3	1	0	4
3		Elective Course 5	ELC	3	1	0	4
4	EC4000	Internship	PCD				P/F
							12.0
Semester 8							
S.No	Course Code		Category	L	T	P	C
1		Elective Course 6	ELC	3	1	0	4
2	EC4001	Project	PCD	0	0	16	8
							12.0

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Semester wise Credit Distribution

Category	Semester wise Credits									
	S1	S2	S3	S4	S5	S6	S7	S8	Total	%
Basic Science Course (BSC)	8.5	4	0	0	0	0	0	0	12.5	7.5
Science Elective Course (SEC)	0	4	4	4	0	0	0	0	12	7.2
Basic Engineering Course (BEC)	11.5	4	0	0	0	0	0	0	15.5	9.3
Design Course (DSC)	3	3	3	3	3	3	0	0	18	10.8
IT Skill Course (ITC)	0	6	0	0	4	0	0	0	10	6.0
Professional Core Course (PCC)	0	4	17	17	11	5	0	0	54	32.5
Professional Elective Course (PEC)	0	0	0	0	4	4	0	0	8	4.8
Elective Course (ELC)	0	0	0	0	0	8	12	4	24	14.5
Humanities and Social Science Course (HSC)	2	0	0	0	0	2	0	0	4	2.4
Professional Career Development (PCD)	0	0	0	0	0	0	0	8	8	4.8
Total	25.0	25.0	24.0	24.0	22.0	22.0	12.0	12.0	166.0	100.0
	25.0	50.0	74.0	98.0	120.0	142.0	154.0	166.0	166.0	

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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.					

Curriculum & Syllabus

Course Name	Engineering Electromagnetics	Course Code	MA1000			
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 also provides an understanding of theories of electrostatics, magnetism and electrodynamics with their applications. It will enhance the problem solving capacity of the student.					
Contents of the course	• Vectors - an introduction; Unit vectors in spherical and cylindrical polar co-ordinates; Concept ofvector fields; Gradient of a scalar field; flux, divergence of a vector, Gauss's theorem, Continuity equation; Curl –rotational and irrational vector fields, Stoke's theorem. (12) • Electrostatics: • Electrostatic potential and field due to discrete and continuous charge distributions, boundary condition, Energy for a charge distribution, Conductors and capacitors, Laplace's equation Image problem, Dielectric polarization, electric displacement vector, dielectric susceptibility, energy in dielectric systems. (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 of current-carrying conductors, Magnetization and bound currents, Energy density in a magnetic field Magnetic permeability and susceptibility. (10) • Electrodynamics: • Electromotive force, Time-varying fields, Faradays' law of electromagnetic induction, • Self and mutual inductance, displacement current, Maxwell's equations in free space. Boundary condition, propagation in linear medium. Plane electromagnetic waves—reflection and refraction,electromagnetic energy density, Pointing Vector.(10)					
Essential Reading	1. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McGraw Hill Education Pvt.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, Electricity and Magnetism Berkley Physics Course, V2, Tata McGraw Hill, 2008. 3. Feynman. R.P, Leighton. R.B, Sands. M, The Feynman Lectures on Physics, Narosa Publishing House, Vol. II, 2008. Hill, 2008. 4. G. B. Arfken, H. J. Weber and F. E. Harris, Mathematical Methods for Physicists, Academic Press, 2013					

