



VIT[®]

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING

B. Tech Electronics and Communication Engineering

Curriculum and Syllabus

(2022-23 admitted students)

VISION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

Transforming life through excellence in education and research.

MISSION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

World class Education: Excellence in education, grounded in ethics and critical thinking, for improvement of life.

Cutting edge Research: An innovation ecosystem to extend knowledge and solve critical problems.

Impactful People: Happy, accountable, caring and effective workforce and students.

Rewarding Co-creations: Active collaboration with national & international industries & universities for productivity and economic development.

Service to Society: Service to the region and world through knowledge and compassion.

VISION STATEMENT OF THE SCHOOL OF ELECTRONICS ENGINEERING

To be a leader by imparting in-depth knowledge in Electronics Engineering, nurturing engineers, technologists and researchers of highest competence, who would engage in sustainable development to cater the global needs of industry and society

MISSION STATEMENT OF THE SCHOOL OF ELECTRONICS ENGINEERING

- Create and maintain an environment to excel in teaching, learning and applied research in the fields of electronics, communication engineering and allied disciplines which pioneer for sustainable growth.
- Equip our students with necessary knowledge and skills which enable them to be lifelong learners to solve practical problems and to improve the quality of human life.

B. Tech Electronics and Communication Engineering

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO_01. Graduates will be engineering practitioners and leaders, who would help solve industry's technological problems

PEO_02. Graduates will be engineering professionals, innovators or entrepreneurs engaged in technology development, technology deployment, or engineering system implementation in industry

PEO_03. Graduates will function in their profession with social awareness and responsibility

PEO_04. Graduates will interact with their peers in other disciplines in industry and society and contribute to the economic growth of the country

PEO_05. Graduates will be successful in pursuing higher studies in engineering or management

PEO_06. Graduates will pursue career paths in teaching or research

B. Tech Electronics and Communication Engineering

PROGRAMME OUTCOMES (POs)

PO_01. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO_02. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO_03. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO_04. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO_05. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO_06. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO_07. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO_08. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO_09. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO_10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO_11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO_12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B. Tech Electronics and Communication Engineering

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On the completion of B.Tech Electronics and Communication Engineering degree, Students will be able to

On completion of B. Tech. (Electronics and Communication Engineering) Programme, graduates will be able to

PSO_01. Design and analyse the different electronic circuits and systems.

PSO_02. Design and develop the communication systems for various applications

PSO_03. Use modern tools and techniques to solve contemporary problems in the field of Electronics and Communication Engineering

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B. Tech Electronics and Communication Engineering

CREDIT STRUCTURE

Category-wise Credit distribution

Category	Credits
Foundation Core Courses	49
<ul style="list-style-type: none"> • Basic Sciences and Mathematics (24) • Engineering Sciences (10) • Humanities, Social Sciences and • Management (HSM) (15) 	
Discipline-linked Engineering Science Courses	10
Discipline Core Courses	53
Discipline Elective Courses	15
Open Elective Courses	15
Project and Internship	9
Total Graded Credit Requirement	151
Non-Graded Credit Requirement	11

B. Tech Electronics and Communication Engineering

DETAILED CURRICULUM

Foundation Core Courses: 49 Credits

No	Course Code	Course Title	L	T	P	C
Basic Sciences and Mathematics						
1	BPHY101L	Engineering Physics	3	0	0	3
2	BPHY101P	Engineering Physics Lab	0	0	2	1
3	BCHY101L	Engineering Chemistry	3	0	0	3
4	BCHY101P	Engineering Chemistry Lab	0	0	2	1
5	BMAT101L	Calculus	3	0	0	3
6	BMAT101P	Calculus Lab	0	0	2	1
7	BMAT102L	Differential Equations and Transforms	3	1	0	4
8	BMAT201L	Complex Variables and Linear Algebra	3	1	0	4
9	BMAT202L	Probability and Statistics	3	0	0	3
10	BMAT202L	Probability and Statistics Lab	0	0	2	1
Engineering Sciences						
11	BEEE102L	Basic Electrical and Electronics Engineering	3	0	0	3
12	BEEE102P	Basic Electrical and Electronics Engineering Lab	0	0	2	1
13	BCSE101E	Computer Programming: Python	1	0	4	3
14	BCSE103E	Computer Programming: Java	1	0	4	3
Humanities, Social Sciences and Management (HSM)						
15	BENG101N	Effective English Communication (NGC)	0	0	4	2
16	BENG101L	Technical English Communication	2	0	0	2
17	BENG101P	Technical English Communication Lab	0	0	2	1
18	BENG102P	Technical Report Writing	0	0	2	1
19	BSTS101P	Quantitative Skills Practice I	0	0	3	1.5
20	BSTS102P	Quantitative Skills Practice II	0	0	3	1.5
21	BSTS201P	Qualitative Skills Practice I	0	0	3	1.5
22	BSTS202P	Qualitative Skills Practice II	0	0	3	1.5
23	BFLE200L	Foreign Language	2	0	0	2



24	BHSM200L	HSM Elective	3	0	0	3
		TOTAL				49

Foreign Language

No	Course Code	Course Title	L	T	P	C
1	BARB101L	Arabic	2	0	0	2
2	BCHI101L	Chinese I	2	0	0	2
3	BESP101L	Spanish I	2	0	0	2
4	BFRE101L	French I	2	0	0	2
5	BGER101L	German I	2	0	0	2
6	BGRE101L	Modern Greek	2	0	0	2
7	BITL101L	Italian	2	0	0	2
8	BJAP101L	Japanese I	2	0	0	2
9	BKOR101L	Basic Korean – Level 1	2	0	0	2
10	BKOR102L	Basic Korean – Level 2	2	0	0	2

HSM Elective

No	Course Code	Course Title	L	T	P	C
1	BHUM102E	Indian Classical Music	3	0	0	3
2	BHUM103L	Micro Economics	3	0	0	3
3	BHUM104L	Macro Economics	3	0	0	3
4	BHUM105L	Public Policy and Administration	3	0	0	3
5	BHUM106L	Principles of Sociology	3	0	0	3
6	BHUM107L	Sustainability and Society	3	0	0	3
7	BHUM108L	Urban Community Development	3	0	0	3
8	BHUM109L	Social Work and Sustainability	3	0	0	3
9	BHUM110E	Cognitive Psychology	3	0	0	3
10	BMGT101L	Principles of Management	3	0	0	3
11	BMGT102L	Human Resource Management	3	0	0	3
12	BMGT103L	Organizational Behavior	3	0	0	3
13	BMGT104L	Marketing Management	3	0	0	3



14	BMGT105L	Consumer Behavior	3	0	0	3
15	BMGT106L	Digital Marketing	3	0	0	3
16	BMGT107L	Business Analytics	3	0	0	3
17	BCLE214L	Global Warming	3	0	0	3
18	BCLE215L	Waste Management	3	0	0	3
19	BCLE216L	Water Resources Management	3	0	0	3

Discipline-linked Engineering Science Courses: 10 Credits

No.	Course Code	Course Title	L	T	P	C	Pre-Requisite
1.	BECE201L	Electronic Materials and Devices	3	0	0	3	NIL
2.	BECE202L	Signals and Systems	2	1	0	3	BMAT102
3.	BECE203L	Circuit Theory	3	1	0	4	BEEE101L, BEEE101P
		TOTAL				10	

Discipline Core Courses: 53 Credits

No.	Course Code	Course Title	L	T	P	C	Pre-Requisite
1.	BECE102L	Digital Systems Design	3	0	0	3	NIL
2.	BECE102P	Digital Systems Design Lab	0	0	2	1	NIL
3.	BECE204L	Microprocessors and Microcontrollers	3	0	0	3	BECE102L
4.	BECE204P	Microprocessors and Microcontrollers Lab	0	0	2	1	BECE102L
5.	BECE205L	Engineering Electromagnetics	3	0	0	3	BPHY101L, BPHY101P
6.	BECE206L	Analog Circuits	3	0	0	3	BECE201L
7.	BECE206P	Analog Circuits Lab	0	0	2	1	BECE201L



8.	BECE207L	Random Processes	2	1	0	3	BMAT202L, BMAT202P, BECE202L
9	BECE301L	Digital Signal Processing	3	0	0	3	BECE202L
10.	BECE301P	Digital Signal Processing Lab	0	0	2	1	BECE202L
11.	BECE302L	Control Systems	2	1	0	3	BECE202L
12.	BECE303L	VLSI System Design	3	0	0	3	BECE204L, BECE204P
13.	BECE303P	VLSI System Design Lab	0	0	2	1	BECE204L, BECE204P
14.	BECE304L	Analog Communication Systems	3	0	0	3	BECE206L, BECE206P
15.	BECE304P	Analog Communication Systems Lab	0	0	2	1	BECE206L, BECE206P
16.	BECE305L	Antenna and Microwave Engineering	3	0	0	3	BECE205L
17.	BECE305P	Antenna and Microwave Engineering Lab	0	0	2	1	BECE205L
18	BECE306L	Digital Communication Systems	3	0	0	3	BECE206L, BECE206P
19	BECE306P	Digital Communication Systems Lab	0	0	2	1	BECE206L, BECE206P
20	BECE317L	Wireless and Mobile Communications	3	0	0	3	BECE306L, BECE306P
21	BECE317P	Wireless and Mobile Communications Lab	0	0	2	1	BECE306L, BECE306P
22	BECE318L	Optical Fiber Communications	3	0	0	3	BECE306L, BECE306P
23	BECE318P	Optical Fiber Communications Lab	0	0	2	1	BECE306L, BECE306P
24	BECE401L	Computer Communications and Networks	3	0	0	3	BECE306L,



							BECE306P
25	BECE401P	Computer Communications and Networks Lab	0	0	2	1	BECE306L, BECE306P

Discipline Elective Courses: 15 Credits

No.	Course Code	Course Title	L	T	P	C	Pre-Requisite
1	BECE208E	Data Structures and Algorithms	2	0	2	3	BCSE101E
2	BECE209E	Structured and Object Oriented Programming	2	0	4	4	NIL
3	BECE309L	Artificial Intelligence and Machine Learning	3	0	0	3	BMAT201L
4	BECE310L	Satellite Communications	3	0	0	3	BECE306L, BECE306P
5	BECE311L	Radar Systems	3	0	0	3	BECE305L, BECE305P
6	BECE312L	Robotics and Automation	3	0	0	3	NIL
7	BECE313L	Information Theory and Coding	3	0	0	3	BECE306L, BECE306P
8	BECE314L	Electromagnetic Interference and Compatibility	2	1	0	3	BECE205L
9	BECE315L	Optical Networks	3	0	0	3	BECE308L, BECE308P/ BECE318L, BECE318P
10	BECE316E	Digital Image Processing	3	0	2	4	BECE301L, BECE301P
11	BECE403E	Embedded Systems Design	3	0	2	4	BECE204L, BECE204P
12	BECE404L	Detection, Estimation and Modulation Theory	3	0	0	3	BECE207L
13	BECE405L	Cognitive Radio Networks	3	0	0	3	BECE307L, BECE307P/ BECE317L, BECE317P
14	BECE406E	FPGA Based System Design	2	0	2	3	BECE102L, BECE102P
15	BECE407E	ASIC Design	2	0	2	3	BECE303L,



No.	Course Code	Course Title	L	T	P	C	Pre-Requisite
							BECE303P
16	BECE408L	Microwave Integrated Circuits	3	0	0	3	BECE305L, BECE305P
17	BECE409E	Sensors Technology	2	0	2	3	NIL
18	BECE410L	Micro-Electromechanical Systems	3	0	0	3	NIL
19	BECE411L	Cryptography and Network Security	3	0	0	3	BECE401L, BECE401P/ BCSE308L, BCSE308P
20	BECE391J	Technical Answers to Real Problems Project	0	0	0	3	NIL
21	BECE392J	Design Project	0	0	0	3	NIL
22	BECE393J	Laboratory Project	0	0	0	3	NIL
23	BECE394J	Product Development Project	0	0	0	3	NIL
24	BECE395J	Computer Project	0	0	0	3	NIL
25	BECE396J	Reading Course	0	0	0	3	NIL
26	BECE397J	Special Project	0	0	0	3	NIL
27	BECE398J	Simulation Project	0	0	0	3	NIL

