



**Uttarakhand Technical University, Dehradun Scheme of
Examination as per AICTE Flexible Curricula**

Evaluation Scheme & Syllabus for B. Tech Second Year

**W.E.F. Academic Session 2019-20
III & IV SEMESTER**

Bachelor of Technology (B. Tech.)

**[Electronics & Communication/Electronics &
Telecommunication Engineering]**

Uttarakhand Technical University, Dehradun
New Scheme of Examination as per AICTE Flexible Curricula
Bachelor of Technology (B.Tech.) II Year
[Electronics & Communication Engineering]
W.E.F. Academic Session 2019-20

III Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical			L	T	P	
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Team Work / Lab Work & Sessional					
1.	BCET 401	BSC-5	Mathematics-III	100	30	20	-	-	150	3	1	-	4
2.	BECT 302 BECP 302	DC-1	Electronic Measurement & Instrumentation	100	30	20	30	20	200	3	1	2	5
3.	BECT 303 BECP 303	DC-2	Digital Electronics	100	30	20	30	20	200	3	1	2	5
4.	BECT 304 BECP 304	DC-3	Electronic Devices	100	30	20	30	20	200	3	1	2	5
5.	BEET 305 BEEP 305	DC-4	Network Analysis & Synthesis	100	30	20	30	20	200	3	1	2	5
6.	BASP 107	DLC-1	Evaluation of Internship-I completed at I year level	-	-	-	-	50	50			4	2
7.	BASP 307	DLC-4	90 hrs Internship based on using various software's –Internship -II	To be completed anytime during Third/ fourth semester. Its evaluation/credit to be added in fifth semester.									
Total				500	150	100	120	130	1000	15	5	12	26
NSS/NCC													

IV Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical			L	T	P	
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Team Work / Lab Work & Sessional					
1.	BAST 301	ESC	Energy & Environmental Engineering	100	30	20	-	-	150	3	1	-	4
2.	BECT 402 BECP 402	DC	Signal & Systems	100	30	20	30	20	200	3	1	2	5
3.	BECT 403 BECP 403	DC	Analog Communication	100	30	20	30	20	200	3	1	2	5
4.	BEET 404 BEEP 404	DC	Control System	100	30	20	30	20	200	3	1	2	5
5.	BECT 405 BECP 405	DC	Analog Circuits	100	30	20	30	20	200	3	1	2	5
6.	BECP 406	DLC	Signals & Systems and Simulation Lab	-	-	-	-	50	50			4	2
	BECP 407	DLC	90 hrs Internship based on using various software's –Internship -II										
7.	BCST 408	MC	Cyber Security	Non Credit Course									
Total				500	150	100	120	130	1000	15	5	12	26

Note: Meaning of Last Character of Subject Code (T – Theory; P – Practical)

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	1 Credit	1 Credit

BAST 301	Mathematics – III	3L-1T-0P	4 Credits
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Course Objective:

The objective of this course is to familiarize the students with Laplace Transform, Fourier Transform, techniques in numerical methods & some statistical techniques. It aims to present the students with standard concepts and tools at B.Tech first year to superior level that will provide them well towards undertaking a variety of problems in the concern discipline.

The students will learn:

- The idea of Laplace transform of functions and their applications.
- The idea of Fourier transform of functions and their applications.
- To evaluate roots of algebraic and transcendental equations.
- Interpolation, differentiation, integration and the solution of differential equations.
- The basic ideas of statistics including measures of central tendency, correlation, regression and their properties.

COURSE OUTCOMES(s):

At the end of this course, the students will be able to:

1. Remember the concept of Laplace transform and apply in solving real life problems.
2. Understand the concept of Fourier transform to evaluate engineering problems
3. Understand to evaluate roots of algebraic and transcendental equations.
4. Understand interpolation, differentiation, integration and the solution of differential equations.
5. Understand the concept of correlation, regression, moments, skewness and kurtosis and curve fitting.

Module 1: Fourier Transforms: (8 hours)

Fourier integral, Fourier Transform, Complex Fourier transform, Inverse Transforms, Convolution Theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations.

Module 2: Laplace Transform: (8 hours)

Definition of Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve linear differential equations.

Module 3: Solution of Algebraic and Transcendental equations & Interpolation (8 hours)

Number and their accuracy, Solution of algebraic and transcendental equations: Bisection method, Iteration method, Newton-Raphson method and Regula-Falsi method. Rate of convergence of these methods (without proof),

Interpolation: Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formula. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formula.