Curriculum & Syllabus

Course Name	Electrical Circuits for Engineers	Course Code	EC1000			
Offered by Department	Electronics and Communication Engineering	Structure (LTPC)	3	1	0	4
To be offered for	B TECH	Course Type	Core			
Pre-requisite	NIL	Approved In	Senate-43			
Learning Objectives	This course aims to equip the students with a basic understanding of electrical circuits andmachines for specific types of applications. This course also equips students with an ability to understand basics of analog and digital electronics.					
Learning Outcomes	The students shall develop an intuitive understanding of the circuit analysis, basic conceptsof electrical machines, and electronic devices and circuits and be able to apply them inproduct design and development					
Contents of the course *(With approximate break-up of hours)*	Elements in electrical circuits: R, L, C, voltage and current sources, Ohm's law, Kirchoff'sLaws **(4)** Network analysis: Nodal and mesh analysis with only independent sources **(4)** Network theorems: Superposition, Thevenin's & Norton's, Maximum power transfertheorems **(4)** DC circuits: Response of RC, RL and RLC circuits **(6)** AC circuits: AC signal measures, Phasor analysis of single-phase AC circuits, Three phase AC circuits **(6)** Machines: Transformers, DC generator, DC motor, AC induction machines **(8)** Diodes: V-I characteristics, applications -rectifiers, clippers, clampers **(2)** Op-amps: gain, feedback, applications - inverting/non-inverting amplifiers, sum anddifference amplifier, comparators **(4)** Logic gates and combinational circuits – Basic gates, Karnaugh maps, Full adder, half adder **(4)**					
Essential Reading	1. Edward Hughes, Ian McKenzie Smith, John Hiley, Keith Brown, 'Hughe's Electrical and Electronic Technology', 10th edition, Pearson, 2010					
Supplementary Reading	1. Charles Alexander and Matthew Sadiku 'Fundamentals of Electric Circuits' 7th Edition, McGraw Hill, 2021 2. C. H. Roth, Jr., Larry R Kinney, 'Fundamentals of Logic Design', 7th Edition, Cengage Learning, 2013. 3. Jacob Millman, Christos C Halkais, Satyabrata Jit, 'Millman's Electronic Devices and Circuits', 4th Edition, Mc Graw Hill India, 2015 4. Stephen D Umans, 'Fitzgerald & Kingsley's Electric Machinery', McGraw-Hill, 7thed. 2020.					

Curriculum & Syllabus

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 (4 hours) • 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					

Curriculum & Syllabus

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.					

Curriculum & Syllabus

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. Koos Eissen and Roselien Steur, 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					

Curriculum & Syllabus

Course Name	Engineering Electromagnetics Practice	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 behaves in different situations. The students will be able to relate the knowledge they have got in the theory class with their experience. This course will enhance their skill of handling instruments and the presentation of the results obtained from the experiments.					
Contents of the course	Electrical and magnetic properties of materials based on the concept of electrical polarization, magnetization of materials will be studied in various experiments. Experiments based on the concept of phenomena such as interference, diffraction etc. related to electromagnetic waves will be done here and these methods will be applied to measure some unknown physical quantities such as wavelength of a light, diameter of a very thin wire, very small aperture for light etc.					
Essential Reading	1. IIITD&M Laboratory manual for Electromagnetic Wave Practice					
Supplementary Reading	1. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McFraw Hill Education Pvt. Ltd,2006.					

Curriculum & Syllabus

Course Name	Problem Solving and Programming Practice	Course Code	CS1001			
Offered by Department	Computer Science	Structure (LTPC)	0	0	3	1.5
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. The sequence, selection and repetition statements in C programming language shall be discussed with case studies.					
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)	• 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					
Essential Reading	Deitel P J and Deitel H M, C : How To Program, Prentice Hall, 7th Edn, 2012.					
Supplementary Reading	Kernighan, Ritchie D, The C Programming Language, Prentice Hall, 2 Edn., 1988					

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<table>
<tr><td>Course Name</td><td>Effective Language and Communication Skills</td><td>Course Code</td><td colspan="4">HM1000</td></tr>
<tr><td>Offered by Department</td><td>SH-English</td><td>Structure(LTPC)</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-43</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• 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</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• 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</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/ be done practice)</td><td colspan="6">• 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)</td></tr>
<tr><td>Essential & Supplementary Reading</td><td colspan="6">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.</td></tr>
</table>

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	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