Open Elective Courses: 15 Credits

No.	Course Code	Course Title	L	T	P	C	Pre-Requisite
1	BHUM201L	Mass Communication	3	0	0	3	NIL
2	BHUM202L	Rural Development	3	0	0	3	NIL
3	BHUM203L	Introduction to Psychology	3	0	0	3	NIL
4	BHUM204L	Industrial Psychology	3	0	0	3	NIL
5	BHUM205L	Development Economics	3	0	0	3	NIL
6	BHUM206L	International Economics	3	0	0	3	NIL
7	BHUM207L	Engineering Economics	3	0	0	3	NIL
8	BHUM208L	Economics of Strategy	3	0	0	3	NIL
9	BHUM209L	Game Theory	3	0	0	3	NIL
10	BHUM210E	Econometrics	3	0	0	3	NIL
11	BHUM211L	Behavioral Economics	3	0	0	3	NIL



No.	Course Code	Course Title	L	T	P	C	Pre-Requisite
12	BHUM212L	Mathematics for Economic Analysis	3	0	0	3	NIL
13	BHUM213L	Corporate Social Responsibility	3	0	0	3	NIL
14	BHUM214L	Political Science	3	0	0	3	NIL
15	BHUM215L	International Relations	3	0	0	3	NIL
16	BHUM216L	Indian Culture and Heritage	3	0	0	3	NIL
17	BHUM217L	Contemporary India	3	0	0	3	NIL
18	BHUM218L	Financial Management	3	0	0	3	NIL
19	BHUM219L	Principles of Accounting	3	0	0	3	NIL
20	BHUM220L	Financial Markets and Institutions	3	0	0	3	NIL
21	BHUM221L	Economics of Money, Banking and Financial Markets	3	0	0	3	NIL
22	BHUM222L	Security Analysis and Portfolio Management	3	0	0	3	NIL
23	BHUM223L	Options, Futures and other Derivatives	3	0	0	3	NIL
24	BHUM224L	Fixed Income Securities	3	0	0	3	NIL
25	BHUM225L	Personal Finance	3	0	0	3	NIL
26	BHUM226L	Corporate Finance	3	0	0	3	NIL
26	BHUM227L	Financial Statement Analysis	3	0	0	3	NIL
28	BHUM228L	Cost and Management Accounting	3	0	0	3	NIL
29	BSTS301P	Advanced Competitive Coding – I	0	0	3	1.5	NIL
30	BSTS302P	Advanced Competitive Coding – II	0	0	3	1.5	NIL
31	BECE351E	Internet of Things	1	0	2	2	NIL

Project and Internship: 9 Credits

No.	Course Code	Course Title	L	T	P	C
1	BECE399J	Summer Industrial Internship	0	0	0	1
2	BECE497J	Project-I	0	0	0	3
3	BECE498J	Project-II / Internship	0	0	0	5
4	BECE499J	One Semester Internship	0	0	0	14

Non-Graded Credit Requirement: 11 Credits

No.	Course Code	Course Title	L	T	P	C
1	BECE101N	Introduction to Engineering	0	0	0	1
2	BSSC101N	Essence of Traditional Knowledge	0	0	0	2
3	BSSC102N	Indian Constitution	0	0	0	2
4	BEXC100N	Extracurricular Activities	0	0	0	2
5	BCHY102N	Environmental Sciences	0	0	0	2
6	BHUM101N	Ethics and Values	0	0	0	2

SHORT SYLLABUS

BPHY101L Engineering Physics

3 Credits (3-0-0)

Introduction to waves, Harmonic waves, Standing waves and their eigenfrequencies, Phase velocity and Group velocity, Electromagnetic waves, Maxwell's equations, Electromagnetic wave equation in free space, Elements of quantum mechanics, Heisenberg uncertainty principle, Schrödinger wave equation, Quantum confinement and nanostructures, Lasers, Types of lasers, EM wave propagation, Attenuation, Dispersion, Optoelectronics devices, LED & Laser diode, Photodetectors.

BPHY101L	Engineering Physics	L	T	P	C		
		3	0	0	3		
Pre-requisite	12th of equivalent	Syllabus version		1.0			
Course Objectives							
<ol style="list-style-type: none"> 1. To explain the dual nature of radiation and matter. 2. To apply Schrödinger's equation to solve finite and infinite potential problems and apply quantum ideas at the nanoscale. 3. To understand the Maxwell's equations for electromagnetic waves and apply the concepts to semiconductors for engineering applications. 							
Course Outcome							
At the end of the course the student will be able to							
<ol style="list-style-type: none"> 1. Comprehend the phenomenon of waves and electromagnetic waves. 2. Understand the principles of quantum mechanics. 3. Apply quantum mechanical ideas to subatomic domain. 4. Appreciate the fundamental principles of a laser and its types. 5. Design a typical optical fiber communication system using optoelectronic devices. 							
Module:1	Introduction to waves	7 hours					
Waves on a string - Wave equation on a string (derivation) - Harmonic waves- reflection and transmission of waves at a boundary - Standing waves and their eigenfrequencies - waves with dispersion - Superposition of waves and Fourier method (qualitative) - Wave packet - phase velocity and group velocity.							
Module:2	Electromagnetic waves	7 hours					
Physics of divergence - gradient and curl - surface and volume integral - Maxwell Equations (Qualitative) - Continuity equation for current densities - Displacement current - Electromagnetic wave equation in free space - Plane electromagnetic waves in free space - Hertz's experiment.							
Module:3	Elements of quantum mechanics	7 hours					
Need for Quantum Mechanics: Idea of Quantization (Planck and Einstein) - Compton effect (Qualitative) – de Broglie hypothesis - justification of Bohr postulate - Davisson-Germer experiment - Wave function and probability interpretation - Heisenberg uncertainty principle - Gedanken experiment (Heisenberg's microscope) - Schrödinger wave equation (time dependent and time independent).							
Module:4	Applications of quantum mechanics	6 hours					
Eigenvalues and eigenfunction of particle confined in one dimensional box - Basics of nanophysics - Quantum confinement and nanostructures - Tunnel effect (qualitative) and scanning tunneling microscope.							
Module:5	Lasers	6 hours					
Laser characteristics - spatial and temporal coherence - Einstein coefficients and their significance - Population inversion - two, three and four level systems - Pumping schemes - threshold gain coefficient - Components of a laser - He-Ne, Nd:YAG and CO ₂ lasers and their engineering applications.							
Module:6	Propagation of EM waves in optical fibers	5 hours					
Introduction to optical fiber communication system - light propagation through fibers - Acceptance angle - Numerical aperture - V-parameter - Types of fibers – Attenuation - Dispersion-intermodal and intramodal. Application of fiber in medicine - Endoscopy.							
Module:7	Optoelectronic devices	5 hours					
Introduction to semiconductors - direct and indirect bandgap – p-n junction, Sources: LED and laser diode, Photodetectors: PN and PIN							
Module:8	Contemporary Topics	2 hours					
Guest lectures from Industry and, Research and Development Organisations							
		Total Lecture hours:	45 hours				

Text Book(s)	
1.	H. D. Young and R. A. Freedman, University Physics with Modern Physics, 2020, 15 th Edition, Pearson, USA.
2.	D. K. Mynbaev and Lowell L. Scheiner, Fiber Optic Communication Technology, 2011, Pearson, USA
Reference Books	
1.	H. J. Pain, The Physics of vibrations and waves, 2013, 6 th Edition, Wiley Publications, India.
2.	R. A. Serway, J. W. Jewett, Jr, Physics for Scientists and Engineers with Modern Physics, 2019, 10 th Edition, Cengage Learning, USA.
3.	K. Krane, Modern Physics, 2020, 4 th Edition, Wiley Edition, India.
4.	M.N.O. Sadiku, Principles of Electromagnetics, 2015, 6 th Edition, Oxford University Press, India.
5.	W. Silfvast, Laser Fundamentals, 2012, 2 nd Edition, Cambridge University Press, India.
Mode of Evaluation: Written assignment, Quiz, CAT and FAT	
Recommended by Board of Studies	26.06.2021
Approved by Academic Council	No. 63
	Date 23.09.2021

SHORT SYLLABUS

BPHY101L Engineering Physics Lab

1 Credit (0-0-2)

Experiments to prove the wave and particle duality of light, determine the phase velocity, group velocity of EM wave, material properties like refractive index of a medium, numerical aperture, acceptance angle of an optical fibre.

BPHY101P	Engineering Physics Lab	L	T	P	C									
		0	0	2	1									
Pre-requisite	12th or equivalent	Syllabus version		1.0										
Course Objectives														
To apply theoretical knowledge gained in the theory course and get hands-on experience of the topics.														
Course Outcome														
At the end of the course the student will be able to														
<ol style="list-style-type: none"> 1. Comprehend the dual nature of radiation and matter by means of experiments. 2. Get hands-on experience on the topics of quantum mechanical ideas in the laboratory. 3. Apply low power lasers in optics and optical fiber related experiments. 														
Indicative Experiments														
1.	To determine the dependence of fundamental frequency with the length and tension of a stretched string using sonometer.													
2.	To determine the characteristics of EM waves using Hertz experiment													
3.	To determine the wavelength of laser source (He-Ne laser and diode lasers of different wavelengths) using diffraction grating													
4.	To demonstrate the wave nature of electron by diffraction through graphite sheet													
5.	To determine the Planck's constant using electroluminescence process													
6.	To numerically demonstrate the discrete energy levels and the wavefunctions using Schrödinger equation (e.g., particle in a box problem can be given as an assignment)													
7.	To determine the refractive index of a prism using spectrometer (angle of prism will be given)													
8.	To determine the efficiency of a solar cell													
9.	To determine the acceptance angle and numerical aperture of an optical fiber													
10.	To demonstrate the phase velocity and group velocity (simulation)													
Total Laboratory Hours 30 hours														
Mode of assessment: Continuous assessment / FAT / Oral examination														
Recommended by Board of Studies	26.06.2021													
Approved by Academic Council	No. 63	Date	23.09.2021											

SHORT SYLLABUS

BCHY101L Engineering Chemistry

3 Credits (3-0-0)

Importance of chemical thermodynamics and kinetics; Chemistry and applications of metal complexes, organometallics and organic intermediates; Electrochemical systems for fabricating the energy devices; Function of metal oxides, polymers and nanomaterials in industries; Introduction to spectroscopy and the related instrumental techniques for the characterization of molecules and materials; Utility of chemical concepts in industries; Integrating the chemistry and computer science for basic understanding the molecular interactions.