Module 4: Numerical differentiation, Integration & Solution of ODE (8 hours)

Numerical Differentiation, Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8 rule Runge-Kutta method of fourth order for solving first order linear differential equations. Milne's predictor-corrector method.

Module 5: Statistical Techniques (8 hours)

Introduction: Measures of central tendency, Moments, Moment generating function (MGF), Skewness, Kurtosis, Curve Fitting : Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves. Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions coefficients and non-linear regression.

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics; John Wiley & Sons
2. B.V. Ramana: Higher Engineering Mathematics; Tata McGraw- Hill Publishing Company Limited, New Delhi.
3. Peter V.O' Neil. Advanced Engineering Mathematics, Thomas (Cengage) Learning
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. T.Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi.
6. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing House, New Delhi.
7. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
8. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
9. N.P. Bali and Manish Goyal, Computer Based Numerical and Statistical Techniques , Laxmi Publications, Reprint, 2010.
10. J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.
11. D.N.Elhance,V. Elhance & B.M. Aggarwal: Fundamentals of Statistics; Kitab Mahal Distributers, New Delhi.

BECT 302 BECP 302	Electronic Measurements and Instrumentation	3L-1T-2P	5 Credits
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COURSE OBJECTIVE(s):

1. To introduce the meters used to measure current & voltage.
2. To provide detailed study of resistance, inductance and capacitance measuring methods.
3. To have an adequate knowledge different a/d conversion techniques used in Digital Multimeter.
4. To have an adequate knowledge of Signal generator & Analyzer.

COURSE OUTCOME(s):

1. Apply the suitable method for measurement of resistance, inductance and capacitance.
2. Compare the different types of measuring instruments, their construction, operation and characteristics.
3. To understand how to use CRO in lab and its calibration
4. Basic understanding of generating signal and analysing it.

Course Contents:

Module 1:

Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, Other unit systems, dimension and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter.

Module 2:

Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, multimeter probes, Digital voltmeter systems, digital multimeters, digital frequency meter System, Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments, AC bridge theory, capacitance bridges, Inductance bridges, Q meter

Module 3:

Analog to digital converter: Transfer characteristics, A/D conversion technique: Simple potentiometer and servo method, successive approximation method ramp type, integrating and dual slope integrating method D/A Converter: Transfer characteristic, D/A conversion technique, digital mode of operation, performance characteristics of D/A convertors.

Display Devices: Alpha numeric display using LCD and LED Specification of digital meters, Display digits and count resolution, sensitivity, accuracy, speed and settling time etc.

Module 4:

CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope Probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO Applications.

Module 5:

Signal generator and analyzer: Signal generator: Sine wave, non-sinusoidal signal and function generators, frequency synthesis techniques.

Signal analyzers: Spectrum analyzer and distortion, Concept of ECG, EMG, EEG etc.

Recorders: X-Y recorders, plotters

List of Experiment:

1. Study of semiconductor diode voltmeter and its use as DC average responding AC voltmeter.
2. Study of L.C.R. Bridge and determination of the value of the given components.
3. Study of distortion factor meter and determination of the % distortion of the given oscillator.
4. Study of the transistor tester and determination of the parameters of the given transistors.
5. Study of the following transducer (i) PT-100 Transducer (ii) J- type Transducer (iii) K-type Transducer (IV) Pressure Transducer
6. Measurement of phase difference and frequency using CRO (Lissajous Pattern)
7. Measurement of low resistance Kelvin's double bridge.
8. Measurement of Capacitance by De Sauty's bridge, Schering bridge
9. Measurement of Inductance by Maxwell, Hay's, Anderson, Owen's bridge
10. Radio Receiver Measurements
11. Study of A to D convertor and its realization
12. Study of D to A convertor and its realization
13. Designing of some characters like A by alpha numeric Display.

Reference Books:

1. David A. Bell, "Electronic Instrumentation and Measurements", 2nd Ed., PHI, New Delhi 2008
2. Elements of Electronic Instrumentation and Measurement, 3/e, Carr. Pearson
3. Oliver and Cage, "Electronic Measurements and Instrumentation", TMH, 2009.
4. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Butterworth Heinmann), 2008
5. A.K. Sawhney, "Electrical and Electronic measurements and Instrumentation"

BECT 303 & BECP 303	DIGITAL ELECTRONICS	3L-1T-2P	5 Credits
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COURSE OBJECTIVE(s):

The objectives of this course are to:

1. Introduce the concept of digital and binary systems
2. Be able to design and analyze combinational logic circuits.
3. Be able to design and analyze sequential logic circuits.
4. Understand the basic software tools for the design and implementation of digital circuits and systems.
5. Reinforce theory and techniques taught in the classroom through experiments and projects in the laboratory.