Curriculum & Syllabus

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					

Curriculum & Syllabus

Course Name	Engineering Graphics	Course Code	ME1001			
Offered by Department	Mechanical Engineering	Structure(LTPC)	2	0	4	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate-44			
Learning Objectives	• To introduce the basic concepts and techniques of technical drawing. • 2D and 3D representation of various shapes/objects and its engineering applications.					
Learning Outcomes	Students will acquire visualization skills and will be able to prepare technical drawings and 3D models using computer aided tools.					
Course Contents (with approximate breakup of hours for lecture/tutorial/practice)	• Role of technical drawing in product development process, Basics of technicaldrawing, Standards, Dimensioning principles. *(L2+P4 hrs.)* • Computer aided drafting. *(L2+P8 hrs.)* • Engineering curves and its applications. *(L4+P8 hrs.)* • Principles of orthographic projection. Orthographic projection of points, lines, planes and regular solids, Exercises related to engineering applications. *(L7+P8hrs.)* • Principles of isometric projections. Orthographic to isometric and isometric to orthographic transformation of objects. *(L3+P8 hrs.)* • Section and intersection of regular solids and their lateral developments. • *(L6+P12 hrs.)* • Introduction to 3D modelling of shapes and objects; electrical CAD. *(L2+P4hrs.)*					
Essential Reading	1. K. Venugopal and V Prabhu Raja, Engineering Drawing + AutoCAD, New Age International (P) Limited. 5th Edition Reprint: July, 2016 2. Narayana. K.L, and Kannaiah. P, Engineering Drawing, Scitech Pub. Pvt. Ltd, 3. 3rd Edition.					
Supplementary Reading	1. PI Varghese, Engineering Graphics, McGraw Hill Education, 2013. 2. Bhatt. N.D, Engineering Drawing – Plane and Solid Geometry, Charotar Publishing House Pvt. Ltd., 53 Edition 2014.					

Curriculum & Syllabus

Course Name	Elementary Data Structures and Logical Thinking	Course Code	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			
Learning Objectives	The focus is to discuss how data is organized and retrieved in computers. Elementary data structures with supporting operations shall be discussed. Studentswill be exposed to art of logical thinking through algorithmic puzzles.					
Learning Outcomes	At the end of the course, given a computational problem, students are expected tocome up with an algorithm and a suitable data structure, and implement the same using a programming language.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• History of Computing and Computers – the need for data organization – introduction to abstract data types and data structures (3L) • Introduction to logical thinking (algorithmic thinking) through simple examples.Introduction to Elementary data structures - Discussion on Stacks and Queues with supporting operations – implementation using arrays and lists – implementation of stack using queues and vice-versa – variants of stacks and queues – algorithmic puzzles (10L) • Arrays and applications - algorithmic puzzles involving arrays- sorting andsearching. (8L) • Discussion on linked lists with various supporting operations- algorithmic puzzles involving lists. Types of Lists – double, circular – the need for double and circular linked lists – puzzles involving lists (10L) • Introduction to trees, binary trees, search trees (7L) • Applications of elementary data structures in computer science and engineering. (7L)					
Essential Reading	1. M. A. Weiss, Data Structures and Algorithm Analysis in C, 2nd ed., Pearson,2002. 2. Anany Levitin and Maria Levitin, Algorithmic Puzzles, Oxford UniversityPress, 2011.					
Supplementary Reading	1. Narasimha Karumanchi, Data Structure and Algorithmic Thinking with Python,Careermonk Publications, 2017					

Curriculum & Syllabus

Curriculum & Syllabus

Course Name	Sociology of Design	Course Code	DS1001			
Offered by Department	SIDI	Structure (LTPC)	1	2	0	3
To be offered for	B.Tech	Course Type	Core			
Prerequisite	Foundation Program	Approved In	Senate 43			
Learning objectives	The objective of the course is to introduce engineering students tothe importance of understanding the social context of technology and product design: • Observing the problem context and surfacing unstated user/customer needs / new product concepts, • Understanding people, team dynamics and working in multicultural / cross-functional / distributed teams.					
Course Outcomes	At the end of the course, the students should be in a 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 break up of hours)	Module 1: Technology, Design and Society - [9 hrs] • 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 Module 2: Understanding user/customer contexts [21 hrs] • Ethnography - immersion in a problem context • Learning to observe - see and listen; • Developing rich pictures; Gigamapping • Introduction to signs and semiotic analysis Module 3: Understanding groups (multicultural/cross-functional teams) [12 hrs] • Learning team formation and dynamics through a movie; • Introduction to sociological imagination - Functionalism, Conflict Theory, Symbolic Interactionism; Interaction Ritual Chains • Values, culture, methods of engineers and designers and how they shape thequality of our lives; • Group dynamics within organizations and across organizations andimplications for innovation and change Evaluation: Continuous assessment (40%); Final ethnography report (20%); End Semester (40%)					
Essential & Supplementary Readings	1. Trevor Pinch (Editors) (2012), The Social Construction of Technological Systems: New directions in the sociology and history of technology, MIT Press, Anniversary Edition 2. Wendy Gunn, Ton Otto and Rachel Smith (2013), Design Anthropology: Theory and practice, Bloomsbury 3. Adrian Forty (2014), Objects of desire: Design and society since 1750s, Thames & Hudson 4. Bernhard E Burdek(2015), History, theory and practice of product design,second revised edition 5. Keri Smith (2008), How to be an Explorer of the World: Portable Life Museum, Penguin Group					