BCHY101L	Engineering Chemistry	L	T	P	C			
		3	0	0	3			
Pre-requisite	NIL	Syllabus version			1.0			
Course Objectives								
<ol style="list-style-type: none"> To enable students to have fundamental understanding of the basic concepts of different disciplines of chemistry. To provide avenues for learning advanced concepts from school to university To empower students with emerging concepts in applied chemistry to be useful in addressing societal needs To integrate analytical and computational ability with experimental skills to create individuals competent in basic science and its by-product of its application. To offer opportunities to create pathways for self-reliant in terms of knowledge and higher learning 								
Course Outcomes :								
<ol style="list-style-type: none"> Understand the fundamental concepts in organic, inorganic, physical, and analytical chemistry. Analyze the principles of applied chemistry in solving the societal issues. Apply chemical concepts for the advancement of materials. Appreciate the fundamental principles of spectroscopy and the related applications. Design new materials, energy conversion devices and new protective coating techniques. 								
Module:1	Chemical thermodynamics and kinetics	6 hours						
Laws of thermodynamics - entropy change (selected processes) – spontaneity of a chemical reaction and Gibbs free energy - heat transfer; Kinetics - Concept of activation energy and energy barrier - Arrhenius equation- effect of catalysts (homo and heterogeneous) – Enzyme catalysis (Michaelis-Menten Mechanism).								
Module:2	Metal complexes and organometallics	6 hours						
Inorganic complexes - structure, bonding and application; Organometallics – introduction, stability, structure and applications of metal carbonyls, ferrocene and Grignard reagent; Metals in biology (haemoglobin, chlorophyll- structure and property).								
Module:3	Organic intermediates and reaction transformations	6 hours						
Organic intermediates - stability and structure of carbocations, carbanions and radicals; Aromatics (aromaticity) and heterocycles (3, 4, 5, 6 membered and fused systems); Organic transformations for making useful drugs for specific disease targets (two examples) and dyes (addition, elimination, substitution and cross coupling reactions).								
Module:4	Energy devices	6 hours						
Electrochemical and electrolytic cells – electrode materials with examples (semi-conductors), electrode-electrolyte interface- chemistry of Li ion secondary batteries, supercapacitors; Fuel cells: H ₂ -O ₂ and solid oxide fuel cell (SOFC); Solar cells - photovoltaic cell (silicon based), photoelectrochemical cells and dye-sensitized cells.								
Module:5	Functional materials	7 hours						
Oxides of AB, AB ₂ , ABO ₃ type (specific examples); Composites - types and properties; Polymers - thermosetting and thermoplastic polymers – synthesis and application (TEFLON, BAKELITE); Conducting polymers- polyacetylene and effect of doping – chemistry of display devices specific to OLEDs; Nano materials – introduction, bulk vs nano (quantum dots), top-down and bottom-up approaches for synthesis, and properties of nano Au.								
Module:6	Spectroscopic, diffraction and microscopic techniques	5 hours						
Fundamental concepts in spectroscopic and instrumental techniques; Principle and applications of UV-Visible and XRD techniques (numericals); Overview of various techniques such as AAS, IR, NMR, SEM and TEM.								
Module:7	Industrial applications	7 hours						

Water purification methods - zeolites, ion-exchange resins and reverse osmosis; Fuels and combustion -LCV, HCV, Bomb calorimeter (numericals), anti-knocking agents); Protective coatings for corrosion control: cathodic and anodic protection - PVD technique; Chemical sensors for environmental monitoring - gas sensors; Overview of computational methodologies: energy minimization and conformational analysis.

Module:8	Contemporary topics	2 hours
Guest lectures from Industry and, Research and Development Organizations		
	Total Lecture hours:	45 hours

Textbook

1. Theodore E. Brown, H Eugene, LeMay Bruce E. Bursten, Catherine Murphy, Patrick Woodward, Matthew E. Stoltzfus, Chemistry: The Central Science, 2017, 14th edition, Pearson Publishers, 2017. UK

Reference Books

1. Peter Vollhardt, Neil Schore, Organic Chemistry: Structure and Function, 2018, 8th ed. WH Freeman, London
2. Atkins' Physical Chemistry: International, 2018, Eleventh edition, Oxford University Press; UK
3. Colin Banwell, Elaine McCash, Fundamentals for Molecular Spectroscopy, 4th Edition, McGraw Hill, US
4. Solid State Chemistry and its Applications, Anthony R. West. 2014, 2nd edition, Wiley, UK.
5. Angèle Reinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Photovoltaic solar energy: From fundamentals to Applications, 2017, Wiley publishers, UK.
6. Lawrence S. Brown and Thomas Holme, Chemistry for engineering students, 2018, 4th edition – Open access version

Mode of Evaluation: CAT, Written assignment, Quiz and FAT

Recommended by Board of Studies	28.06.2021		
Approved by Academic Council	No. 63	Date	23.09.2021

SHORT SYLLABUS

BCHY101P Engineering Chemistry Lab

1 Credit (0-0-2)

Thermodynamics functions from EMF measurements; Determination of reaction rate, order and molecularity; Colorimetric estimation of Ni²⁺; Laboratory scale preparation of important drug intermediate; Conversion of Chemical to electrical energy; Analysis of iron in an alloy sample by potentiometry; Preparation of tin oxide by sol-gel method and its characterization; Size dependent color variation of Cu(I)O / gold nanoparticles by UV-Vis spectroscopy; Determination of hardness of water sample by complexometric titration; Computational Optimization of molecular geometry using Avogadro software.

BCHY101P	Engineering Chemistry Lab	L	T	P	C									
		0	0	2	1									
Pre-requisite	NIL	Syllabus version		1.0										
Course Objective														
To apply theoretical knowledge gained in the theory course and get hands-on experience of the topics.														
Course Outcome :														
At the end of the course the student will be able to														
<ol style="list-style-type: none"> 1. Understand the importance and hands-on experience on analysis of metal ions by means of experiments. 2. Get practical experience on synthesis and characterization of the organic molecules and nanomaterials in the laboratory. 3. Apply their knowledge in thermodynamic functions, kinetics and molecular geometries through the experiments. 														
Indicative Experiments														
1.	Thermodynamics functions from EMF measurements : Zinc – Copper system													
2.	Determination of reaction rate, order and molecularity of ethylacetate hydrolysis													
3.	Colorimetric estimation of Ni^{2+} using conventional and smart phone digital-imaging methods													
4.	Laboratory scale preparation of important drug intermediate - para aminophenol for the synthesis for acetaminophen													
5.	Magnesium-sea water activated cell – Effect of salt concentration on voltage generation													
6.	Analysis of iron in an alloy sample by potentiometry													
7.	Preparation of tin oxide by sol- gel method and its characterization													
8.	Size dependent colour variation of Cu_2O nanoparticles by spectrophotometer													
9.	Determination of hardness of water sample by complexometric titration before and after ion-exchange process													
10.	Computational Optimization of molecular geometry using Avogadro software													
Total Laboratory Hours 30 hours														
Mode of assessment: Mode of assessment: Continuous assessment / FAT / Oral examination and others														
Recommended by Board of Studies	28.06.2021													
Approved by Academic Council	No. 63	Date	23.09.2021											

SHORT SYLLABUS

BMAT101L Calculus

3 Credits (3-0-0)

Limits and Continuity of Single Variable Functions- Differentiation- Rolle's Theorem and The Mean Value Theorem- Maxima and Minima. Integration- Area between Curves - Volumes of Solids Of Revolution. Functions of Two Variables-Limits and Continuity-Partial Derivatives –Total Differential- Jacobian. Taylor's Expansion For two Variables – Maxima and Minima - Lagrange's Multiplier Method. Evaluation Of Double Integrals– Change of Order of Integration -Change of Variables -Evaluation of Triple Integrals-Beta And Gamma Functions-Error Functions Complementary Error Functions. Scalar and Vector Valued Functions – Gradient, Tangent Plane–Directional Derivative-Divergence and Curl– Scalar and Vector Potentials. Line, Surface and Volume Integrals - Statement of Green's, Stoke's and Gauss Divergence Theorems.

BMAT101L	Calculus	L	T	P	C		
		3	0	0	3		
Pre-requisite	Nil	Syllabus version					
		1.0					
Course Objectives							
1. To provide the requisite and relevant background necessary to understand the other important engineering mathematics courses offered for Engineers and Scientists.							
2. To introduce important topics of applied mathematics, namely Single and Multivariable Calculus and Vector Calculus etc.							
3. Enhance to use technology to model the physical situations into mathematical problems, experiment, interpret results, and verify conclusions.							
Course Outcomes							
At the end of the course the student should be able to:							
1. Apply single variable differentiation and integration to solve applied problems in engineering and find the maxima and minima of functions							
2. Evaluate partial derivatives, limits, total differentials, Jacobians, Taylor series and optimization problems involving several variables with or without constraints							
3. Evaluate multiple integrals in Cartesian, Polar, Cylindrical and Spherical coordinates.							
4. Use special functions to evaluate various types of integrals.							
5. Understand gradient, directional derivatives, divergence, curl, Green's, Stokes and Gauss Divergence theorems.							
Module:1	Single Variable Calculus	8 hours					
Differentiation- Extrema on an Interval Rolle's Theorem and the Mean value theorem-Increasing and decreasing functions.-First derivative test-Second derivative test-Maxima and Minima-Concavity. Integration-Average function value - Area between curves - Volumes of solids of revolution.							
Module:2	Multivariable Calculus	5 hours					
Functions of two variables-limits and continuity-partial derivatives –total differential-Jacobian and its properties.							
Module:3	Application of Multivariable Calculus	5 hours					
Taylor's expansion for two variables–maxima and minima–constrained maxima and minima-Lagrange's multiplier method.							
Module:4	Multiple integrals	8 hours					
Evaluation of double integrals–change of order of integration–change of variables between Cartesian and polar co-ordinates - evaluation of triple integrals–change of variables between Cartesian and cylindrical and spherical co-ordinates.							
Module:5	Special Functions	6 hours					
Beta and Gamma functions–interrelation between beta and gamma functions-evaluation of multiple integrals using gamma and beta functions. Dirichlet's integral -Error functions complementary error functions.							
Module:6	Vector Differentiation	5 hours					
Scalar and vector valued functions – gradient, tangent plane–directional derivative-divergence and curl–scalar and vector potentials. Statement of vector identities-simple problems.							
Module:7	Vector Integration	6 hours					
Line, surface and volume integrals - Statement of Green's, Stoke's and Gauss divergence theorems -verification and evaluation of vector integrals using them.							
Module:8	Contemporary Topics	2 hours					
Guest lectures from Industry and, Research and Development Organizations							
		Total Lecture hours:	45 hours				
Text Book							
1.	George B.Thomas, D.Weir and J. Hass, Thomas Calculus, 2014, 13th edition, Pearson						

Reference Books	
1.	Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India
2.	B.S. Grewal, Higher Engineering Mathematics, 2020, 44th Edition, Khanna Publishers
3.	John Bird, Higher Engineering Mathematics, 2017, 6th Edition, Elsevier Limited.
4.	James Stewart, Calculus: Early Transcendental, 2017, 8th edition, Cengage Learning.
5.	K.A.Stroud and Dexter J. Booth, Engineering Mathematics, 2013, 7th Edition, Palgrave Macmillan.
Mode of Evaluation: CAT, Assignment, Quiz and FAT	
Recommended by Board of Studies	24.06.2021
Approved by Academic Council	No. 63 Date 23.09.2021

SHORT SYLLABUS

BMAT101P Calculus Lab

1 Credit (0-0-2)

Extremum of one and two variable functions, Area and Volume evaluations, Lagrange Multiplier optimization method, Evaluation of gradient, curl and divergence, Green's theorem to real world problems.