COURSE OUTCOME(s):

1. After successful completion of the course student will be able to
2. Develop a digital logic and apply it to solve real life problems.
3. Analyze, design and implement combinational logic circuits.
4. Classify different semiconductor memories.
5. Analyze, design and implement sequential logic circuits.
6. Analyze digital system design using PLD.
7. Simulate and implement combinational and sequential circuits.

Course Contents:

Module 1:

Number Systems Binary Codes: Number System and its arithmetic, conversion between bases, Boolean algebra, Canonical form, SOP & POS forms, Minimization of Boolean Functions: K Map (upto 5 variables), Quine-Mcclusky method, Error detection & correcting codes, Hamming codes, Binary codes.

Module 2:

Combinational Logic Circuits: Introduction to Combinational Circuits, Analysis and Design Procedure, Binary Adder, Subtractor, Parallel Adder/Subtractor, Carry Look Ahead Adder, Decoder, Encoder, Priority Encoder, Digital Multiplexer, Magnitude Comparator. Programmable Logic Devices, PLA & PAL.

Module 3:

Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, Flip Flops: SR, JK, D and T Type, Timing and Triggering Consideration, JK Master Slave, Excitation Table of all Flip Flops, Conversion from one type of Flip-Flop to another.

Counters: Asynchronous and Synchronous Counters, Design of Up Counters, Design of Down Counters, Mod Counter, Lock-Out table, Self-Starting Counter.

Module 4:

Finite State Machine: Mealy and Moore machines, State Table, State Diagram, Reduction of State Table, FSM Design Steps, Counter Design Using FSM.

Logic Families: Classification of Logic Families, Parameters: Propagation Delay, Power Dissipation, Fan-in, Fan-out, Noise Margin. TTL Family, TTL output configurations, ECL Family, IIL Family, MOS Family. Logic gate design using TTL and MOS.

Module 5:

Hazard, Fault Detection: Hazard and Fault Detection, Static Hazards, Dynamic Hazards, Determination of Hazards in Combinational Circuits. Fault Detection Using Fault Table and Path Sensitizing Methods.

Memories: Sequential Access Memories, Random Access Memories, RAM, ROM, PROM, EPROM, EEPROM, Static and Dynamic RAM cells using nMOS CMOS, Memory Size Expansion.

List of Experiments:

1. Introduction to Digital Electronics lab- nomenclature of digital ICS.
2. Implementation of the given Boolean function using logic gates in both sop and pos forms.
3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
4. Implementation and verification of decoder/de-multiplexer and encoder using logic gates.
5. Implementation of 4x1 multiplexer using logic gates.
6. Implementation of 4-bit parallel adder using 7483 IC.
7. To design and verify operation of half adder and full adder.
8. To design & verify the operation of magnitude comparator.
9. Design and verify the 4-bit synchronous counter.
10. Design and verify the 4-bit asynchronous counter.

Textbooks/References:

1. M. Morris Mano and M. D. Ciletti, Digital Fundamental, 4th, Edition, Pearson.
2. Digital Systems: Principles and Design, Raj Kamal, Pearson.
3. Fundamentals of Digital Circuits A. Anand Kumar PHI 3rd Edition, 2014.
4. Digital Fundamental, Thomas L Floyd, 11th Edition

BECT 304 & BECP 304	ELECTRONIC DEVICES	3L-1T-2P	5 Credits
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COURSE OBJECTIVE(s):

1. To understand operation of semiconductor devices.
2. To understand DC analysis and AC models of semiconductor devices.
3. To study diodes and its application
4. To study basic concepts for the design of BJT and FET

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand the principles of semiconductor Physics.
2. Understand and utilize the mathematical models of semiconductor junctions.
3. Understand carrier transport in semiconductors.
4. Utilize the mathematical models of MOS transistors for circuits and systems.
5. Analyze and find application of special purpose diodes.

Course Contents:

Module 1: Introduction to Semiconductor: Crystal Properties and charge Carriers in Semiconductors, Elemental and compound semiconductor materials, crystal lattice Structure, Energy bands in intrinsic and extrinsic silicon, carrier transport, diffusion current, drift current, mobility and resistivity, Hall effect.

Module 2: Generation and recombination of carriers: Poisson and continuity equation P-N junction characteristics, I-V characteristics, carrier recombination, and small signal switching models.

Module 3: Diodes and its Applications: PN Junction diode: Half & Full wave rectifier, Clipper, Clamper. Voltage multiplier. Avalanche breakdown, Zener diode, Schottky diode, LED, Solar cell, tunnel diode.