Curriculum & Syllabus

Course Name	Design and Manufacturing Lab.	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 the domain of mechanical, electrical, electronics and communication engineering. The exercises will train the students to acquire skills which are very essential for the engineers through hands-on sessions.					
Contents of the course	Experiments will be framed 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 ReferenceBook for the Practical Electrical Man”, Tata McGraw Hill, 2002.					

Curriculum & Syllabus

Course Name	Digital Circuits	Course Code	EC1001			
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 objective of this course is to provide a good understanding on the design and implementation of digital circuits and systems					
Learning Outcomes	The course would equip the students to • Understand Digital Logics and circuits design. • Design Combinational & Sequential digital circuits. • Develop Digital Circuits/Systems for practical problems.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Introduction to Digital Systems: Introduction to Digital Logic, Data Representations, Number systems, Code conversion (L5+T1) • Boolean Algebra & Logic: Laws and theorems of Boolean Algebra, Truth Tableand algebraic form, Boolean Logic Minimization, Design using MSI Components, K Maps, QM method, SOP, POS; NAND and NOR implementations, Digital Circuit Characterization (L7+T2) • Combinational Circuit Design: Design Procedure, Multiplexer, Decoder, Encoder, Comparator, Seven-segment display, Parity generator, Design of large circuits. (L8+T2) • Sequential Circuit Design: Asynchronous and Synchronous Design, Flip Flops& Latches, Design of sequential modules – SR, D, T and J-K Flip-flops, applications, Clock generation, Registers and Counters. (L10 +T3) • State Machine Design: Moore and Mealy Machines, State Table and Diagram, State machine Design Approach, Digital Implementation of State Machine. (L8+T3) • Introduction to HDL and Design Examples : (L3+T1)					
Essential Reading	1. C. H. Roth, Jr., Fundamentals of Logic Design, 7th Edition, Cengage Learning,ISBN: 9781133628477, 2013. 2. S. Brown and Z. Vranesic, Fundamentals of Digital Logic with VHDL Design,3rdEdition, TMH, ISBN: 9780077221430, 2008.					
Supplementary Reading	1. R. J. Tocci, N. S. Widmer, and G. L. Moss, Digital Systems Principles and applications,10th Edition, Pearson Prentice Hall Edition, ISBN:9780131725799, 2006. 2. V.A.Pedroni, Digital Electronics and Design with VHDL, 1st Edition, Elsevier, ISBN:978-0-12-374270-4, 2008. 3. Taub and Schilling, Digital Principles and Applications, 7th Edition, TMH, ISBN: 978-0-07-014170-4., 2011. 4. J. F. Wakerly, Digital Design- Principles and Practices, 3rd Edition, Pearson, ISBN:9332508135, 2008. 5. M Morris Mano, Digital Design, 5th Edition, Pearson, ISBN:9332535763, 2014. 6. M Morris Mano, Digital Design with an Introduction to the Verilog HDL, VHDL & System Verilog,6th Edition, Pearson, ISBN:9353062019, 2018. 7. T. L. Floyd and R. P. Jain, Digital Fundamentals, 8th Edition, Pearson, ISBN:9332584600, 2017.					

