BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2021–22

Choice Based Credit System (CBCS)

UG PROGRAM: ELECTRONICS & TELECOMMUNICATION ENGINEERING (ETE) — **Semester: IV**

Sl. No	Course Category	Course Code	Course Title	Teaching Dept.	Teaching Hours /Week			Credits	Examination			
					L	T	P		Duration in Hours	CIE Marks	SEE Marks	Total Marks
1	BS	21MTA41	Numerical Methods, Complex Variable and Sampling Theory	MAT	3	1	1	4	3	50	50	100
2	HS	21CIP42	Constitution of India and Professional Ethics	HS	1	0	0	1	2	50	50	100
3	UHV	21UHV43	Universal Human Values-II	HS	1	0	0	1	2	50	50	100
4	HS	21HSS44	Environmental Studies	HS	2	0	0	2	3	50	50	100
5	PC	21EC45	Principles of Communication Systems	ETE	2	2	0	3	3	50	50	100
6	PC	21EC46	Verilog HDL	ETE	3	0	0	3	3	50	50	100
7	PC	21EC47	Control Systems	ETE	3	0	0	3	3	50	50	100
8	PC	21ECL48A	Communication System Laboratory	ETE	0	0	2	1	3	50	50	100
9	PC	21ECL48B	HDL Laboratory	ETE	0	0	2	1	3	50	50	100
10	PC	21ECL48C	Circuits and Control Systems Laboratory	ETE	0	0	2	1	3	50	50	100
TOTAL					**15**	**3**	**7**	**20**		**500**	**500**	**1000**

Course prescribed to Lateral entry Diploma holders admitted to IV Semester B.E.

2	NCMC	21DIP41A	Additional Mathematics-II	MAT	3	0	0	0	3	100	--	100

- For Lateral entry students Assessment of Internship-I to be conducted during IV semester.
- The Assessment Pattern for 1/2/3 credit courses shall be done as per the VTU guidelines.
- BS-MTX (X-Variable) Eg: Core branches: ME, CV, EEE, ETE, ECE-**MTA**, Digital branches: CSE, ISE, AIML- **MTB**.
- Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
- Successful completion of the course Additional Mathematics-II shall be indicated as satisfactory in the grade card. Non completion of the same shall be indicated as unsatisfactory.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Numerical Methods, Complex Variable and Sampling Theory (3:1:1) 4

(Common to ECE, ETE, EEE, MECH & CIVIL Branches)

(Effective from the academic year 2021-22)

Course Code	21MTA41	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:1:1	SEE Marks	50
Total Number of Contact Hours	50	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Apply the concept of Numerical Techniques, probability distribution and stochastic processes to analyze problems arising in Science and Engineering field.
2. Analyze engineering problems by applying the concept of Complex Analysis, Curve fitting and Statistical Methods.
3. Apply the important analytical tools for solving partial differential equations arising in engineering applications.

Module – I

Introduction: Understanding the importance of the study of Complex Analysis, Transformations, Numerical techniques, Statistics, Probability and Sampling Distributions and their applications in the field of Science, Engineering, Business & Research.

Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula Falsi method and Newton Raphson method.

Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, Modified Euler's method, 4^{th} order Runge -Kutta method, Milne's predictor and corrector methods.

Self-Learning Component: Picard's method

Lab Session 1:

1. Solution of differential equation using Euler Method, 4^{th} order Runge- Kutta method.
2. Determination of roots of a polynomial by Newton Raphson method, Regula Falsi method. (10 Hours)

Module – II

Complex Variables: Analytic functions - Cauchy-Riemann equations in Cartesian and Polar forms, Construction of analytic functions by Milne's method. Complex line integrals - Cauchy's theorem and Cauchy's integral formula.

Transformation: Conformal transformation, discussion of transformations: $w = z^2, w = e^z$, $w = z + \frac{1}{z}$ $(z \neq 0)$. Bilinear transformation-problems.

Self-Learning Component: Residue, poles, Cauchy's Residue theorem (without proof) and problems.

Lab Session 2:

1. Conformal mapping using Matlab for $= e^z, W = z^2$, $W = z + \frac{1}{z}$ $(z \neq 0)$, complex valued functions.
2. Compute residues and poles for complex functions. (10 Hours)

Module – III

Partial Differential Equations: Formation of PDEs by elimination of arbitrary constants / functions, Solution of non-homogeneous PDE by direct integration, Homogeneous PDEs involving derivative with respect to one independent variable only, Solution of Lagrange's linear PDE. Solution of One-dimensional heat and wave equations by method of separation of variables.