Module 4: Bipolar Junction Transistor: Basic construction, transistor action, CB, CE and CC configurations, input/output Characteristics, concept of Biasing of transistors-fixed bias, emitter bias, potential divider bias, BJT Models.

Module 5: Field Effect Transistor: JFET: Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristics equation CG, CS and CD configurations, Introduction to self and fixed biasing. MOSFET: depletion and enhancement type MOSFET-construction, operation and characteristics.

LIST OF EXPERIMENTS

1. **Study of Lab Equipment and Components:** CRO, multimeter, and function generator, power supply- active, passive components and bread board.
2. **P-N Junction diode:** Characteristics of PN junction diode - static and dynamic resistance measurement from graph.
3. **Applications of PN Junction diode:** Half & Full wave rectifier- Measurement of V_{rms} , V_{dc} , and ripple factor.
4. **Characteristics of Zener diode:** V-I characteristics of Zener diode, graphical measurement of forward and reverse resistance.
5. **Characteristics of Photo diode:** V-I characteristics of photo diode, graphical

measurement of forward and reverse resistance.

6. **Characteristics of Solar cell:** V-I characteristics of solar cell, graphical measurement of forward and reverse resistance.
7. **Application of Zener diode:** Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.
8. **Characteristic of BJT:** BJT in CE configuration- graphical measurement of h-parameters from input and output characteristics. Measurement of A_v , A_i , R_o and R_i of CE amplifier with potential divider biasing.
9. **Field Effect Transistors:** Single stage common source FET amplifier –plot of gain in dB Vs frequency, measurement of bandwidth and input impedance.
10. **Metal Oxide Semiconductor Field Effect Transistors:** Single stage MOSFET amplifier–plot of gain in dB Vs frequency, measurement of bandwidth and input impedance.

Textbooks/References:

1. Boylestad and Nashelsky, 'Electronic Devices and circuits' PHI, 6e, 2001.
2. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2014.
3. D. Neamen , D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education.
4. C.T. Sah, "Fundamentals of Solid State Electronics," World Scientific publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford univ. press, 2011.
6. Muhammad H. Rashid, "Electronic Devices and Circuits," Cengage publication, 2014.

BEET 305 BEEP 305	Networks Analysis & Synthesis	3L:1T:0P	4 Credits
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COURSE OBJECTIVE(s):

1. To make the students capable of analyzing any given electrical network.
2. To make the students learn how to synthesize an electrical network from a given impedance/admittance function.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Apply the knowledge of basic circuit law and simplify the network using reduction techniques
2. Analyze the circuit using Kirchhoff's law and Network simplification theorems
3. Infer and evaluate transient response, Steady state response, network functions
4. Obtain the maximum power transfer to the load, and Analyze the series resonant and parallel resonant circuit
5. Evaluate two-port network parameters, design attenuators and equalizers
6. Synthesize one port network using Foster and Cauer Forms.

Course Contents:

Module 1: Graph Theory: Basic circuit law, Mesh & Nodal analysis. Importance of Graph Theory in Network Analysis, Graph of a network, Definitions, planar & Non-Planar Graphs, Isomorphism, Tree, Co Tree, Link, basic loop and basic cut set, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analysis.

Module 2: Network Theorems: Concepts of AC and DC Network Theorems, Electrical Sources, Basic circuit law. Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's Theorem.

Module 3: Laplace transforms and properties, Application of Laplace transforms in Electrical System, Application of Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

Module 4: Two Port Networks- Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Interconnections of two port networks, Ladder and Lattice networks: T & Π representation, terminated two Port networks, Image Impedance. Concept of complex frequency, Transform impedances network functions of one port and two port networks,

Module 5: a) Network Synthesis: Concept of poles and zeros, Properties of driving point and transfer functions. Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Caue first and second forms.

(b) Introduction to passive filters

LIST OF EXPERIMENT(s):

1. To verify Thevenin's & Norton's theorem
2. To verify maximum power transfer theorem.
3. To find h and g parameters of two port network.
4. The verification of principle of super position with DC and AC source
5. Verification of tellegen's theorem
6. Design of passive filters
7. Determination of transient response of RL, RC, RLC
8. MATLAB realization of all the above experiments

Text/Reference Books:

1. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
2. CL Wadhwa, "Network Analysis and Synthesis", New Age International Publishers.
3. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co.
4. Reference Books:
5. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill.
6. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill.
7. ME Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
8. T.S.K.V. Iyer, "Circuit Theory", Tata McGraw Hill.