Curriculum & Syllabus

Course Name	Elementary Data Structures and Logical Thinking Practice	Course Code	CS1006			
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			
Learning Objectives	• The focus is to discuss how data is organized and retrieved in computers. • Elementary data structures with supporting operations shall be discussed. Students will be exposed to art of logical thinking through algorithmic puzzles.					
Learning Outcomes	At the end of the course, given a computational problem, students are expected to come up with an algorithm and a suitable data structure, and implement the sameusing a programming language.					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• Case studies that motivates logical thinking (algorithmic thinking) – implementation using C programming • Case studies involving arrays and implementation - Arrays with various supporting operations- algorithmic puzzles involving arrays – sorting and searching • Examples on linked lists with various supporting operations- algorithmic puzzles involving singly, doubly and circular linked lists. – puzzles involvinglists • Case studies on Stacks and Queues with supporting operations – implementation using arrays and lists – implementation of stack using queues and vice-versa – variants of stacks and queues – algorithmic puzzles • Applications of elementary data structures in computer science and engineeringand implementation					
Essential Reading	1. M. A. Weiss, Data Structures and Algorithm Analysis in C, 2nd ed., Pearson,2002. 2. Anany Levitin and Maria Levitin, Algorithmic Puzzles, Oxford UniversityPress, 2011					
Supplementary Reading	1. Narasimha Karumanchi, Data Structure and Algorithmic Thinking with Python, Careermonk Publications, 2017					

Curriculum & Syllabus

Course Name	Earth, Environment and Design	Course Code	HS1002			
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.					

Curriculum & Syllabus

Course Name	Systems Thinking for Design	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	Design for effectiveness – Level 1					
Learning Outcomes	This course will help students understand • The importance of modeling systems to realize effective designs • Abstraction of key elements from problem situations Use of specific techniques to model problems in a holistic manner					
Contents of thecourse	•Real-world problems & the need for inter-disciplinary approaches [2] •Basic concepts of systems thinking (parts, relations, patterns) [6] •Technique #1: Rich Pictures •Technique #2: Mapping Stakeholder, Needs, Alterables, Constraints [6] •Technique #3: Structural Modeling (Hierarchical decomposition) [6] Technique #4: Influence Diagrams (Self-regulating systems) [6]					
Essential Reading	1. Hitchins, Derek K. (2007) Systems Engineering: A 21st Century SystemsMethodology, John Wiley, ISBN: 978-0-470-05856-5. 2. Wilson, Brian (1991) Systems: Concepts, Methodologies and Applications. 2nd Edition, Wiley. ISBN: 0471927163. Hutchinson, William; Systems Thinking and Associated Methodologies, Praxis Education. ISBN: 0 646 34145 6.					
Supplementary Reading	1. Gerald Wienberg (2001), An introduction to general systems thinking, Dorset House Publishing. 2. Sage, A.P. (1977); Methodology for Large Scale Systems, McGraw Hill, New York.					

Curriculum & Syllabus

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 hours for lecture/ tutorial/practice)	• **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) • **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.					

Curriculum & Syllabus

<table>
<tr><td>Course Name</td><td>Network Theory</td><td>Course Code</td><td colspan="4">EC2001</td></tr>
<tr><td>Offered by Department</td><td>Electronics & Communication Engineering</td><td>Structure (LTPC)</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>NIL</td><td>Approved In</td><td colspan="4">Senate-44</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• 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.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">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.</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">• 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)</td></tr>
<tr><td>Essential Reading</td><td colspan="6">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, 5th Edition,McGraw Hill, New Delhi, ISBN:9339219604, 2017.</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">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, 9th Edition , TMH, ISBN: 9780073545516, 2019.
3. Smarajit Ghosh, Network Theory Analysis and Synthesis, 8th Edition ,Prentice Hall of India, New Delhi, ISBN:9332511040,2011.</td></tr>
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Curriculum & Syllabus

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.					

Curriculum & Syllabus

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.					

Curriculum & Syllabus

Course Name	Digital Circuits Practice	Course Code	EC2004			
Offered by Department	Electronics & Communication Engineering	Structure(LTPC)	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, 5th Edition , 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.					