Self-Learning Component: Derivation of One-dimensional heat and wave equations by method of separation of variables.

Lab Session 3:

1. Formation of PDE by eliminating arbitrary constant and function.
2. Solution of Heat equation. (10 Hours)

Module – IV

Vector Integration: Line integrals – problems, Surface and Volume integrals - definition, Green's theorem in a plane, Stoke's theorem and Gauss Divergence theorem (without proof) - problems.

Self-Learning Component: Proof of Green's theorem in a plane.

Lab Session 4:

1. Evaluation of line integral.
2. Evaluate Green's Theorem in a plane. (10 Hours)

Module – V

Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution & Chi-square distribution as a test of goodness of fit.

Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, problems.

Self-Learning Component: Test of hypothesis for difference of means and difference of Proportions.

Lab Session 5:

1. Testing of hypothesis using Chi-square distribution.
2. Testing of hypothesis using t – distribution.

Recap/Summary of the Course. (10 Hours)

Course Outcomes:

The students will be able to:

CO1: Solve order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.

CO2: Explain the concepts of analytic functions, describe conformal and Bilinear transformation arising in field theory and signal processing.

CO3: Analyze a variety of partial differential equations and solution by exact methods/method of separation of variables.

CO4: Apply Green's Theorem, Divergence Theorem and Stoke's theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems.

CO5: Demonstrate testing of hypothesis of sampling distributions and illustrate examples of Markov chains related to discrete parameter stochastic process.

Question paper pattern:

SEE will be conducted for 100 marks.

- The question paper will be set for 100 marks (duration of 03 hours) and marks scored will be proportionally scaled down to 50 marks.
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

CIE will be announced prior to the commencement of the course.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) for **20 Marks** (duration 01 hour).

The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Textbooks:

1. B.S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. E. Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2015.
3. B.V. Ramana, "Higher Engineering Mathematics", 6th Edition, Tata McGraw-Hill, 2010.

References:

1. N.P. Bali, Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publishers, 2014.
2. H.K. Dass, Er. RajnishVerma, "Higher Engineering Mathematics", 3rd Edition, S. Chand publishers, 2014.
3. P. Kandasamy, K. Thilagavathi, K. Gunavathi, "Engineering Mathematics", Vol. III, 2001.
4. S.S. Sastry, "Introductory Methods of Numerical Analysis", 4th Edition, Prentice Hall of India, 2010.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Constitution of India and Professional Ethics (1:0:0) 1

(Common to all Branches)

(Effective from the academic year 2021-22)

Course Code	21CIP42	CIE Marks	50
Teaching Hours/Week (L:T:P)	1-0-0	SEE Marks	50
Total Number of Lecture Hours	13	Exam Hours	01

Course objectives:

This course will enable students to

1. Familiarise with the Indian Constitution and have legal knowledge enabling them to take competitive exams and understand complex political issues.
2. Understand engineering ethics and responsibility and raise awareness and consciousness of the issues related to the profession, liability, risk and safety at work place.

Module – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation.

Introduction and Basic information about the Indian Constitution:

Introduction, Definition and significance of the Indian Constitution, Historical Background of the Indian Constitution. Framing of the Indian constitution: Role of the Constituent Assembly, Preamble and Salient features of the Constitution of India. **2 Hours**

Module – 2

Fundamental Rights, Directive Principles of State Policy and Fundamental Duties:

Fundamental Rights and its limitations, Directive Principles of State Policy: Importance and its relevance. Fundamental Duties and their significance. Case Studies **3 Hours**

Module – 3

Union Administration:

The Union Executive-The President and The Vice President, The Prime Minister and The Council of Ministers, The Union Legislature -Lok Sabha & Rajya Sabha, The Union Judiciary- The Supreme Court of India and its jurisdiction. **3 Hours**

Module – 4

State Administration, Elections, Constitutional Amendments, Emergency Provisions and Special Constitutional Provisions:

The State Executive-The Governors, The Chief Ministers and The Council of Ministers, The State Legislature- Legislative Assembly and Legislative Council, The State Judiciary- The State High Courts and its jurisdiction.