BMAT101P	Calculus Lab	L	T	P	C							
		0	0	2	1							
Pre-requisite	NIL	Syllabus version		1.0								
Course Objectives												
<p>1. To familiarize with the basic syntax, semantics and library functions of MATLAB which serves as a tool not only in calculus but also many courses in engineering and sciences</p> <p>2. To visualize mathematical functions and its related properties.</p> <p>3. To evaluate single and multiple integrals and understand it graphically.</p>												
Course Outcomes												
At the end of the course the student should be able to:												
<p>1. Demonstrate MATLAB code for challenging problems in engineering</p> <p>2. Using plots/displays, interpret and illustrate elementary mathematical functions and procedures.</p>												
Indicative Experiments												
1.	Introduction to MATLAB through matrices and general Syntax											
2.	Plotting and visualizing curves and surfaces in MATLAB – Symbolic computations using MATLAB											
3.	Evaluating Extremum of a single variable function											
4.	Understanding integration as Area under the curve											
5.	Evaluation of Volume by Integrals (Solids of Revolution)											
6.	Evaluating maxima and minima of functions of two variables											
7.	Applying Lagrange multiplier optimization method											
8.	Evaluating Volume under surfaces											
9.	Evaluating triple integrals											
10.	Evaluating gradient, curl and divergence											
11.	Evaluating line integrals in vectors											
12.	Applying Green's theorem to real world problems											
Total Laboratory Hours 30 hours												
Text Book												
1.	Brian H. Hahn, Daniel T. Valentine, Essential MATLAB for Engineers and Scientists, Academic Press, 7th edition, 2019.											
Reference Books												
1.	Amos Gilat, MATLAB: An Introduction with Applications, Wiley, 6/e, 2016.											
2	Marlin Brokate, Pammy Manchanda, Abul Hasan Siddiqi, Calculus for Scientists and Engineers, Springer, 2019											
Mode of assessment: DA and FAT												
Recommended by Board of Studies	24.06.2021											
Approved by Academic Council	No. 63	Date	23.09.2021									

SHORT SYLLABUS

BMAT102L Differential Equations and Transforms

4 Credits (3-1-0)

Prerequisites: Calculus Second order non-homogenous differential equations with constant coefficients- Method of undetermined coefficients-Method of Variation of parameters-Solving Damped forced oscillations and LCR circuit theory problems. Formation of partial differential equations –Solutions of standard types of first order partial differential equations – Lagrange's linear equation-Method of separation of variables. Properties of Laplace transform-Laplace transform of standard functions and periodic functions. Inverse Laplace transform- Applications. Solution of ODE's - Solution to First order. Fourier series - Dirichlet's conditions - Half range series –Parseval's identity- Simple applications to solve PDE. Z-transform of standard functions - Inverse Z-transform- Difference equation - First and second order difference equations with constant coefficients - Solution of simple difference equations using Z-transform.

BMAT102L	Differential Equations and Transforms	L	T	P	C
		3	1	0	4
Pre-requisite	BMAT101L, BMAT101P	Syllabus version			1.0
Course Objectives					

1. To impart the knowledge of Laplace transform, an important transform techniques for Engineers which requires knowledge of integration.
2. Presenting the elementary notions of Fourier series, this is vital in practical harmonic analysis.
3. Enriching the skills in solving initial and boundary value problems.
4. Impart the knowledge and application of difference equations and the Z-transform in discrete systems that are inherent in natural and physical processes.

Course Outcomes

At the end of the course the student should be able to:

1. Find solution for second and higher order differential equations, formation and solving partial differential equations.
2. Understand basic concepts of Laplace Transforms and solve problems with periodic functions, step functions, impulse functions and convolution.
3. Employ the tools of Fourier series and Fourier transforms.
4. Know the techniques of solving differential equations and partial differential equations.
5. Know the Z-transform and its application in population dynamics and digital signal processing.

Module:1 Ordinary Differential Equations (ODE)	6 hours
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Second order non- homogenous differential equations with constant coefficients- Differential equations with variable coefficients- method of undetermined coefficients-method of Variation of parameters-Solving Damped forced oscillations and LCR circuit theory problems.

Module:2 Partial Differential Equations (PDE)	5 hours
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Formation of partial differential equations – Singular integrals — Solutions of standard types of first order partial differential equations – Lagrange's linear equation-Method of separation of variables

Module:3 Laplace Transform	7 hours
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Definition- Properties of Laplace transform-Laplace transform of standard functions - Laplace transform of periodic functions-Unit step function-Impulse function. Inverse Laplace transform-Partial fractions method and by Convolution theorem..

Module:4 Solution to ODE and PDE by Laplace transform	7 hours
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Solution of ODE's – Non-homogeneous terms involving Heaviside function, Impulse function - Solving Non-homogeneous system using Laplace transform - solution to First order PDE by Laplace transform.

Module:5 Fourier Series	6 hours
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Fourier series - Euler's formulae- Dirichlet's conditions - Change of interval - Half range series – RMS value – Parseval's identity.

Module:6 Fourier Transform	6 hours
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Complex Fourier transform - properties - Relation between Fourier and Laplace Transforms- Fourier sine and cosine transforms – Parseval's identity- Convolution Theorem and simple applications to solve PDE.

Module:7 Z-Transform	6 hours
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Definition of Z-transform and Inverse Z-transform - Standard functions - Partial fractions and

convolution method. Difference equation - first and second order difference equations with constant coefficients - solution of simple difference equations using Z-transform.		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45 hours
	Total Tutorial hours :	15 hours
Text Book(s)		
1. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, John Wiley India. 2. B.S. Grewal, Higher Engineering Mathematics, 2020, 44th Edition, Khanna Publishers.		
Reference Books		
1. Michael D. Greenberg, Advanced Engineering Mathematics, 2006, 2nd Edition, Pearson Education, Indian edition. 2. A First Course in Differential Equations with Modelling Applications, Dennis Zill, 2018, 11th Edition, Cengage Publishers.		
Mode of Evaluation: CAT, written assignment, Quiz, FAT		
Recommended by Board of Studies	24-06-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

SHORT SYLLABUS

BMAT201L Complex Variables and Linear Algebra

4 Credits (3-1-0)

Prerequisites: Differential Equations and Transforms Complex variable - Analytic functions and Cauchy – Riemann equations- Harmonic functions- Applications of analytic functions to fluid-flow and Field problems. Conformal mapping Elementary transformations; Bilinear transformation; Power Series - Taylor and Laurent series. Singularities - Poles – Residues; Integration of a complex function along a contour; Cauchy-Goursat theorem; Cauchy's integral formula; Cauchy's residue theorem; Linear Algebra-Eigenvalues and Eigen vectors; Cayley-Hamilton theorem; System of linear equations; Gaussian elimination and Gauss Jordan methods, Vector space – subspace- span - linearly dependent – Independent – bases; Dimensions; Finite dimensional vector space; Row and column spaces; Rank and nullity, Linear transformations; Invertible linear transformation; Dot products and inner products; Matrix representations of inner products; Gram - Schmidt – Orthogonalization.

BMAT201L	Complex Variables and Linear Algebra	L	T	P	C
		3	1	0	4
Pre-requisite	BMAT102L	Syllabus version			
		1.0			

Course Objectives

1. To present comprehensive, compact, and integrated treatment of one of the most important branches of applied mathematics namely Complex variables to the engineers and the scientists.
2. To present comprehensive, compact, and integrated treatment of another most important branches of applied mathematics namely Linear Algebra to the engineers and the scientists.
3. To provide students with a framework of the concepts that will help them to analyse deeply about many complex problems.

Course Outcomes

At the end of the course the student should be able to

1. Construct analytic functions and find complex potential of fluid flow and electric fields.
2. Find the image of straight lines by elementary transformations and to express analytic functions in power series.
3. Evaluate real integrals using techniques of contour integration.
4. Use the power of inner product and norm for analysis.
5. Use matrices and transformations for solving engineering problems.

Module:1	Analytic Functions	7 hours
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Complex variable - Analytic functions and Cauchy – Riemann equations; Laplace equation and Harmonic functions; Construction of Harmonic conjugate and analytic functions; Applications of analytic functions to fluid-flow and electric field problems.

Module:2	Conformal and Bilinear transformations	7 hours
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Conformal mapping - Elementary transformations; Translation, Magnification, Rotation, Inversion; Exponential and Square transformations ($w = e^z$, z^2); Bilinear transformation; Cross-ratio-Images of the regions bounded by straight lines under the above transformations;

Module:3	Complex Integration	7 hours
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Functions given by Power Series - Taylor and Laurent series-Singularities - Poles – Residues; Integration of a complex function along a contour; Statements of Cauchy-Goursat theorem- Cauchy's integral formula-Cauchy's residue theorem-Evaluation of real integrals-Indented contour integral.

Module:4	Vector Spaces	6 hours
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Vector space – subspace; linear combination - span - linearly dependent – Independent – bases; Dimensions; Finite dimensional vector space. Row and column spaces; Rank and nullity.

Module:5	Linear Transformations	6 hours
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Linear transformations – Basic properties; Invertible linear transformation; Matrices of linear transformations; Vector space of linear transformations; Change of bases; Similarity.

Module:6	Inner Product Spaces	5 hours
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Dot products and inner products; Lengths and angles of vectors; Matrix representations of inner products; Gram - Schmidt – Orthogonalization.

Module:7	Matrices and System of Equations	5 hours
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Eigenvalues and Eigen vectors; Properties of Eigenvalues and Eigen vectors; Cayley-Hamilton theorem; System of linear equations; Gaussian elimination and Gauss Jordan methods.

Module:8	Contemporary issues:	2 hours
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	Total Lecture hours: Total Tutorial hours :	45 hours 15 hours
Text Book(s)		
<p>1. G. Dennis Zill, Patrick D. Shanahan, A first course in complex analysis with applications, 2013, 3rd Edition, Jones and Bartlett Publishers Series in Mathematics.</p> <p>2. Jin Ho Kwak, Sungpyo Hong, Linear Algebra, 2004, Second edition, Springer.</p>		
Reference Books		
<p>1. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, John Wiley & Sons (Wiley student Edition).</p> <p>2. Michael, D. Greenberg, Advanced Engineering Mathematics, 2006, 2nd Edition, Pearson Education.</p> <p>3. Bernard Kolman, David, R. Hill, Introductory Linear Algebra - An applied first course, 2011, 9th Edition Pearson Education.</p> <p>4. Gilbert Strang, Introduction to Linear Algebra, 2015, 5th Edition, Cengage Learning</p> <p>5. B.S. Grewal, Higher Engineering Mathematics, 2020, 44th Edition, Khanna Publishers.</p>		
Mode of Evaluation: Digital Assignments(Solutions by using soft skill), Quiz, Continuous Assessments, Final Assessment Test.		
Recommended by Board of Studies	24-06-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

SHORT SYLLABUS

BMAT202L Probability and Statistics

3 Credits (3-0-0)

Prerequisites: Calculus Introduction to statistics and data analysis; Measures of central tendency; Measures of variability; Random variables, Probability mass Function, Distribution and density functions, Joint Probability distribution and Joint Density functions; Mathematical expectation, and its properties; Covariance; Moment generating function; Characteristic function. Correlation and Regression; Rank Correlation; Partial and Multiple correlation; Some standard discrete and continuous distributions; Testing of hypothesis; Large sample tests - Z test; Small sample tests- Student's t-test, F-test; Chi-square test; Design of Experiments; Analysis of variance; CRD-RBD- LSD; Hazard function; Reliabilities of series and parallel systems; System Reliability; Maintainability; Preventive and repair maintenance; Availability.

BMAT202L	Probability and Statistics	L	T	P	C
		3	0	0	3
Pre-requisite	BMAT101L, BMAT101P	Syllabus version			1.0
Course Objectives :					

1. To provide students with a framework that will help them choose the appropriate descriptive methods in various data analysis situations.
2. To analyze distributions and relationship of real-time data.
3. To apply estimation and testing methods to make inference and modelling techniques for decision making.

Course Outcome :

At the end of the course the student should be able to:

1. Compute and interpret descriptive statistics using numerical and graphical techniques.
2. Understand the basic concepts of random variables and find an appropriate distribution for analyzing data specific to an experiment.
3. Apply statistical methods like correlation, regression analysis in analyzing, interpreting experimental data.
4. Make appropriate decisions using statistical inference that is the central to experimental research.
5. Use statistical methodology and tools in reliability engineering problems.

Module:1	Introduction to Statistics	6 hours
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Statistics and data analysis; Measures of central tendency; Measure of Dispersion, Moments-Skewness-Kurtosis (Concepts only).

Module:2	Random variables	8 hours
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Random variables- Probability mass function, distribution and density functions-Joint probability distribution and Joint density functions; Marginal, Conditional distribution and Density functions- Mathematical expectation and its properties- Covariance, Moment generating function.

Module:3	Correlation and Regression	4 hours
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Correlation and Regression – Rank Correlation; Partial and Multiple correlation; Multiple regression.

Module:4	Probability Distributions	7 hours
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Binomial distribution; Poisson distributions; Normal distribution; Gamma distribution; Exponential distribution; Weibull distribution.

Module:5	Hypothesis Testing-I	4 hours
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Testing of hypothesis –Types of errors - Critical region, Procedure for testing of hypothesis-Large sample tests- Z test for Single Proportion- Difference of Proportion- Mean and difference of means.