IV Semester

BCET 401	Energy and Environment Engineering	3L-1T-0P	4 Credits
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Course Objectives:

The objective of this course is to apply knowledge of mathematics, science, technology and engineering appropriate to energy science and engineering degree discipline and to enhance the understanding of conventional and non-conventional energy sources and its relationship with the ecology and environment. More precisely the objectives are:

1. Use mathematical or experimental tools and techniques relevant to the energy and energy-related environmental disciplines along with an understanding of their processes and limitations.
2. Equip the students with knowledge and understanding of various possible mechanisms about renewable energy projects
3. To produce graduates strong in understanding on energy resources, technologies and systems, energy management fundamentals, and capable in innovative technological intervention towards the present and potential future energy.
4. To identify, formulate and solve energy and energy-related environmental problems by pursuing development of innovative technologies that can generate clean and sustainable energy to address energy scarcity and combat pollution and climate change.

Course Outcomes

1. Apply advanced level knowledge, techniques, skills and modern tools in the field of Energy and Environmental Engineering.
2. Distinguish the different energy generation systems and their environmental impacts.
3. Respond to global policy initiatives and meet the emerging challenges with sustainable technological solutions in the field of energy and environment.

Detailed Content

Module I:

Introduction to Energy Science - Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment, Global Energy Scenario: Role of energy in economic development. Indian Energy Scenario: Introduction to Energy resources & Consumption in India. Common terminologies

Module II

Energy Sources - Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment. Various Methods of using solar energy.

Commercial and noncommercial forms of energy, Fossil fuels, Renewable sources including: Nuclear Energy, Hydel Energy, Storage of Hydrogen, Hydrogen Production, Hydrogen Energy Geothermal, Tide and Wave Energy, Bio-fuels in India.

Module III

Energy Efficiency and Conservation - Introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and Research policy.

Module IV

Energy & Environment - Environment: Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness. Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession. Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards , solid waste Management.

Module V

Environmental Protection and Ethics - Environmental Protection- Role of Government Initiatives by Non-governmental Organizations (NGO) Environmental Education. Ethics and moral values Objectives of ethics, Professional and Non-professional ethics Sustainable Development of the ecology and environment Codes of ethics and their limitations

Suggested reading material:

1. Schaeffer, John. 2007. Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living (30th anniversary edition). Gaia.
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (eds.) 2004. Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press, 619 pages (ISBN: 0-19-926179-2)
3. Energy Management Principles: C.B.Smith (Pergamon Press)
4. Renewable Sources of Energy and Conversion Systems: N.K.Bansal and M.K.Kleeman.
5. Energy Management: W.R.Murphy, G.Mckay (Butterworths)
6. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley
7. Ravindranath, N. H., & Hall, D. O. (1995). Biomass, energy and environment: a developing country perspective from India. Oxford University Press.
8. Popp, D., Newell, R. G., & Jaffe, A. B. (2010). Energy, the environment, and technological change. In Handbook of the Economics of Innovation (Vol. 2, pp. 873-937). North-Holland.

BECT 402 & BECP 402	Signals & System	3L-1T-2P	5 Credits
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Course Objective:

The objectives of this course are

1. To develop good understanding about signals, systems and their classification to provide with necessary tools and techniques.
2. To analyze electrical networks and systems to develop expertise in time-domain and frequency domain approaches to the analysis of continuous and discrete systems.
3. To introduce to the basics of probability, random variables and the various distribution and density functions;
4. To develop students' ability to apply modern simulation software to system.

COURSE OUTCOME(s):

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

1. Analyze the properties of signals & systems
2. Apply Laplace transform, Fourier transform, Z transform and DTFT in signal analysis
3. Analyze continuous time LTI systems using Fourier and Laplace Transforms
4. Analyze discrete time LTI systems using Z transform and DTFT

Module 1: Signals and Systems: Continuous-time and discrete-time Signals, Transformations of the Independent Variable, Exponential and Sinusoidal Signals, Continuous-Time and Discrete-Time LTI Systems and their properties.

Module 2: Time domain representation of LTI System: Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral and convolution sum using graphical method for unit step to unit step, unit step to exponential only. Properties of Convolution. Introduction to basic signals simulation using MATLAB.

Module 3: Fourier series and Fourier Transform: The response of LTI Systems to Complex Exponentials, Fourier Series Representation of Continuous-time Periodic Signals and their Properties, Continuous time and discrete time Fourier Transforms and their properties, System Characterized by Linear Constant Coefficient Differential equations and Difference equation.