Elections-Electoral Process in India, Election Commission of India: Powers & Functions, Constitutional Amendments- methods and Important Constitutional Amendments ie 42nd, 44th, 61st,74th, 76th, 77th, 86th ,91st, 100, 101st, 118th , Emergency Provisions-types and its effect, Special Constitutional Provisions for Schedule Castes, Schedule Tribes & Other Backward Classes Women & Children. **3 Hours**

Module – 5

Professional Ethics:

Definition of Ethics, Scope and Aim of Professional and Engineering Ethics, Code of ethics as defined in the Institution of Engineers (India), Responsibilities of Engineers and impediments to responsibilities, Honesty, Integrity and Reliability of Engineers, Risk, Safety and Liability in Engineering, Case Studies. **2 Hours**

Course outcomes: The students will be able to:

CO1. Understand and have constitutional knowledge and legal literacy

CO2. Understand Engineering and Professional ethics and responsibilities of Engineers.

Question paper pattern:

SEE will be conducted for 50 marks.

- The question paper will have 50 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks.
- The duration of the examination is 01 Hour.

CIE will be announced prior to the commencement of the course.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) for **20 Marks** (duration 01 hour).

The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Textbooks

1. Durga Das Basu, Introduction to the Constitution of India, Lexis Nexis, 20th Edn, 2011.

2. Shubham Singles, Charles E. Haries and Et al, Constitution of India and Professional Ethics, Cengage Learning India Private Limited, Latest Edition, 2018.

References

1. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Engineering Ethics, Prentice –Hall of India Pvt. Ltd. New Delhi, 2004.

2. M.V.Pylee, An Introduction to Constitution of India, Vikas Publishing,2002.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Universal Human Values- II (1:0:0) 1

(Effective from the academic year 2021-22)

Course Code	21UHV43	CIE Marks	50
Teaching Hours/Week (L: T:P)	1-0-0	SEE Marks	50
Total Number of Lecture Hours	13	Exam Hours	01

Course objectives:

This introductory course is intended to

1. Develop a holistic perspective based on self-exploration about family, society and nature/existence.
2. Understand harmony in the family, society and nature/existence
3. Strengthening of self-reflection.
4. Develop commitment and courage to act.

Module – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation.

Harmony in the Family: Understanding values in human relationships; Family as basic unit; Harmony in family, Recognizing feelings in relationships-trust, respect, affection, care, guidance, reverence, glory, gratitude and love.

Case study and Group Discussion **3 Hours**

Module – 2

Harmony in Society: Extending relationship from family to society; Comprehensive human goal, Fivedimensions of human endeavor; Harmony from family order to World family order**.**

Case study and Group Discussion **2 Hours**

Module – 3

Harmony in the Nature: Understanding the harmony in the Nature; Interconnectedness, self-regulation andmutual fulfillment; four orders of nature; Recyclability, Natural characteristics.

Case study and Group Discussion **3 Hours**

Module – 4

Harmony in Existence: Understanding existence as co-existence; Space; Co-existence of units in space,various attributes of units and space, Role of a human being in existence.

Case study and Group Discussion **2 Hours**

Module – 5

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics, Holistic Technologies.

Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Case study and Group Discussion **3 Hours**

Course outcomes: The students will be able to:

1. Understand the role of a human being in ensuring harmony in family, society and nature, significanceof value inputs in a classroom and start applying them in their life and profession

2. Distinguish between values and skills, ethical and unethical practices, happiness and accumulation of physical facilities, Intention and Competence of an individual etc and start working out the strategy toactualize a harmonious environment wherever they work

Question paper pattern:

SEE will be conducted for 50 marks.

- The question paper will have 50 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks.
- The duration of the examination is 01 Hour.

CIE will be announced prior to the commencement of the course.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) for **20 Marks** (duration 01 hour).
- The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Textbooks

1. The Textbook *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-47-1

2. The Teacher's Manual for *A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, NewDelhi, 2019. ISBN 978-93-87034-53-2

References

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher, 1973, Blond & Briggs, UK
4. Vivekananda - Romain Rolland (English)

Relevant websites, documentaries

1. Value Education websites, http://uhv.ac.in,
2. Story of Stuff, *http://www.storyofstuff.com*

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – IV

Environmental Studies (2:0:0) 2
(Common to all Branches)
(Effective from the academic year 2021-22)

Course Code	21HSS44	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	02

Course Objectives:

This course will enable students to:

1. Recognize the ecological basis for regional and global Environmental issues, and lead by example as an environmental steward.
2. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
3. Analyze the trans-national character of environmental problems and ways of addressing them, including interactions across local to global scales.
4. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as environmentalists.

Module – 1

Introduction: Relevance of the Subject to Historical and real-time Global, Economic and Societal Scenario. Internship and Job Opportunities in the current scenario.