Module:6	Hypothesis Testing-II	9 hours
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Small sample tests- Student's t-test, F-test- chi-square test- goodness of fit - independence of attributes- Design of Experiments - Analysis of variance – One way-Two way-Three way classifications - CRD-RBD- LSD.

Module:7	Reliability	5 hours
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Basic concepts- Hazard function-Reliabilities of series and parallel systems- System

Reliability - Maintainability-Preventive and repair maintenance- Availability.		
Module:8	Contemporary Issues	2 hours
	Total lecture hours:	45 hours
Text Book:		
1. R. E. Walpole, R. H. Myers, S. L. Mayers, K. Ye, Probability and Statistics for engineers and scientists, 2012, 9 th Edition, Pearson Education.		
Reference Books		
1. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, 2016, 6 th Edition, John Wiley & Sons. 2. E. Balagurusamy, Reliability Engineering, 2017, Tata McGraw Hill, Tenth reprint. 3. J. L. Devore, Probability and Statistics, 2012, 8 th Edition, Brooks/Cole, Cengage Learning. 4. R. A. Johnson, Miller Freund's, Probability and Statistics for Engineers, 2011, 8th edition, Prentice Hall India. 5. Bilal M. Ayyub, Richard H. McCuen, Probability, Statistics and Reliability for Engineers and Scientists, 2011, 3 rd edition, CRC press.		
Mode of Evaluation: Digital Assignments, Continuous Assessment Tests, Quiz, Final Assessment Test.		
Recommended by Board of Studies	24-06-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

SHORT SYLLABUS

BMAT202P Probability and Statistics Lab

1 Credit (0-0-2)

Prerequisites: Calculus Simple linear and multiple linear regression models, fitting Binomial, Poisson and Normal distribution, hypothesis testing, ANOVA for Completely randomized design, Randomized Block design, Latin square Design.

BMAT202P	Probability and Statistics Lab			L	T	P	C							
				0	0	2	1							
Pre-requisite	BMAT101L, BMAT101P			Syllabus version										
				1.0										
Course Objectives:														
<ol style="list-style-type: none"> 1. To enable the students for having experimental knowledge of basic concepts of statistics using R programming. 2. To study the relationship of real-time data and decision making through testing methods using R. 3. To make students capable to do experimental research using statistics in various engineering problems. 														
Course Outcomes:														
At the end of the course the student should be able to:														
<ol style="list-style-type: none"> 1. Demonstrate R programming for statistical data. 2. Carry out appropriate analysis of statistical methods through experimental techniques using R. 														
Indicative Experiments														
1.	Introduction: Understanding Data types; importing/exporting data					Total Laboratory hours: 30								
2.	Computing Summary Statistics /plotting and visualizing data using Tabulation and Graphical Representations													
3.	Applying correlation and simple linear regression model to real dataset; computing and interpreting the coefficient of determination													
4.	Applying multiple linear regression model to real dataset; computing and interpreting the multiple coefficients of determination													
5.	Fitting the probability distributions: Binomial distribution													
6.	Normal distribution, Poisson distribution													
7.	Testing of hypothesis for one sample mean and proportion from real time problems													
8.	Testing of hypothesis for two sample means and proportion from real time problems													
9.	Applying the t-test for independent and dependent samples													
10.	Applying Chi-square test for goodness of fit test and Contingency test to real dataset													
11.	Performing ANOVA for real dataset for Completely randomized design, Randomized Block design, Latin square Design													
Text Book														
1.	Statistical analysis with R by Joseph Schmuller, John wiley and sons Inc., New Jersey 2017.													
Reference Books:														
1.	The Book of R: A First course in Programming and Statistics, by Tilman M Davies, William Pollock, 2016.													
2.	R for Data Science, by Hadley Wickham and Garrett Grolemund, O' Reilly Media Inc., 2017.													
Mode of assessment: Continuous assessment, FAT / Oral examination and others														
Recommended by Board of Studies	24-06-2021													
Approved by Academic Council	No. 64	Date	16-12-2021											

Course Code	Course Title	L	T	P	C				
BEEE102L	Basic Electrical and Electronics Engineering	3	0	0	3				
Pre-requisite	NIL				Syllabus version				
Course Objectives									
1. Familiarize with various laws and theorems to solve electric and electronic circuits 2. Provide an overview on working principle of machines 3. Excel the concepts of semiconductor devices, op-amps and digital circuits									
Course Outcomes									
On completion of the course, the students will be able to:									
1. Evaluate DC and AC circuit parameters using various laws and theorems 2. Comprehend the parameters of magnetic circuits 3. Classify and compare various types of electrical machines and its applications 4. Design basic combinational circuits in digital system 5. Analyze the characteristics and applications of semiconductor devices									
Module:1 DC Circuits		7 hours							
Basic circuit elements and sources; Ohms law; Kirchhoff's laws; Series and Parallel connection of circuit elements; Star-delta transformation; Mesh current analysis; Node voltage analysis; Theorems: Thevenin's, Maximum power transfer and Superposition theorem.									
Module:2 AC Circuits		8 hours							
Alternating voltages and currents, RMS, average, maximum values, Single Phase RL, RC, RLC series circuits, Power in AC circuits, Power Factor, Three phase balanced systems, Star and delta Connections, Electrical Safety, Fuses and Earthing.									
Module:3 Magnetic Circuits		7 hours							
Magnetic field; Toroidal core: Flux density, Flux linkage; Magnetic circuit with airgap; Reluctance in series and parallel circuits; Self and mutual inductance; Transformer: turn ratio determination.									
Module:4 Electrical Machines		7 hours							
Construction, working principle and applications of DC Machines, Transformers, Three phase Induction motors, synchronous generators, single phase induction motors, special machines stepper motor, universal motor and BLDC motor.									
Module:5 Digital Systems		7 hours							
Binary arithmetic; Number base conversion; Boolean algebra: simplification of Boolean functions using K-maps; Logic gates; Design of basic combinational circuits: adders, multiplexers, de-multiplexers.									
Module:6 Semiconductor Devices and Applications		7 hours							
Characteristics: PN junction diode, Zener diode, BJT, MOSFET; Applications: Rectifier, Voltage regulator, Operational amplifier.									
Module:7 Contemporary Issues		2 hours							
		Total Lecture hours:							
		45 hours							
Text Books									
1	Allan R. Hambley, "Electrical Engineering -Principles & Applications", 2019, 6 th Edition, Pearson Education								
2	V. D. Toro, Electrical Engineering Fundamentals, 2 nd edition. PHI, 2014								
Reference Books									
1	R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 11 th edition.								

	Pearson, 2012
2	DP Kothari & Nagrath, "Basic Electric Engineering", 2019, Tata McGraw Hill
Recommended by Board of Studies	28-05-2022
Approved by Academic Council	No. 67 Date 08-08-2022

Course code	Course Title	L	T	P	C				
BEEE102P	Basic Electrical and Electronics Engineering Lab	0	0	2	1				
Pre-requisite	Nil	Syllabus version		1.0					
Course Objective									
1. Design and solve the fundamental electrical and electronics circuits									
Course Outcomes									
1. Identify appropriate method of solving the fundamental electrical and electronics circuits									
2. Design and conduct experiments on electrical and electronics circuits									
Experiments (Indicative)									
1	Verification of Kirchoff's law								
2	Verification of Maximum Power Transfer Theorem								
3	Staircase wiring circuit layout for multi storage building								
4	Lamp dimmer circuit (Darlington pair circuit using transistors) used in cars.								
5	Measurement of Earth resistance using Megger								
6	Sinusoidal steady state response of RLC circuits								
7	Three phase power measurement for ac loads								
8	Design of half-adder and full-adder digital circuits								
9	Synthesis of 8x1 multiplexer and 1x8 de-multiplexers								
10	Characteristics of PN diode and acts as switch								
11	Realization of single-phase rectifier								
12	Design of regulated power supply using Zener diode.								
13	Characteristics of MOSFET								
14	Characteristics of BJT								
15	Measurement of energy using single-phase energy meter								
16	Measurement of power in a 1-phase circuit by using CTs and PTs								
Total Laboratory Hours					30 hours				
Mode of assessment: Continuous assessment, FAT									
Recommended by Board of Studies	28-05-2022								
Approved by Academic Council	No. 67	Date	08-08-2022						

SHORT SYLLABUS

BCSE101E Computer Programming: Python

3 Credits (1-0-4)

Fundamentals of problem Solving. Basic constructs in python. Control Structures. Collections. Strings and Regular Expressions. Functions. Files and Packages.

BCSE101E	Computer Programming: Python	L	T	P	C		
		1	0	4	3		
Pre-requisite	NIL	Syllabus version		1.0			
Course Objectives							
<p>1. To provide exposure to basic problem-solving techniques using computers.</p> <p>2. To inculcate the art of logical thinking abilities and propose novel solutions for real world problems through programming language constructs.</p>							
Course Outcome							
<p>1. Classify various algorithmic approaches, categorize the appropriate data representation, and demonstrate various control constructs.</p> <p>2. Choose appropriate programming paradigms, interpret and handle data using files to propose solution through reusable modules; idealize the importance of modules and packages.</p>							
Module:1	Introduction to Problem Solving	1 hour					
Problem Solving: Definition and Steps, Problem Analysis Chart, Developing an Algorithm, Flowchart and Pseudocode.							
Module:2	Python Programming Fundamentals	2 hours					
Introduction to python – Interactive and Script Mode – Indentation – Comments – Variables – Reserved Words – Data Types – Operators and their precedence – Expressions – Built-in Functions – Importing from Packages.							
Module:3	Control Structures	2 hours					
Decision Making and Branching: if, if-else, nested if, multi-way if-elif statements – Looping: while loop, for loop – else clauses in loops, nested loops – break, continue and pass statements.							
Module:4	Collections	3 hours					
Lists: Create, Access, Slicing, Negative indices, List methods, List comprehensions – Tuples: Create, Indexing and slicing, Operations on tuples – Dictionary: Create, add, and replace values, Operations on dictionaries – Sets: Creation and operations.							
Module:5	Strings and Regular Expressions	2 hours					
Strings: Comparison, Formatting, Slicing, Splitting, Stripping – Regular Expressions: Matching, Search and replace, Patterns.							
Module:6	Functions and Files	3 hours					
Functions – Parameters and Arguments: Positional arguments, Keyword arguments, Parameters with default values – Local and Global scope of variables – Functions with Arbitrary arguments – Recursive Functions – Lambda Function. Files: Create, Open, Read, Write, Append and Close – tell and seek methods.							
Module:7	Modules and Packages	2 hours					
Built-in modules – User-Defined modules – Overview of Numpy and Pandas packages.							
		Total Lecture hours:		15 hours			
Text Book(s)							
1.	Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, 2nd Edition, No starch Press, 2019						
Reference Books							
1.	Martic C Brown, Python: The Complete Reference, 4th Edition, McGraw Hill Publishers, 2018.						
2.	John V. Guttag, Introduction to computation and programming using python: with applications to understanding data. 2nd Edition, MIT Press, 2016.						

Mode of Evaluation: No separate evaluation for theory component.			
Indicative Experiments			
1.	Problem Analysis Chart, Flowchart and Pseudocode Practices.		
2.	Sequential Constructs using Python Operators, Expressions.		
3.	Branching (if, if-else, nested if, multi-way if-elif statements) and Looping (for, while, nested looping, break, continue, else in loops).		
4.	List, Tuples, Dictionaries & Sets.		
5.	Strings, Regular Expressions.		
6.	Functions, Lambda, Recursive Functions and Files.		
7.	Modules and Packages (NumPy and Pandas)		
Total Laboratory Hours			
60 hours			
Text Book(s)			
1.	Mariano Anaya, Clean Code in Python: Develop maintainable and efficient code, 2 nd Edition, Packt Publishing Limited, 2021.		
Reference Books			
1.	Harsh Bhasin, Python for beginners, 1 st Edition, New Age International (P) Ltd., 2019, Mode of assessment: Continuous assessments and FAT		
Recommended by Board of Studies	03.07.2021		
Approved by Academic Council	No. 63	Date	23.09.2021

SHORT SYLLABUS

BCSE103E Computer Programming: Java

3 Credits (1-0-4)

Basics of Object-Oriented Programming. Java basic constructs and data types. Looping and Arrays. Classes and Objects. Inheritance and Polymorphism. Packages and Exception Handling. Files and IO Streams. Collection Framework.