Module 4: Sampling and Laplace Transform: Signal representation by samples, sampling theorem, Impulse train sampling, sampling of discrete time signals, discrete time processing of continuous time signals. Laplace Transform, Region of convergence, inverse Laplace Transform, Analysis and characterization of LTI System, Block diagram representation, Unilateral Laplace transform.

Module 5: Z-Transform: Z-Transform, Region of convergence, Inverse Z-transform, analysis and characterization of LTI system, Block diagram representation, Unilateral Z-transform.

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems," Pearson, 2015.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous

- and Discrete," 4th edition, Prentice Hall, 1998.
3. B.P. Lathi, "Signal Processing and Linear Systems," Oxford University Press, 1998.
 4. Douglas K. Lindner, "Introduction to Signals and Systems," McGraw Hill International Edition: 1999.
 5. Simon Haykin, Barry van Veen, "Signals and Systems," John Wiley and Sons (Asia) Private Limited, 1998.
 6. V. Krishnaveni, A. Rajeswari, "Signals and Systems," Wiley India Private Limited, 2012.
 7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems," John Wiley and Sons, 1995.
 8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB," TMH, 2003.
 9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems," TMH New Delhi, 2001.
 10. A. Anand Kumar, "Signals and Systems," PHI 3rd edition, 2018.
 11. D. Ganesh Rao, K.N. Hari Bhat, K. Anitha Sheela, "Signal, Systems, and Stochastic Processes," Cengage publication, 2018.

COURSE OBJECTIVES:

1. The fundamentals of basic communication system, types of noise affecting communication system and noise parameters
2. Need of modulation, modulation processes and different amplitude modulation schemes
3. Different angle modulation schemes with different generation and detection methods.
4. Various radio receivers with their parameters.
5. Need of sampling and different sampling techniques.
6. Generation and detection of pulse modulation techniques and multiplexing.

COURSE OUTCOME(s):

At the end of this course students will demonstrate the ability to:

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
2. Analyze the behavior of a communication system in presence of noise.
3. Investigate pulsed modulation system and analyze their system performance.
4. Investigate various multiplexing techniques.
5. Analyze different digital modulation schemes and compute the bit error performance.

Course Contents:

Module 1: INTRODUCTION: Introduction to Signal and its classification, Overview of Communication system, Communication channels Need for modulation, Baseband and Pass band signals, Frequency division and time division multiplexing

Module 2: Amplitude Modulation: Amplitude Modulation, Double side band with Carrier (DSB-C), Double side band without Carrier, Single Side Band Modulation, DSB-SC, DSB-C, SSB Modulators and Demodulators, Vestigial Side Band (VSB), Quadrature Amplitude Modulator, Suppressed carrier systems, single side band transmission, power analysis of all modulation schemes, comparison of various AM systems, Examples Based on Mat Lab.

Module 3: Angle Modulation: Angle Modulation, Tone Modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulators and Demodulators, PM Signal and its modulation, Stereophonic FM Broadcasting, Examples Based on Mat Lab.

Module 4: Pulse Modulation Digital Transmission of Analog Signals: Sampling Theorem and its applications, Pulse Amplitude Modulation (PAM), Pulse Width Modulation, and Pulse Position Modulation. Their generation and Demodulation, Digital Representation of Analog Signals, Pulse Code Modulation (PCM), PCM System, Issues in digital transmission: Frequency Division Multiplexing, Time Division Multiplexing, Line Coding and their Power Spectral density, T1 Digital System, TDM Hierarchy

Module 5: Review of probability and random process: Gaussian and white noise characteristics, noise in amplitude modulation systems, noise in frequency modulation systems, pre-emphasis and de-emphasis, threshold effect in angle modulation.

Experiments

1. Amplitude modulation and demodulation.
2. Frequency modulation and demodulation.
3. Balanced modulator and Synchronous Detector.
4. Study of Pre-emphasis and de-emphasis.
5. To study SSB System.
6. Spectral analysis of AM and FM signals using spectrum analyzer.
7. To study Phase locked Loop
8. Sampling Theorem – Verification.
9. Pulse Amplitude Modulation and demodulation.
10. Pulse Width & Pulse Position Modulation and demodulation.

Text/Reference Books:

1. Haykin S., "Communications Systems," John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering," Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Principles of Communication Systems," Tata McGraw Hill, 2001.
4. Wozencraft J. M. and Jacobs I. M., "Principles of Communication Engineering," John Wiley, 1965.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., "Digital Communication," Kluwer Academic Publishers, 2004.
6. Proakis J.G., "Digital Communications', 4th Edition, McGraw Hill, 2000.
7. Abhay Gandhi, "Analog and Digital Communication," Cengage publication, 2015.