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats to Biodiversity.

(5 Hours)

***Field work:** Visit to a local area to document environmental assets: river / forest / grassland / hill

Module – 2

Environmental Pollution & Abatement (with Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

(5 Hours)

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, so as to observe and document environmental pollution and recommend remedial measures.

Module – 3

Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

(5 Hours)

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, so as to observe and document environmental impacts and recommend remedial measures.

Module – 4

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Fluoride problem in drinking water; Cloud Seeding, and Carbon Trading.

(5 Hours)

***Field work:** Visit to a Green Building, followed by understanding of process and its brief documentation.

Module – 5

Latest Developments in Environmental Pollution Mitigation (Concept and Applications): G.I.S. and Remote Sensing, Environment Impact Assessment (E.I.A.), Environmental Management Systems (E.M.S.), ISO14001.

Case Studies: Environmental Stewardship, Environmental NGOs.

***Field work:** Visit to an Environmental Engineering Laboratory / Water Treatment Plant/Wastewater treatment Plant, followed by understanding of process and its brief documentation

Summary of the Course

(6 Hours)

(*Note: Any 1 among the 5 Field works is mandatory from the Exercises discussed in across the 5 modules, and Students have to submit a report)

Course outcomes:

The students will be able to:

CO1:	Appraise the significance of ecological systems under the ambit of environment.
CO2:	Analyze for the consequences owing from anthropogenic interactions on the environmental processes.
CO3:	Recommend solutions in the Anthropocene Epoch, with an in-depth understanding of the interdisciplinary facets of environmental issues.
CO4:	Elucidate the trans-national character of environmental problems and ways of addressing them.
CO5:	Appraise latest developments, concerns and ethical challenges associated with Environmental Protection.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools
- Case Studies: Real-life Article Inferential Discussion
- Site-visit and Reporting

Question paper pattern:

- SEE will be conducted for 50 marks, and will comprise of 50 MCQs. The duration of exam is 2 hours.
- CIE will be conducted for 40 marks. It will be for 1-hour duration; it shall consist of 40 MCQs, each carrying 1 mark.
- CIE will be announced prior to the commencement of the course.
- Two assignments ought to be submitted each of 10 Marks
- One alternate assessment tools (AATs) from the list shall be planned to attain the COs and POs for 20 Marks (duration 01 hours)
- The average of three tests, two assignments, and AATs will be out of 100 marks and will

be scaled down to 50 marks.

Text Books

1. Rajesh Gopinath and N. Balasubramanya, "Environmental science and Engineering", 1st Edition, City of Publisher, Cengage Learning India Private Limited, 2018.
2. J. S. Singh, S. P. Singh and S. R. Gupta, "Ecology, Environmental Science and Conservation", India, S. Chand Publishing, 2017.

References:

1. M. Gadgil and R. Guha, "This Fissured Land: An Ecological History of India", Univ. of California Press, 1993.
2. E. P. Odum and H. T. Odum, "Fundamentals of Ecology", Philadelphia: Saunders Publisher, 1971.
3. M. L. Mckinney, "Environmental Science systems & Solutions", Web enhanced Edition, City of Publisher, R. M. Publisher, 1996.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Principles of Communication Systems (2:1:0) 3

(Effective from the academic year 2021-22)

Course Code	21EC45	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

1. Understand concepts of analog modulation and demodulation schemes.
2. Explain the concept of digitization of signals viz; sampling, quantizing and encoding.
3. Develop the concept of SNR in the presence of channel induced noise
4. Evolve the concept of quantization noise for sampled and encoded signals and study the concepts of reconstruction from these samples at a receiver.

Module – 1

Introduction: Evolution of analog communication, Significance and Scope of the course in economic growth of Nation, Impact of the course on Societal Problems, Career Perspective, Innovations, Research status/trends.

Amplitude Modulation: Introduction, Amplitude Modulation, Time & Frequency – Domain description, switching modulator, Envelope detector.

Double Side - Band Suppressed Carrier Modulation: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

Single Side–Band and Vestigial Sideband Methods of Modulation: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Applications.

(9 Hours)

Module – 2

Angle Modulation: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super heterodyne Receiver.

(8 Hours)

Module – 3

Noise: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth, Noise Figure

Noise In Analog Modulation: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect.

Noise in FM receivers: Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.

(7 Hours)

Module – 4

Sampling And Quantization: Introduction, Why Digitize Analog Sources? The Low Pass Sampling process, Pulse Amplitude Modulation. Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves.