Curriculum & Syllabus

<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>

Curriculum & Syllabus

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,ISBN 9780132341998, 2007.					

Curriculum & Syllabus

Course Name	Electromagnetic Waves	Course Code	EC2008			
Offered by Department	Electronics & Communication Engineering	Structure(LTPC)	3	1	0	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	Engineering Electromagnetics	Approved In	Senate-44			
Learning Objectives	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.					
Learning outcomes	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					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• 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)					
Essential Reading	1. R K Shevgaonkar, Electromagnetic Waves, 1ST Edition, Tata McGraw Hill, ISBN: 9780070591165, 2006. 2. C. A. Balanis, Antenna Theory and Design, 3rd Edition, John Wiley & Sons, ISBN-047166782X, 2005.					
Supplementary Reading	1. David K. Cheng, Field and Wave Electromagnetics, 2nd Edition, Pearson Education, ISBN: 9781292026565 2014. 2. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, 6th Edition, Pearson Education, ISBN: 978 0131139619, 2013. 3. Fawwaz T. Ulaby Eric Michielssen and Umberto Ravaioli, Fundamentals of Applied Electromagnetics, 7th Edition, Pearson Education, ISBN: 9781292082486, 2015. 4. David. M. Pozar, Microwave Engineering, 4th Edition, John Wiley, ISBN: 9781118298138, 2011. 5. J. D. Kraus and R. J. Marhefka, Antennas for All Applications, 3rd Edition, Tata McGraw Hill,ISBN: 978-0071122405 , 2002.					

Curriculum & Syllabus

Course Name	Analog Circuits	Course Code	EC2009			
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	• 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.					

Curriculum & Syllabus

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.					

Curriculum & Syllabus

<table>
<tr><td>Course Name</td><td>Embedded Systems Practice</td><td>Course Code</td><td colspan="4">EC2011</td></tr>
<tr><td>Offered by Department</td><td>Electronics & Communication Engineering</td><td>Structure(LTP C)</td><td>1</td><td>0</td><td>3</td><td>2.5</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 familiarize with the design and implementation of different embedded systems with real time applications.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">The course would equip the students to
• Design embedded systems using ARM SoC platform
• Use RTOS for system design and IoT systems design.</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">• 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</td></tr>
<tr><td>Essential Reading</td><td colspan="6">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.</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">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.</td></tr>
</table>

Curriculum & Syllabus

Course Name	Introduction of Data Science for Engineers	Course Code	CS2005			
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					

Curriculum & Syllabus

<table>
<tr><td>Course Name</td><td>Entrepreneurship and Management Functions</td><td>Course Code</td><td colspan="4">DS3000</td></tr>
<tr><td>Offered by Department</td><td>SIDI</td><td>Structure (LTPC)</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 (Core / Elective)</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>Systems Thinking and 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 is to provide engineering students an exposure to the basic concepts of entrepreneurship and management, with a specific focus on the process of turning an idea into a commercially viable venture.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, the students will learn how to
• Understand the market & competition
• Prepare a business case for the product/idea</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Module 1: Introduction
• Division of labor and creation of value
• Evolution of organizations, industries and sectors, for profit and non-profit
• Role of Entrepreneurs and Managers in value creation
• Principles of Management - Planning, Organizing, Resourcing, Directing (4)

Module 2: Strategy & Planning
• Understanding industry dynamics & competition (Porter's Framework)
• Understanding the industry value chain and firm positioning (6)

Module 3: Organizing
• Typical organizational functions (R&D, Marketing & Sales, HR, Operations)
• Cybernetics of organizational functions (Stafford Beer's viable systems model)
• Types of organization structures (product, functional, matrix, global) (6)

Module 4: Resource Management
• Financial management (Sources of funding, how to read a P&L, balance sheet)
• Human resource management (Interviewing, compensation, motivation)
• Global sourcing and supply chain management (8)

Module 5: Management Information & Decision Making (4)