BEET 404 BEEP 404	CONTROL SYSTEMS	3L-1T-2P	5 Credits
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COURSE OBJECTIVE(s):

1. To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
2. To assess the system performance using time domain analysis and methods for improving it
3. To assess the system performance using frequency domain analysis and techniques for improving the performance
4. To design various controllers and compensators to improve system performance

Course contents:

Module 1. Introduction : Elements of control systems, concept of open loop and closed loop systems, Examples and application of open loop and closed loop systems, brief idea of multivariable control systems. Mathematical Modeling of Physical Systems: Representation of physical system (Electro Mechanical) by differential equations, Determination of transfer function by block diagram reduction techniques and signal flow method, Laplace transformation function, inverse Laplace transformation.

Module 2. Time Response Analysis of First Order and Second Order System: Characteristic Equations, response to step, ramp and parabolic inputs. Transient response analysis, steady state errors and error constants, Transient & steady state analysis of LTI systems

Module 3. Control System Components: Constructional and working concept of ac servomotor, synchronous and stepper motor Stability and Algebraic Criteria: concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations. Root Locus Technique: The root locus concepts, construction of root loci.

Module 4. Frequency Response Analysis: Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, M and N Loci, Nichols chart.

Module 5. The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain. Brief idea of proportional, derivative and integral controllers.

Module 6: State Variable Analysis : Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability.

Course outcomes: After completion of this course the student is able to

1. Improve the system performance by selecting a suitable controller and/or a compensator for a specific application
2. Apply various time domain and frequency domain techniques to assess the system performance

3. Apply various control strategies to different applications (example: Power systems, electrical drives etc...)
4. Test system Controllability and Observability using state space representation and applications of state space representation to various systems.

TEXT BOOKS:

1. "I. J. Nagrath and M. Gopal", "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009.
2. "B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

REFERENCE BOOKS:

1. "N. K. Sinha", "Control Systems", New Age International (P) Limited Publishers, 3rd Edition, 1998.
2. "NISE", "Control Systems Engineering", John wiley, 6th Edition, 2011.
3. "Katsuhiko Ogata", "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

List of Experiments:

1. Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox or its equivalent open source freeware software like SCILab using Spoken Tutorial MOOCs.
2. Determine transpose, inverse values of given matrix.
3. Plot the pole-zero configuration in s-plane for the given transfer function.
4. Determine the transfer function for given closed loop system in block diagram representation.
5. Plot unit step response of given transfer function and find delay time, rise time, peak time and peak overshoot.
6. Determine the time response of the given system subjected to any arbitrary input.
7. Plot root locus of given transfer function, locate closed loop poles for different values of k. Also find out W_d and W_{nat} for a given root.
8. Create the state space model of a linear continuous system.
9. Determine the State Space representation of the given transfer function.
10. Plot bode plot of given transfer function. Also determine the relative stability by measuring gain and phase margins.
11. Determine the steady state errors of a given transfer function.
12. Plot Nyquist plot for given transfer function and to discuss closed loop stability. Also determine the relative stability by measuring gain and phase margin.

BECT 405 & BECP 405	ANALOG CIRCUITS	3L-0T-2P	4 Credits
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Course Objectives:-

1. To prepare students to perform the analysis of any Analog electronics circuit.
2. To empower students to understand the design and working of BJT / FET amplifiers, oscillators and Operational Amplifier.
3. To understand multistage amplifiers and basics of operational amplifier.
4. To prepare the students for advanced courses in Analog / Mixed Signal Circuit Design.

COURSE OUTCOME(s):

1. Design and analyze the basic operations of MOSFET.
2. Know about the multistage amplifier using BJT and FET in various configuration to determine frequency response and concept of voltage gain.
3. Know about different power amplifier circuits, their design and use in electronics and communication circuits.
4. Know the concept of feedback amplifier and their characteristics.
5. Design the different oscillator circuits for various frequencies.

Course Contents

Module 1: IC biasing-Current sources, Current Mirrors and Current steering circuits: The basic MOSFET current source, MOS Current steering circuits, BJT circuits.

The cascade Amplifier: The MOS cascade, frequency response of the MOS cascade, the BJT cascade, a cascade current source, double cascading, the folded cascade, Bi-CMOS cascode.