(7 Hours)

Module – 5

Pulse–Code Modulation (PCM): Sampling, Quantization, Encoding, Regeneration, Decoding, DPCM, ADPCM, Delta modulation, ADM (refer Chapter 7 of Text), Time Division Multiplexing. Applications: (a) Video + MPEG (7.11 in Text) and (b) Vocoders.

Summary of the Course: Course covers the fundaments of analog Communication, different types of modulation techniques starting from AM, FM to PCM. The concepts on different types of noises in analog communication, Noises in FM receiver, Process of sampling and Quantization are dealt in detail.

(9 Hours

Course outcomes: The students will be able to:

CO1: **Apply** the knowledge of electronic circuits for the generation and detection of modulation /demodulation schemes.

CO2: **Analyse** the performance of modulation/demodulation schemes in the presence of noise.

CO3: Interpret the given case study material related to the application of modulation/ demodulation schemes.

CO4: Perform in a **group** to demonstrate modulation/demodulation schemes using **modern tools**.

Question paper pattern:

SEE will be conducted for 100 marks.

- The question paper will be set for 100 marks (duration of 03 hours) and marks scored will be proportionally scaled down to 50 marks.
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

CIE will be announced prior to the commencement of the course.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) for **20 Marks** (duration 01 hour).

The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks

Textbooks

1. Simon Haykins, 'Communication Systems", 5th Edition, John Willey, India Pvt. Ltd, John Willey, India Pvt. Ltd,
2. Simon Haykins, "An Introduction to Analog and Digital Communication", John Wiley India Pvt. Ltd., 2008

References

1. B. P. Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press H.Taub & D.L.Schilling," Principles of Communication Systems" TMH, 2011.
2. Harold P.E, Stern Samy and A.Mahmond,,"Communication Systems", Pearson Edition, 2004.
3. R.P.Singh and S. Sapre, "Communication Systems" 2nd Edition, Analog and Digital", TMH,2007

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER – IV

Verilog HDL (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21EC46	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Curse objectives:

This course will enable students to:

1. Understand the structure of HDL programming.
2. Apply dataflow, gate level and behavioural level of abstraction on digital systems
3. Design various digital subsystems in VERILOG

Module – 1

Introduction: Introduction to HDL, Significance and scope of Verilog in current scenario, industry applications, research and innovations related to Verilog, impact on course on societal problems.

Overview of Digital Design with Verilog HDL: Emergence of HDLs, typical design flow, Trends in HDL.

Hierarchical Modeling Concepts: Design methodologies, 4- bit ripple carry counter, modules and module instances, parts of a simulation, design block, stimulus block**.**

Basic Concepts: Lexical conventions, data types, system tasks and compiler directives.

8 Hours

Module – 2

Dataflow Modeling: Continuous assignments, delay specification, expressions, operators, operands, operator types.

Behavioral Modeling: Process Model, If-Then-Else, loops, multiway branching, Functions and Tasks.

8 Hours

Module – 3

Concurrent Processes: Concurrent Processes, Events, The Wait Statement, A Concurrent Process Example, A Simple Pipelined Processor, Intra-Assignment Control and Timing Events, Procedural Continuous Assignment, Sequential and Parallel Blocks.

8 Hours

Module – 4

Logic Synthesis with Verilog HDL: Logic synthesis, Verilog HDL Synthesis, Interpretation of Verilog Constructs, Synthesis Design flow, examples, verification of the gate level netlist, modelling tips for logic synthesis.

8 Hours

Module – 5

SOC verification: Verification Technology Options, Verification Methodology, Testbench Creation, Testbench Migration, Verification Languages, Verification IP Reuse, Verification Approaches, Verification and Device Test.

Summary of the Course: Course covers the importance and benefits of Verilog HDL programming, structure of Verilog module, analysing digital circuits using dataflow, gate level and behavioural levels of abstractions and designing real world circuits using Verilog.

8 Hours

Summary of the Course:

This course introduces students to the design flow of System-on-Chip for high performance embedded systems. The choice of Processors, Memories, Bus Protocol and trade of in performance at each iteration will provide insights into Area, Speed and Power trade off in design. Applications of System-on-Chip in area of communication and computer vision will enhance student's skills for roles in Industry and Research.

Course outcomes: The students will be able to:

CO1: **Apply** the knowledge of design methodologies to various digital circuits

CO2: **Analyse** the various levels of abstractions on digital sub systems using HDL

CO3: **Interpret** the given case study material related to design and demonstrate an of Digital sub system.