Module 6: Legal and Regulatory environment (4)</td></tr>
<tr><td>Essential Reading</td><td colspan="6">1. Peter F Drucker, The Practice of Management, Harper Collins, 2006, ISBN: 978-0060878979
2. Hentry Mintzberg, Managing, Berret-Koehler Publishers, 2009, ISBN: 978-1605098746
3. Michael Porter, On competition: Updated and Expanded Edition, HBS, 2008, ISBN: 978-1422126967
4. Vasanta Desai, Dynamics of Entrepreneurial Development and Management, HimalayaPublishing House, ISBN:9788183184113.</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">1. Walter Isaacson, Steve Jobs, 2011, ISBN:978-1451648539
2. Eric Ries, The Lean Startup, Portfolio Penguin, 2011, ISBN: 978-0307887894
3. Vineet Bajpai, Build from scratch, Jaico books, 2013, ISBN: 9788184952919.</td></tr>
</table>

Curriculum & Syllabus

Course Name	Control Systems	Course Code	EC3000			
Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	3	1	0	4
To be offered for	B.Tech	Course Type	Core			
Prerequisite	Preliminary Mathematics	Approved In	Senate-44			
Learning Objectives	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.					
Learning Outcomes	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					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	• 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.					
Essential Reading	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.					
Supplementary Reading	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.					

Curriculum & Syllabus

<table>
<tr><td>Course Name</td><td>Communication Systems</td><td>Course Code</td><td colspan="4">EC3001</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>Signals & Systems</td><td>Approved In</td><td colspan="4">Senate-44</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">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</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">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</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">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)</td></tr>
<tr><td>Essential Reading</td><td colspan="6">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.</td></tr>
<tr><td>Supplementary Reading</td><td colspan="6">1. A Bruce Carlson, PB Crilly, JC Rutledge, Communication Systems, 4th Edition, McGraw Hill New York,ISBN: 978-0071210287, 2002.</td></tr>
</table>

Curriculum & Syllabus

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.					

Curriculum & Syllabus

Course Name	Analog Circuits Practice	Course Code	EC3003			
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			
Learning Objectives	• 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					
Learning Outcomes	• 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					
Course Contents with approximate breakup of hours for lecture (L)/ tutorial (T) /practice (P)	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.					
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					

Curriculum & Syllabus

<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 a minimum viable product</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Students will develop skills in rapid prototyping; project management and focusingon delivering outcomes</td></tr>
<tr><td>Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)</td><td colspan="6">1. Minimum viable product plan (3 hours)
• Markets and Needs
• Business Goals
• Key features
2. Core Product Architecture (6 hours)
• Storyboarding of the product core.
• Framework for mechanical, electronics and computing paradigm
3. Design for Manufacture & Assembly (3 hours)
• Manufacturing Process: Form
• Assembly constraints: Fit
4. Developing the Proof of Concept (30 hours)
• Build
• Assemble
• Iterate
• Validate
• Pitch
Evaluation: Continuous assessment (80%); Final PoC demo (20%)
2 one-day hackathons may be organized during this period (one weekends) to accelerate PoC 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,John Zeratsky, Braden Kowitz
2. The Total Inventors Manual: Transform Your Idea into a Top-Selling Product by Sean Michael Ragan
3. Prototyping and Model making for Product Design by Bjarki Hallgrimsson
Bringing a Hardware Product to Market: Navigating the Wild Ride from Conceptto Mass Production by Elaine Chen</td></tr>
</table>

Curriculum & Syllabus

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.					

Curriculum & Syllabus

Course Name	Communication Systems Practice	Course Code	EC3005			
Offered by Department	Electronics & Communication Engineering	Structure(LTP C)	0	0	2	1
To be offered for	B.Tech	Course Type	Core			
Prerequisite	Communication Systems	Approved In	Senate-44			
Learning Objectives	The primary goal of this course is to have hands on experience with the analog and digital communication systems.					
Learning Outcomes	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					
Course Contents (with approximate breakup of hours for lecture/ tutorial/practice)	● 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					
Essential Reading	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					
Supplementary Reading	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.					

Curriculum & Syllabus

<table>
<tr><td>Course Name</td><td>Professional Communication</td><td>Course Code</td><td colspan="4">HS3001</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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