Module 2: Power Amplifiers: Introduction to power amplifiers (large signal amplifiers), classifications of power amplifiers, class A, B, AB, and C power amplifiers, push-pull and complementary push-pull amplifiers, power output, efficiency, cross-over distortions and harmonic distortions, specifications of power amplifiers, class B and class C- tuned amplifiers

Module 3: The 741 OPAMP Circuit: Bias circuit, short circuit protection, the input stage, the second stage, the output stage, the Device parameters **DC Analysis of 741:** Reference bias current, input stage bias, input bias and offset current, input offset voltage, input common range, second stage bias, output stage bias.

Small Signal Analysis of 741: The input stage, second stage, the output stage Gain, Frequency Response and Slew rate of 741: Small signal gain, frequency response, a simplified model, slew rate, relationship between Ft and SR.

Module 4: Introduction to filtering: Frequency response, characteristics and terminology, Active versus passive filter.

Low Pass filter: first order and second order active filter model, second order low pass filter characteristic, Sallen-Key unity gain filter, Sallen- Key equal component filter, high order filter, High pass filter.

Band Pass Filter: Single op-amp band pass filter, Multistage band pass filter.

Module 5: Generation of square and triangular waveform using OPAMP based astable multivibrator: Operation of astable multivibrator, generation of triangular waveform.

Generation of standardized pulse: The OPAMP based monostable multivibrator

Integrated Circuit Timer: The 555 Circuit, implementing monostable multivibrator using 555 IC, astable multivibrator using 555 IC

List of Experiments:

1. To design Integrator & differentiator using OP-AMP.
2. To design Voltage comparator and zero crossing detector.
3. To design Voltage to current & current to voltage converter.
4. To design Astable & Monostable multivibrator using IC 555.
5. To generate clock pulse with varying duty cycles using IC 555.
6. To generate various functions (sine, triangular, square etc..) by using OP-AMP.
7. To design first order Low Pass, High Pass & Band Pass active Filter.
8. To design second order Low Pass, High Pass & Band Pass active Filter.
9. To design Log & Anti Log Amplifiers.

BECP 406	SIGNAL & SYSTEMS and SIMULATION LAB	4P	2Credit
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COURSE OBJECTIVE(s):

1. To impart the fundamental knowledge on using various analytical tools like MATLAB or SCILAB, PSPICE, ORCAD etc., for Engineering Simulation.
2. To know various fields of engineering where these tools can be effectively used to improve the output of a product.
3. To impart knowledge on how these tools are used in Industries by solving some real time problems using these tools.

COURSE OUTCOME(s):

Upon successful completion of this course student should be able to:

1. The student will be able to appreciate the utility of the tools like MATLAB or SCILAB in solving real time problems and day to day problems.
2. Use of these tools for any engineering and real time applications.
3. Acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment.

Instructions:

- All the experiments are to be simulated using MATLAB or equivalent software
- Minimum 10 no. of experiments are to be completed with a project.

List of Experiments (Signal & Systems)

- 1: Familiarization with MATLAB
- 2: Matrix Operations & Plotting using MATLAB
- 3: Relational Operators, Loops & Functions using MATLAB
- 4: Generation of Signals & Signal Operations
- 5: Synthesis of signals using Fourier Series
- 6: Advanced MATLAB Problems related to signals & systems
- 7: Convolution on Continuous Time Signals
- 8: Study of Laplace Transforms using MATLAB
- 9: Study of Analog Filters Using PSPICE
- 10: DFT & FFT algorithms using MATLAB

List of Experiments (Simulation):

1. Basic Operations on Matrices.
2. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4. Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
5. Convolution for Signals and sequences.

6. Auto Correlation and Cross Correlation for Signals and Sequences.
7. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
8. Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realizability and stability properties.
9. Gibbs Phenomenon Simulation.
10. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.

P.S.: Institutes/colleges are advised to get License version of softwares. For e.g. SCILAB, MATLAB etc.

BCST 408	Cyber Security	Non- Credit Course
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Course Objectives:

1. Understand the basic concept of Cyber Security.
2. Understand the basic concept of Viruses.
3. Understand the basic concept of Digital Attacks.
4. Understand the basic concept of Phishing.
5. Understand the basic concept of Cyber Law.

Course Outcomes:

After the completion of this course the student will able to:

1. Know about various attacks and viruses in cyber systems
2. Know about how to prevent digital attacks
3. Know about how to prevent Phishing Attacks
4. Know about how to do secure transactions

MODULE-1

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

MODULE-2

Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control.

Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.

MODULE-3

Developing Secure Information Systems, Application Development Security, Information Security

Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets,

Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.

MODULE-4

Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the Policies.

Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.

References:

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security ", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. 3.Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla ,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press.
4. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill. 5. CHANDER, HARISH," Cyber Laws And It Protection " , PHI Learning Private Limited ,Delhi ,India