CO4: **Write program code** for circuit level modelling using Verilog HDL and perform in a group to make an effective presentation

Question paper pattern:

SEE will be conducted for 100 marks.

- The question paper will be set for 100 marks (duration of 03 hours) and marks scored will be proportionally scaled down to 50 marks.
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

CIE will be announced prior to the commencement of the course.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) for **20 Marks** (duration 01 hour).

The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks

Textbook*s:*

1. Sameer Palnitkar, "Verilog HDL-a guide to digital design and synthesis", 2nd Edition, Pearson, 2003.
2. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", 5th Edition, Springer Science + Business Media.
3. Prakash Rashinkar, Peter Paterson, Leena Singh, "System-on-a-Chip Verification Methodology and Techniques", Cadence Design Systems Inc., USA, Kluwer Academic Publishers, 2001

References:

1. Stephan Brown and Zvonk Vranesic, "Fundamentals of digital logic with Verilog design", 2nd Edition, MC Grawhill, 2008.
2. Peter J Ashenden, "Digital Design and Embedded System Approach using Verilog", 2nd Edition, Elsevier, 2008.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Control Systems (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21EC47	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course Objectives: This course will enable students to:

1. Understand the basics of control systems, mathematical modelling and to determine the transfer function for a given control system.
2. Determine the time domain specifications for first and second order systems.
3. Study the stability of a system in the time domain using various techniques.
4. Gain knowledge about a control system in continuous and discrete time using state variable techniques.

Module – 1

Introduction to control systems, Significance and scope of the course, Control Systems in Economic growth of nation, Sustainable solutions to societal problems, Innovation and research trends in control Systems,

Open loop and closed loop control systems: Examples, Feedback control systems and its effects. Differential equation of Physical Systems – Mechanical Systems, Electrical Systems and Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.

9 Hours

Module – 2

Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants.

Self Study: Laplace transforms

7 Hours

Module – 3

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion, Introduction to Root-Locus Techniques, the root locus concepts, Construction of root loci.

7 Hours

Module – 4

Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Introduction to Polar Plots and Nyquist Stability criterion.

8 Hours

Module – 5

Digital Control System: Introduction, Design of PD, PI and PID Controller, Design of PhaseLead, Phase – Lag and Lead-Lag Controller. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems.

Recap: Stability Analysis of Control Systems by employing various techniques.

9 Hours

Course outcomes: The students will be able to:

CO1: Understand the modelling of a system to describe transfer function using

conventional approach.

CO2: Apply different techniques to assess the stability of a control system.

CO3: Analyze the transfer function and behaviour of a control system.

CO4: Perform in a group to design a control system using MATLAB for given specification

Question paper pattern:

SEE will be conducted for 100 marks.

- The question paper will be set for 100 marks (duration of 03 hours) and marks scored will be proportionally scaled down to 50 marks.
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

CIE will be announced prior to the commencement of the course.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) for **20 Marks** (duration 01 hour).
- The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks

Textbooks

1. I.J. Nagrath & M.Gopal "Control Systems Engineering" New Age International Publishers, 5th edition, 2007.
2. K. Ogata "Discrete Time Control Systems" PHI, 2nd edition, 2009.

References

1. K. Ogata "Modern Control Engineering" PHI, 5th edition, 2010.
2. M. Gopal "Digital Control and State Variable methods" Tata McGraw Hill, 4th edition, 2012.
3. A. Nagoorkani "Advanced Control Theory" RBA publications, 2nd edition, 2006.

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Communication System Laboratory (0:0:1) 1

(Effective from the academic year 2021-22)

Course Code	21ECL48A	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	30	Exam Hours	03

Course objectives:

This course will enable students to:

- Familiarize with various modulation and demodulation techniques.
- Acquire the knowledge of communication systems.
- Use MAT Lab / Lab view software for simulation of modulation and demodulation techniques.

Part A

This lab highlights the importance of designing experiments and practically recording and verifying the results, as per specifications

Conduct the experiments for the following:

1. Design of active second order LPF and HPF filters
2. Generation and Detection of AM Wave
3. Generation and Detection of FM Wave
4. Generation and Detection of PAM, PWM, PPM
5. Generate DSBSC using IC-1496
6. Design and Conduct IF/RF Mixer circuit
7. Generation of Line codes
8. Pre-Emphasis & De-Emphasis Circuits
9. Design of 4 bit DAC(R-2R ladder)

Part B using software tool (MATLab, Lab view, Octave)

1. Simulation of PCM
2. Simulation of Delta and Adaptive delta modulation
3. Simulation of Frequency Division Multiplexing/Demultiplexing.
4. Simulation of Time Division Multiplexing/Demultiplexing.