BCSE103E	Computer Programming : Java	L	T	P	C			
		1	0	4	3			
Pre-requisite	NIL	Syllabus version			1.0			
Course Objectives:								
<ol style="list-style-type: none"> 1. To introduce the core language features of Java and understand the fundamentals of Object -Oriented programming in Java. 2. To develop the ability of using Java to solve real world problems. 								
Course Outcome:								
At the end of this course, students should be able to:								
<ol style="list-style-type: none"> 1. Understand basic programming constructs; realize the fundamentals of Object Orientated Programming in Java; apply inheritance and interface concepts for enhancing code reusability. 2. Realize the exception handling mechanism; process data within files and use the data structures in the collection framework for solving real world problems. 								
Module:1	Java Basics	2 hours						
OOP Paradigm - Features of Java Language - JVM - Bytecode - Java program structure – Basic programming constructs - data types - variables – Java naming conventions – operators.								
Module:2	Looping Constructs and Arrays	2 hours						
Control and looping constructs - Arrays – one dimensional and multi-dimensional – enhanced for loop – Strings - Wrapper classes.								
Module:3	Classes and Objects	2 hours						
Class Fundamentals – Access and non-access specifiers - Declaring objects and assigning object reference variables – array of objects – constructors and destructors – usage of “this” and “static” keywords.								
Module:4	Inheritance and Polymorphism	3 hours						
Inheritance – types -- use of “super” – final keyword - Polymorphism – Overloading and Overriding - abstract class – Interfaces.								
Module:5	Packages and Exception Handling	2 hours						
Packages: Creating and Accessing - Sub packages. Exception Handling - Types of Exception - Control Flow in Exceptions - Use of try, catch, finally, throw, throws in Exception Handling - User defined exceptions.								
Module:6	IO Streams and Files	2 hours						
Java I/O streams – FileInputStream & FileOutputStream – FileReader & FileWriter- DataInputStream & DataOutputStream – BufferedInputStream & BufferedOutputStream – PrintOutputStream - Serialization and Deserialization.								
Module:7	Collection Framework	2 hours						
Generic classes and methods - Collection framework: List and Map.								
		Total Lecture hours:			15 hours			
Text Book(s)								
1.	Y. Daniel Liang, “Introduction to Java programming” - comprehensive version-11 th Edition, Pearson publisher, 2017.							
Reference Books								
1.	Herbert Schildt , The Complete Reference -Java, Tata McGraw-Hill publisher, 10 th Edition, 2017.							
2	Cay Horstmann,”Big Java”, 4th edition, John Wiley & Sons publisher, 5 th edition, 2015							
3	E.Balagurusamy, “Programming with Java”, Tata McGraw-Hill publishers, 6 th edition, 2019							

Mode of Evaluation: No separate evaluation for theory component.	
Indicative Experiments	
1.	Programs using sequential and branching structures.
2.	Experiment the use of looping, arrays and strings.
3.	Demonstrate basic Object-Oriented programming elements.
4.	Experiment the use of inheritance, polymorphism and abstract classes.
5.	Designing packages and demonstrate exception handling.
6.	Demonstrate the use of IO streams, file handling and serialization.
7.	Program to discover application of collections.
	Total Laboratory Hours 60 hours
Text Book(s)	
1.	Marc Loy, Patrick Niemeyer and Daniel Leuck, Learning Java, O'Reilly Media, Inc., 5 th Edition, 2020.
Reference Books	
1.	Dhruti Shah, 100+ Solutions in Java: A Hands-On Introduction to Programming in Java, BPB Publications, 1 st Edition, 2020.
Mode of assessment: Continuous assessments and FAT	
Recommended by Board of Studies	03.07.2021
Approved by Academic Council	No. 63
Date	23.09.2021

SHORT SYLLABUS

BENG101N Effective English Communication

2 Credits (0-0-4)

Fundamentals of Grammar, Vocabulary Enrichment, Speaking to Convey and Interactive Speaking, Basic listening and Pronunciation Practice, Reading Strategies, Skimming Scanning Techniques and Reading for Pleasure, Drafting Paragraphs, Letter and Email Writing, Reading Short stories by Indian writers

BENG101N	Effective English Communication	L	T	P	C						
		0	0	4	2						
Pre-requisite	Nil	Syllabus Version		1.0							
Course Objectives:											
1. To hone LSRW skills for effective communication 2. To enhance communication skills for future career aspirations 3. To gain critical communication skills in writing and public speaking											
Course Outcomes:											
1. Write effective sentences using appropriate grammar and vocabulary 2. Express clearly in everyday conversations with lucid pronunciation 3. Analyse the given listening inputs for effective comprehension 4. Apply different reading strategies to various texts and use them appropriately											
Indicative Experiments											
1.	Fundamentals of Grammar: Parts of Speech, Articles, Tenses, Sentence Structure, Types of Sentences, Subject-Verb Agreement Activity: Exercises and worksheets										
2.	Speaking for Self-Expression: Formal Self-Introduction, Expressing Oneself Activity: Self-Introduction, Just a Minute (JAM)										
3.	Basic Listening: Listening to Simple Conversations, Short Speeches/Stories Activity: Gap fill exercises										
4.	Reading Skills: Reading Strategies, Skimming and Scanning Activity: Cloze reading, Reading comprehension, Reading newspaper articles										
5.	Drafting Paragraphs: Keywords Development, Writing Paragraphs using Connectives Activity: Picture and poster interpretation										
6.	Vocabulary Enrichment: Synonyms and Antonyms, Prefixes and Suffixes, Word Formation, One Word Substitution, Frequently used Idioms and Phrases, Homophones and Homonyms Activity: Crossword puzzles and worksheets										
7.	Listening for Pronunciation: Introduction to Phonemes, Listening to Native Speakers, Listening to Various Accents Activity: Listening and imitating, Spell Bee										
8.	Interactive Speaking: Everyday Conversations, Team Interactions, Simulations Activity: Situational role plays										
9.	Email and Letter Writing: Types and Format of Emails and Letters Activity: Official e-mails and letters, personal letters										
10.	Reading for Comprehension: Short Stories by Indian Writers Activity: Summarising, loud reading										
Total Laboratory Hours 60 hours											
Mode of Evaluation: Continuous assessment / FAT / Written assignments / Quiz/ Oral examination / Group activity											
Recommended by Board of Studies	28.06.2021										
Approved by Academic Council	No. 63	Date	23.09.2021								

SHORT SYLLABUS

BENG101L Technical English Communication

2 Credits (2-0-0)

Introduction to Communication, grammar, written correspondence, business correspondence, professional writing, team building, leadership skills, analysing and interpreting texts

BENG101L	Technical English Communication	L	T	P	C				
		2	0	0	2				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives:									
<ol style="list-style-type: none"> 1. To develop LSRW skills for effective communication in professional situations 2. To enhance knowledge of grammar and vocabulary for meaningful communication 3. To understand information from diverse texts for effective technical communication 									
Course Outcomes:									
<ol style="list-style-type: none"> 1. Use grammar and vocabulary appropriately while writing and speaking 2. Apply the concepts of communication skills in formal and informal situations 3. Demonstrate effective reading and listening skills to synthesize and draw intelligent inferences 4. Write clearly and significantly in academic and general contexts 									
Module:1	Introduction to Communication	4 hours							
Nature and Process - Types of communication: Intra-personal, Interpersonal, Group-verbal and non-verbal communication / Cross-cultural Communication - Communication Barriers and Essentials of good communication - Principles of Effective Communications									
Module:2	Grammatical Aspects	4 hours							
Sentence Pattern - Modal Verbs - Concord (SVA) - Conditionals - Error detection									
Module:3	Written Correspondence	4 hours							
Job Application Letters - Resume Writing - Statement of Purpose									
Module:4	Business Correspondence	4 hours							
Business Letters: Calling for Quotation, Complaint & Sales Letter – Memo - Minutes of Meeting - Describing products and processes									
Module:5	Professional Writing	4 hours							
Paraphrasing & Summarizing - Executive Summary - Structure and Types of Proposal – Recommendations									
Module:6	Team Building & Leadership Skills	4 hours							
Principles of Leadership - Team Leadership Model - Negotiation Skills - Conflict Management									
Module:7	Research Writing	4 hours							
Interpreting and Analysing a research article - Approaches to Review Paper Writing - Structure of a research article - Referencing									
Module:8	Guest Lecture from Industry and R&D organizations	2 hours							
Contemporary Issues									
Total Lecture hours: 30 hours									
Text Book(s)									
1. Raman, Meenakshi & Sangeeta Sharma. (2015). <i>Technical Communication: Principles and Practice</i> , (3 rd Edition). India: Oxford University Press.									
Reference Books									
1. Taylor, Shirley & Chandra .V. (2010). <i>Communication for Business A Practical Approach</i> 4 th Edition. India: Pearson Longman.									
2. Kumar, Sanjay & Pushpalatha. (2018). <i>English Language and Communication Skills for Engineers</i> . India: Oxford University Press.									
3. Koneru Aruna. (2020). <i>English Language Skills for Engineers</i> . India: McGraw Hill Education.									
4. Rizvi, M. Ashraf. (2018). <i>Effective Technical Communication</i> 2 nd Edition. Chennai: McGraw Hill Education.									
5. Mishra, Sunitha & Muralikrishna,C. (2014). <i>Communication Skills for Engineers</i> . India: Pearson Education.									

6.	Watkins, P. (2018). <i>Teaching and Developing Reading Skills: Cambridge Handbooks for Language teachers</i> . India: Cambridge University Press.		
Mode of Evaluation : CAT / Assignment / Quiz / FAT / Group Discussion			
Recommended by Board of Studies	28.06.2021		
Approved by Academic Council	No. 63	Date	23.09.2021

SHORT SYLLABUS

BENG101P Technical English Communication Lab

1 Credit (0-0-2)

Grammar, vocabulary, listening to narratives, presentations, intensive reading, group communication, public speaking, extensive reading, workplace communication, listening to scientific documentaries, case study analysis.

BENG101P	Technical English Communication Lab	L	T	P	C						
		0	0	2	1						
Pre-requisite	NIL	Syllabus version		1.0							
Course Objectives:											
1. To use appropriate grammatical structures in professional communication 2. To improve English communication skills for better employability 3. To enhance meaningful communication skills in writing and public speaking											
Course Outcomes:											
1. Demonstrate professional rhetoric and articulate ideas effectively 2. Interpret material on technology and deliver eloquent presentations 3. Apply receptive and productive skills in real life situations and develop workplace communication											
Indicative Experiments											
1.	Grammar & Vocabulary Error Detection Activity: -Worksheets										
2.	Listening to Narratives Interviews of eminent personalities & Ted Talks Activity: Listening Comprehension / Summarising										
3.	Video Resume SWOT Analysis & digital resume techniques Activity: Preparing a digital résumé for mock interview										
4.	Product & Process Description Describing and Sequencing Activity: Demonstration of product and process										
5.	Mock Meetings Types of meetings and meeting etiquette Activity: Conduct of meetings and drafting minutes of the meeting										
6.	Reading research article Scientific and Technical articles Activity: Writing Literature review										
7.	Analytical Reading Case Studies on Communication, Team Building and Leadership Activity: Group Discussion										
8.	Presentations Preparing Conference/Seminar paper Activity: Individual/ Group presentations										
9.	Intensive Listening Scientific documentaries Activity: Note taking and Summarising										
10.	Interview Skills Interview questions and techniques Activity: Mock Interviews										
Total Laboratory Hours 30 hours											
Mode of Assessment: Continuous Assessment / FAT / Written Assignments / Quiz/ Oral Presentation and Group Activity.											
Recommended by Board of Studies	28.06.2021										
Approved by Academic Council	No. 63	Date	23.09.2021								

SHORT SYLLABUS

BENG102P Technical Report Writing

1 Credit (0-0-2)

Advanced grammar, technical vocabulary, research and analyses, Introduction to technical writing, systematise and categorize information, Categories and types of reports, Structure of reports, supplementary texts, research paper writing, and Presenting Technical reports.

BENG201P	Technical Report Writing	L	T	P	C						
		0	0	2	1						
Pre-requisite	Technical English Communication	Syllabus version		1.0							
Course Objectives:											
1. To augment specific writing skills for preparing technical reports 2. To think critically, evaluate, analyse general and complex technical information 3. To acquire proficiency in writing and presenting reports											
Course Outcomes:											
1. Write error free sentences using appropriate grammar, vocabulary and style 2. Synthesize information and concepts in preparing reports 3. Demonstrate the ability to write and present reports on diverse topics											
Indicative Experiments											
1.	Advanced Grammar, Vocabulary and Editing Usage of Tenses - Adjectives and Adverbs - Jargon vs Technical Vocabulary – Abbreviations - Mechanics of Editing: Punctuation and Proof Reading Activity: Worksheets										
2.	Research and Analyses Synchronise Technical Details from Newspapers - Magazines - Articles and e-content Activity: Writing introduction and literature review										
3.	Systematisation of Information Techniques to Converge Objective-Oriented data in Diverse Technical Reports Activity: Preparing Questionnaire										
4.	Data Visualisation Interpreting Data - Graphs - Tables – Charts - Imagery - Infographics Activity: Transcoding										
5.	Introduction to Reports Meaning - Definition - Purpose - Characteristics and Types of Reports Activity: Worksheets on Types of reports										
6.	Structure of Reports Title – Preface – Acknowledgement - Abstract/Summary – Introduction - Materials and Methods – Results – Discussion - Conclusion - Suggestions/Recommendations Activity: Identifying the structure of report										
7.	Report Writing Data Collection - Draft an Outline and Organize Information Activity: Drafting reports										
8.	Supplementary Texts Appendix – Index – Glossary – References – Bibliography - Notes Activity: Organizing supplementary texts										
9.	Review of Final Reports Structure – Content – Style - Layout and Referencing Activity: Examining clarity and coherence in final reports										
10.	Presentation Presenting Technical Reports Activity: Planning, creating and digital presentation of reports										
Total Laboratory Hours 30 hours											
Mode of assessment: Continuous Assessment / FAT / Assignments / Quiz / Presentations / Oral examination											
Recommended by Board of Studies	28.06.2021										
Approved by Academic Council	No. 63	Date	23.09.2021								

BSTS101P	Quantitative Skills Practice I	L	T	P	C				
		0	0	3	1.5				
Pre-requisite	Nil	Syllabus version							
		1.0							
Course Objectives:									
<ol style="list-style-type: none"> 1. To enhance the logical reasoning skills of the students and help them improve problem-solving abilities 2. To acquire skills required to solve quantitative aptitude problems 3. To boost the verbal ability of the students for academic and professional purposes 									
Course Outcomes:									
<ol style="list-style-type: none"> 1. Exhibit sound knowledge to solve problems of Quantitative Aptitude 2. Demonstrate ability to solve problems of Logical Reasoning 3. Display the ability to tackle questions of Verbal Ability 									
Module:1	Logical Reasoning	5 hours							
Word group categorization questions									
Puzzle type class involving students grouping words into right group orders of logical sense									
Cryptarithmetic									
Module:2	Data arrangements and Blood relations	6 hours							
Linear Arrangement - Circular Arrangement - Multi-dimensional Arrangement - Blood Relations									
Module:3	Ratio and Proportion	6 hours							
Ratio - Proportion - Variation - Simple equations - Problems on Ages - Mixtures and alligations									
Module:4	Percentages, Simple and Compound Interest	6 hours							
Percentages as Fractions and Decimals - Percentage Increase / Decrease - Simple Interest - Compound Interest - Relation Between Simple and Compound Interest									
Module:5	Number System	6 hours							
Number system- Power cycle - Remainder cycle - Factors, Multiples - HCF and LCM									
Module:6	Essential grammar for Placement	7 hours							
<ul style="list-style-type: none"> • Prepositions • Adjectives and Adverbs • Tense • Speech and Voice • Idioms and Phrasal Verbs • Collocations, Gerunds and Infinitives • Definite and Indefinite Articles • Omission of Articles • Prepositions • Compound Prepositions and Prepositional Phrases • Interrogatives 									
Module:7	Reading Comprehension for Placement	3 hours							
Types of questions - Comprehension strategies - Practice exercises									
Module:8	Vocabulary for Placement	6 hours							
Exposure to questions related to Synonyms – Antonyms – Analogy - Confusing words - Spelling correctness									
		Total Lecture hours:			45 hours				
Text Book(s)									
1.	SMART. (2018). <i>Place Mentor 1st (Ed.)</i> . Chennai: Oxford University Press.								
2.	Aggarwal R.S. (2017). <i>Quantitative Aptitude for Competitive Examinations 3rd (Ed.)</i> . New Delhi: S. Chand Publishing.								

3.	FACE. (2016). <i>Aptipedia Aptitude Encyclopedia</i> 1 st (Ed.). New Delhi: Wiley Publications.
4.	ETHNUS. (2016). <i>Aptimithra</i> , 1 st (Ed.) Bangalore: McGraw-Hill Education Pvt. Ltd.
Reference Books	
1.	Sharma Arun. (2016). <i>Quantitative Aptitude</i> , 7 th (Ed.). Noida: McGraw Hill Education Pvt. Ltd.
Mode of evaluation: CAT, Assessments and FAT (Computer Based Test)	
Recommended by Board of Studies	28.06.2021
Approved by Academic Council	No. 63 Date 23.09.2021

Course Code	Course Title	L	T	P	C				
BSTS201P	Qualitative Skills Practice - I	0	0	3	1.5				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives:									
<ol style="list-style-type: none"> 1. To enhance the logical reasoning skills of students and improve problem-solving abilities 2. To strengthen the ability of solving quantitative aptitude problems 3. To enrich the verbal ability of the students for academic purposes 									
Course Outcomes:									
<ol style="list-style-type: none"> 1. Become experts in solving problems of quantitative Aptitude 2. Learn to defend and critique concepts of logical reasoning 3. Integrate and display verbal ability effectively 									
Module:1	Lessons on excellence	2 hours							
Skill introspection - Skill acquisition - consistent practice									
Module:2	Thinking Skill	6 hours							
<ul style="list-style-type: none"> • Problem Solving • Critical Thinking • Lateral Thinking 									
Rebus puzzles, and word-link builder questions									
Module:3	Logical Reasoning	6 hours							
<ul style="list-style-type: none"> • Coding and Decoding • Series • Analogy • Odd Man Out • Visual Reasoning 									
Module:4	Sudoku puzzles	3 hours							
Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers									
Module:5	Attention to detail	3 hours							
Picture and word driven Qs to develop attention to detail as a skill									
Module:6	Quantitative Aptitude	14 hours							
Speed Maths									
<ul style="list-style-type: none"> • Addition and Subtraction of bigger numbers • Square and square roots • Cubes and cube roots • Vedic maths techniques • Multiplication Shortcuts • Multiplication of 3 and higher digit numbers • Simplifications • Comparing fractions • Shortcuts to find HCF and LCM • Divisibility tests shortcuts 									

Algebra and functions		
Module:7	Verbal Ability	6 hours
Grammar challenge A practice paper with sentence based and passage-based questions on grammar discussed - Nouns and Pronouns, Verbs, Subject-Verb Agreement, Pronoun-Antecedent Agreement, Punctuations		
Verbal reasoning		
Module:8	Recruitment Essentials	5 hours
Looking at an engineering career through the prism of an effective resume		
<ul style="list-style-type: none"> • Importance of a resume - the footprint of a person's career achievements • Designing an effective resume • An effective resume vs. a poor resume • Skills you must build starting today the requisite? • How does one build skills 		
Impression Management		
Getting it right for the interview:		
<ul style="list-style-type: none"> • Grooming, dressing • Body Language and other non-verbal signs • Displaying the right behaviour 		
	Total Lecture hours:	45 hours
Text Book(s)		
1.	SMART. (2018). <i>Place Mentor</i> 1 st (Ed.). Chennai: Oxford University Press.	
2.	Aggarwal R.S. (2017). <i>Quantitative Aptitude for Competitive Examinations</i> 3 rd (Ed.). New Delhi: S. Chand Publishing.	
3.	FACE. (2016). <i>Aptipedia Aptitude Encyclopedia</i> 1 st (Ed.). New Delhi: Wiley Publications.	
4.	ETHNUS. (2016). <i>Aptimithra</i> , 1 st (Ed.) Bangalore: McGraw-Hill Education Pvt.Ltd.	
Reference Books		
1.	Sharma Arun. (2016). <i>Quantitative Aptitude</i> , 7 th (Ed.). Noida: McGraw Hill Education Pvt. Ltd.	
Mode of evaluation: CAT, Assessments and FAT (Computer Based Test)		
Recommended by Board of Studies	28-06-2021	
Approved by Academic Council	No. 68	Date 19-12-2022

Course Code	Course Title	L	T	P	C
BSTS202P	Qualitative Skills Practice - II	0	0	3	1.5
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives:

1. To apply critical thinking skills to related to their subject matter
2. To demonstrate competency in verbal, quantitative and reasoning aptitude
3. To produce good written skills for effective communication

Course Outcomes:

1. Apply critical thinking skills to problems solving related to their subject matter
2. Demonstrate competency in verbal, quantitative and reasoning aptitude
3. Display good written skills for use in academic and professional scenarios

Module:1	Logical Reasoning	5 hours
	<ul style="list-style-type: none"> • Clocks • Calendars • Direction Sense • Cubes Practice on advanced problems	
Module:2	Data interpretation and Data sufficiency - Advanced	5 hours
	<ul style="list-style-type: none"> • Advanced Data Interpretation and Data Sufficiency questions of CAT level • Multiple chart problems • Caselet problems 	
Module:3	Time and work– Advanced	5 hours
	<ul style="list-style-type: none"> • Work with different efficiencies • Pipes and cisterns: Multiple pipe problems • Work equivalence • Division of wages • Advanced application problems with complexity in calculating total work 	
Module:4	Time, Speed and Distance - Advanced	5 hours
	<ul style="list-style-type: none"> • Relative speed • Advanced Problems based on trains • Advanced Problems based on boats and streams • Advanced Problems based on races 	
Module:5	Profit and loss, Partnerships and averages - Advanced	5 hours
	<ul style="list-style-type: none"> • Partnership • Averages • Weighted average • Advanced problems discussed 	
Module:6	Number system - Advanced	4 hours

Advanced application problems on Numbers involving HCF, LCM, divisibility tests, remainder and power cycles.		
Module:7	Verbal Ability	13hours
Sentence Correction - Advanced		
<ul style="list-style-type: none"> • Subject-Verb Agreement • Modifiers • Parallelism • Pronoun-Antecedent Agreement • Verb Time Sequences • Comparisons • Prepositions • Determiners 		
Quick introduction to 8 types of errors followed by exposure to GMAT level questions		
Sentence Completion and Para-jumbles - Advanced		
<ul style="list-style-type: none"> • Pro-active thinking • Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues) • Fixed jumbles • Anchored jumbles 		
Practice on advanced GRE/ GMAT level questions		
Reading Comprehension – Advanced		
Exposure to RCs of the level of GRE/ GMAT relating to a wide variety of subjects		
Module:8	Writing skills for Placement	3 hours
Essay writing		
<ul style="list-style-type: none"> • Idea generation for topics • Best practices • Practice and feedback 		
	Total Lecture hours:	45 hours
Text Book(s)		
1.	SMART. (2018). <i>Place Mentor</i> 1 st (Ed.). Chennai: Oxford University Press.	
2.	Aggarwal R.S. (2017). <i>Quantitative Aptitude for Competitive Examinations</i> 3 rd (Ed.). New Delhi: S. Chand Publishing.	
3.	FACE. (2016). <i>Aptipedia Aptitude Encyclopedia</i> 1 st (Ed.). New Delhi: Wiley Publications.	
4.	ETHNUS. (2016). <i>Aptimithra</i> , 1 st (Ed.) Bangalore: McGraw-Hill Education Pvt. Ltd.	
Reference Books		
1.	Sharma Arun. (2016). <i>Quantitative Aptitude</i> , 7 th (Ed.). Noida: McGraw Hill Education Pvt. Ltd.	