Open Ended Experiments (few samples)

1. Design and Evaluation of VCO
2. Performance evaluation of various modulation techniques

Course outcomes: The Student will be able to

CO1**:** **Demonstrate** the working of various modulation and demodulation techniques

CO2**:** **Write** a report on Conducted experiments

CO3**:** **Evaluate** the performance of open-ended experiments on the specified designs using modern tools.

Semester End Exam pattern:

- The SEE will be conducted for 100 marks and reduced to 50 Marks
- Write up carries 15% of the maximum marks
- Conduction of the experiment with tabulation and graphs carries 70% of the maximum marks.
- Viva-voce carries 15% of the maximum marks

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

HDL Laboratory (0:0:1) 1

(Effective from the academic year 2021-22)

Course Code	21ECL48B	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	30	Exam Hours	03

Course Objectives:

This course will enable students to:

- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD board and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/Modelsim or equivalent.

Laboratory Experiments

PART A : Programming

1. Write Verilog program for the following combinational design along with test bench to verify the design:
   a. 2 to 4 decoder realization using NAND gates only (structural model)
   b. 8 to 3 encoder with priority and without priority (behavioral model)
   c. 8 to 1 multiplexer using case statement and if statements
   d. 4-bit binary to gray converter using 1-bit gray to binary converter 1-bit adder and subtractor
2. Model in Verilog for a full adder and add functionality to perform logical operations of XOR, XNOR, AND and OR gates. Write test bench with appropriate input patterns to verify the modeled behavior.
3. Verilog 32-bit ALU shown in figure below and verify the functionality of ALU by selecting appropriate test patterns. The functionality of the ALU is presented in Table 1.
   a. Write test bench to verify the functionality of the ALU considering all possible input patterns
   b. The enable signal will set the output to required functions if enabled, if disabled all the outputs are set to tri-state
   c. The acknowledge signal is set high after every operation is completed

Opcode (2:0)	ALU Operation	Remarks	
000	A+B	Addition of two numbers	Both A and B are in two's complement format
001	A-B	Subtraction of two numbers	
010	A+1	Increment Accumulator by 1	A is in two's complement format
011	A-1	Decrement accumulator by 1	
100	A	True	Inputs can be in any format
101	A Complement	Complement	
110	A OR B	Logic OR	
111	A AND B	Logic AND	

4. Write Verilog code for SR, D and JK and verify the flip flop.
5. Write Verilog code for 4-bit BCD synchronous counter.
6. Write Verilog code for counter with given input clock and check whether it works as clock divider performing division of clock by 2, 4, 8 and 16. Verify the functionality of the code.

PART-B : Interfacing and Debugging

1. Write a Verilog code to design a clock divider circuit that generates 1/2, 1/3rd and 1/4thclock from a given input clock. Port the design to FPGA and validate the functionality through oscilloscope.
2. Interface a DC motor to FPGA and write Verilog code to change its speed and direction.
3. Interface a Stepper motor to FPGA and write Verilog code to control the Stepper motor rotation which in turn may control a Robotic Arm. External switches to be used for different controls like rotate the Stepper motor (i) +N steps if Switch no.1 of a Dip switch is closed (ii) +N/2 steps if Switch no. 2 of a Dip switch is closed (iii) –N steps if Switch no. 3 of a Dip switch is closed etc.
4. Interface a DAC to FPGA and write Verilog code to generate Sine wave of frequency F KHz (eg. 200 KHz) frequency. Modify the code to down sample the frequency to F/2 KHz. Display the Original and Down sampled signals by connecting them to an oscilloscope.
5. Write Verilog code using FSM to simulate elevator operation.

Open end experiment:

1. Students should execute real time digital circuit using Verilog and submit a report for the same

Course Outcomes: At the end of this course,

Students should be able to:

CO1: Execute Verilog programs to realize various combinational and sequential circuits using FPGA.

CO2: Write the report for the conducted experiments.

CO3: Perform open ended experiments related to applications of digital electronics.

Semester End Exam pattern:

- The SEE will be conducted for 100 marks and reduced to 50 Marks
- Write up carries 15% of the maximum marks
- Conduction of the experiment with tabulation and graphs carries 70% of the maximum marks.
- Viva-voce carries 15% of the maximum marks

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Circuits and Control Systems Laboratory (0:0:1) 1

(Effective from the academic year 2021-22)

Course Code	21ECL48C	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	30	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Verify Superposition, thevinin and Maximum power transfer theorem using Network theory concepts.
2. Design and analyze Lead, Lag and Lag – Lead compensators for given specifications.
3. Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.
4. Design and plot root locus, bode plot, Nyquist plots to study the stability of the system using a software package

Laboratory Experiments

Following Experiments to be done using MATLAB

1. Verification of Superposition theorem
2. Verification of Thevenin's theorem
3. Verification of Maximum Power transfer theorem.
4. Determine the overall transfer function of a control system
5. Determine rise time, peak time, peak overshoot and settling time for the given transfer function.
6. Determination of frequency response of a second order System
7. To obtain and plot the Unit step, Unit ramp response of a closed loop control system.
8. To obtain Nyquist diagram for given transfer function.
9. Determine the root locus of the given characteristic equation for the given control system.
10. Determine gain margin, phase margin, gain crossover frequency and phase crossover frequency for Bode plot of the given transfer function.

Open end experiment:

1. Determination of frequency response of a lead, lag and Lead-lag compensators
2. Obtain the time response from state model of a system. Implementation of PI, PD and PID Controllers.

Course outcomes:

The students will be able to:

CO1: Demonstrate the principle of network theorems and characteristics, parameters of a given control system

CO2: Submit a report on the conducted experiments

CO3: Conduct Open-ended experiments for a given specification and submit a report.

Semester End Exam pattern:

- The SEE will be conducted for 100 marks and reduced to 50 Marks
- Write up carries 15% of the maximum marks
- Conduction of the experiment with tabulation and graphs carries 70% of the maximum marks.
- Viva-voce carries 15% of the maximum marks

B.E ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – IV

Diploma Mathematics- II (0:0:0) NIL

COMMON TO ALL BRANCHES

(Effective from the academic year 2021-22)

Course Code	21DIP41A	CIE Marks	100
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	-
Total Number of Contact Hours	3	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Provide an insight into linear & higher order ODE's and elementary probability theory.
2. Familiarize the important tools of Laplace transformations required to analyse the engineering problems.

Module – I

Introduction: Understanding the importance of Vector Differentiation, Differential equations, Laplace Transforms and Probability in the field of Science, Engineering, Business and Research.

Differential equations–I: Introduction-solutions of first order and first-degree differential equations: exact, Equations reducible to exact, linear differential equations and Bernoulli's equation. (6 hours)

Module – II

Differential equations–II: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous/non-homogeneous equations. Inverse differential operators. [Particular Integral restricted to $R(x)= e^{ax}$, sin ax, cos ax, polynomial for $f(D)y = R(x)$]. (6 hours)

Module – III

Probability: Introduction to Probability, Sample space and events. Axioms of probability. Addition & multiplication theorems. Conditional probability, Bayes' theorem, problems.

(6 hours)

Module – IV

Laplace Transforms: Definition and Laplace transforms of elementary functions, Laplace Transforms of e^{at} f(t), t^nf(t), n is a positive integer & (f(t))/t (without proof), Periodic function (statement only) and Unit-step function – problems. (6 hours)

Module – V

Inverse Laplace Transforms: Inverse Laplace Transform- Definition and problems, Convolution theorem (No Proof), Evaluation of Inverse Laplace Transform using Convolution theorem. Solution of linear differential equations using Laplace transforms technique.

Recap/Summary of the course. (6 hours)

Course outcomes: The students will be able to:

CO1: Solve first and higher order ordinary differential equations.

CO2: Use Laplace transform and inverse Laplace transform in solving differential equation.

CO3: Apply elementary probability theory for related problems.

Question paper pattern:

CIE will be announced prior to the commencement of the course.

- 75 marks for test. Average of three tests will be taken.
- 25 marks for Alternate Assessment Method.

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2015.
2. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2015.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2010.

References:

1. N. P. Bali, Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publishers, 2014.
2. C. Pandurangappa, Advanced Mathematics II (Lateral entry bridge course text book)", 3rd Edition. Sanguine Publishers, 2015.
3. S. Pal, S. C. Bhunia, Engineering Mathematics, 3rd Edition, Oxford University Press, 2011.
4. H. K. Dass, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Private Ltd, 2014.