Mode of evaluation: CAT, Assessments and FAT (Computer Based Test)			
Recommended by Board of Studies	28-06-2021		
Approved by Academic Council	No. 68	Date	19-12-2022

Short Syllabus

BARB101L Arabic (2-0-0-2)

Arabic alphabet - The Pronunciation (Phonetic symbol of Arabic Alphabet) - Shapes of Arabic letters - The Vowel - The Vowel Signs & the Cases - The Sun letters & Moon letters - The Noun - The Verb - The Particle - The Definite & the Indefinite - The Gender. Singular - Dual & Plural - Adjective and Noun qualified - The Personal Pronoun - The Demonstrative Pronoun - The Relative Pronoun - The Subject & the Predicate - The Demonstrative Phrase – Conjugations - Daily usage vocabularies – Numerals - Days of the week - Months of the year – Seasons – Colors – Relationship - Technical terminologies.

BARB101L	Arabic	L	T	P	C
		2	0	0	2
Pre-requisite	NIL			Syllabus version	
				1.0	

Course Objectives

The course gives students the necessary background to:

1. Demonstrate proficiency in communicating in Arabic language.
2. Develop the ability to narrate and describe in past, present, and future time by acquiring Arabic grammar knowledge.
3. Develop the knowledge of Arabic literature, culture, and Arabic technical terminologies.

Course Outcome

The student will be able to:

1. Remember Arabic Alphabets and Vowel signs.
2. Remember simple phrases like days, months, colors with simple conversation in professional and corporate mellow.
3. Understand the parts of speech and conjugations (Past, Present, Futures & Imperative).
4. Remember the Cardinal and Ordinal numbers and different types of members of the family as well as society.

Module:1	حروف لهجاء	2 hours
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Arabic alphabet. The Pronunciation (Phonetic symbol of Arabic Alphabet). Shapes of Arabic letters.

Module:2	حروف لعنة	3 hours
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The Vowel. The Vowel Signs & the Cases. The Sun letters & Moon letters.

Module:3	فهیام لکلمة	4 hours
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The Noun. The Verb. The Particle. The Definite & the Indefinite.

Module:4	لجنس. لموصوف ولصفة	5 hours
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The Gender. Singular, Dual & Plural. Adjective and Noun qualified.

Module:5	لفظ مفہور	5 hours
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The Personal Pronoun. The Demonstrative Pronoun. The Relative Pronoun. The Subject & the Predicate. The Demonstrative Phrase.

Module:6	تصویف افعال (لمضی و لمضارع و الامر)	5 hours
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Conjugations. Daily usage vocabularies.

Module:7	الاعداد ولمضادات لتقدير	4 hours
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Numerals. Days of the week. Months of the year. Seasons. Colors. Relationship. Technical terminologies (Computer, Civil & Mechanical Engineering)

Module:8	محضرات	2 hours
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Total Lecture hours: **30 hours**

Textbook(s)

1. Dr. V. Abdur Rahim, Arabic Course for English Speaking students (Vol-1, 2 & 3), 2019, First Edition, Goodword Books, New Delhi. ISBN: 978-0-9879146-2-0.

Reference Books

1. Dr. W. A. Nadwi, A Practical Approach to the Arabic Language, Islamic studies Research.
2. Academy, New Delhi. Revised edition-2016. ISBN: 9798189202148
Dr. Aurang zeb Azmi, A New approach to the Arabic Grammar, Al-balagh Publication-New Delhi. 2018. ISBN: 978-93-83313-57-0.

Mode of Evaluation: CAT, Digital assignment, Quiz, FAT

Recommended by Board of Studies	30-10-2021
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Approved by Academic Council	No. 64	Date	16-12-2021
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Bachelor of Technology in Chemical Engineering, Civil Engineering, Computer Science and Engineering and with Specializations, Electronics and Instrumentation, Electrical and Electronics, Electronics and Communication and with Specialization, Fashion Technology, Information Technology, Mechanical Engineering and with Specializations, Mechatronics and Automation.

Short Syllabus

BCHI101L Chinese I (2-0-0-2)

Phonetics 语音 YuYin - Writing System 书写系统 shuxiexitong - Chinese Characters – Radicals
- Stroke order - The personal pronouns - Question with the interrogative pronoun “谁- Special questions with “什么” - The Affirmative-Negative questions - • Using “不” to express negation - Special questions with “哪儿” or “什么地方” - Learn to ask and tell one's occupation - Adverbials of time and place - Noun/pronoun+“的”+noun - Age (Learn to ask and tell one's age) - The numerals - The special questions with “几” - Time (Learn to tell time in native speakers' style) - Currency (Get idea about the usage of notes and coins in China) - The questions with “多少” and “怎么”.

BCHI101L	Chinese I	L	T	P	C				
		2	0	0	2				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
The course gives students the necessary background to:									
<ol style="list-style-type: none"> 1. Develop basic Chinese and do simple conversation. 2. Write Chinese writing system and basic Chinese characters. 3. Understand basic language texts relating to common daily settings and develop translation ability (Chinese to English & vice-versa). 									
Course Outcome									
The students will be able to:									
<ol style="list-style-type: none"> 1. Greeting people in Chinese and use of personal pronouns and interrogative pronouns. 2. Express family names and understand yes – no question and correct use of phonetics. 3. Create expressions related to nationality, place of origin and special questions. 4. Learn occupations in Chinese, Adverbials of time and place and noun and pronouns and create expressions related to age, numbers, special questions in Chinese. 									
Module:1	Phonetics 语音 YuYin	3 hours							
<ul style="list-style-type: none"> • Phonetics: Syllable initials:/ b / p/m /f ;; • Syllable simple finals:/ a //o// e//i/u// ü; • Phonetics: Syllable initials:/ d//t /n/l; • Syllable compound finals: an// ie //uo/ • Phonetics: Syllable initials:/ g/k/ h/; • Syllable compound finals::/ ai // ao//ei//en/ • Phonetics: Syllable initials:/j//q//x/; • Syllable compound finals: /ang //eng//ong//iang// iong/ • Phonetics: Syllable initials:/z/c//s/; • Phonetics: Syllable initials:/zh//ch//sh//r; • Tones: /1// 2 // 3/ /4/ 									
Module:2	Writing System 书写系统 shuxiexitong	4 hours							
<ul style="list-style-type: none"> • Chinese Characters • Radicals • Stroke order 									
Module:3	Greetings 问候 wenhou	3 hours							
<ul style="list-style-type: none"> • Learn the basic ways to greet people, and tell one's own name and other's name • The personal pronouns“你, 我, 他/她, 您, 您们” • Question with the interrogative pronoun“谁” 									
Module:4	Family Names 名姓 mingxing	4 hours							
<ul style="list-style-type: none"> • Learn to ask and tell Family names, given names • Special questions with “什么” • The Affirmative-Negative questions 									
Module:5	Nationality 国籍 guoji	4 hours							
<ul style="list-style-type: none"> • Learn to ask and tell one's Nationality and origin) • Using “不” to express negation • Special questions with “哪儿”or “什么地方” 									
Module:6	Occupation 职业 zhiye	5 hours							

<ul style="list-style-type: none"> • Learn to ask and tell one's occupation • Adverbials of time and place • Noun/pronoun+“的”+noun 		
Module:7	Numbers 数字 shuzi	5 hours
	<ul style="list-style-type: none"> • Age (Learn to ask and tell one's age) • The numerals • The special questions with “几” • Time (Learn to tell time in native speakers' style) • Currency (Get idea about the usage of notes and coins in China) • The questions with “多少” and “怎么” 	
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	30 hours
Textbook(s)		
1.	Jiang Liping (2014) 《HSK Standard Course 1》 Beijing, Beijing Language and Culture University Press, ISBN7-5619-3709-9.	
Reference Books		
1.	Kang Yuhua & Lai Siping, (2005) 《Conversational Chinese 301》 Book-1& 2, Beijing, Beijing Language and Culture University Press, ISBN 978-7-5619-1403-8/ H 05014.	
Mode of Evaluation: CAT, Digital assignment, Quiz, FAT		
Recommended by Board of Studies	30-10-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

Short Syllabus

BESP101L Spanish I (2-0-0-2)

El Abecedario - Saludos y Datos personales – Origen – Nacionalidad - Números Cardinales (1-100) - Vocales y Consonantes – Sílabas - Artículos definidos e indefinidos - Número y Género - Edad y posesión - Números Cardinales (101-100 000) – Profesión - Los días de la semana - Pronombres personales – Adjetivos - Los verbos SER y TENER - Los verbos regulares (-AR, -ER, -IR) en el presente - Hacer un conocimiento del mundo Hispano - Vocabulario de Mi habitación - Países y Ciudades – Colores - Números Ordinales - Del Primero a Décimo (1 - 10) - Descripción de lugares y cosas - Adjetivos posesivos - El uso del verbo SER y ESTAR - Diferencia entre SER y ESTAR - Mi familia. Direcciones - Expresar la hora - Los meses del año - Expresar y preguntar sobre gustos e intereses - Frases preposicionales - Uso del HAY - Expresar fechas - el tiempo y las direcciones - Presentar y Describir a una persona y lugar - Los verbos irregulares (E-IE, O-UE, E-I) en el presente - Describir el diario - Las actividades cotidianas - Identificar objetos - expresar necesidad - Los Verbos y pronombres reflexivos y posesivos - Los verbos irregulares. Estar + gerundio.

BESP101L	Spanish I	L	T	P	C				
		2	0	0	2				
Pre-requisite	NIL	Syllabus version							
		1.0							
Course Objectives									
The course gives students the necessary background to:									
<ol style="list-style-type: none"> Demonstrate proficiency in reading, writing, and speaking in basic Spanish. Learn vocabulary related to profession, education centers, day-to-day activities, food, culture, sports and hobby, family set up, workplace, market, and classroom activities. Demonstrate the ability to describe things in simple forms and their details and translate from Spanish to English and vice versa. 									
Course Outcome									
The students will be able to									
<ol style="list-style-type: none"> Remember greetings, give personal details and identify genders by using correct articles. Apply the correct use of SER, ESTAR, and TENER verbs to describe people, place, and things. Discuss time and weather conditions by knowing months, days, and seasons in Spanish. Create opinion about people and places by using regular verbs and reflexive verbs and creating small paragraphs about the daily routine, hometown, best friend, and family. 									
Module:1	Abecedario; Saludos y Despedidas	4 hours							
El Abecedario, Saludos y Datos personales: Origen, Nacionalidad, Números Cardinales (1-100)									
Recursos Gramaticales: Vocales y Consonantes, Sílabas. Artículos definidos e indefinidos (Número y Género).									
Recursos Comunicativos: Saludar y despedirse: Aprender a Presentarnos, a preguntar cosas en clase.									
Module:2	Datos personales; recursos para preguntar sobre las palabras	4 hours							
Edad y posesión. Números Cardinales (101-100 000), Profesión, Los días de la semana.									
Recursos Gramaticales: Pronombres personales. Adjetivos. Los verbos SER y TENER. Los verbos regulares (-AR, -ER, -IR) en el presente.									
Recursos Comunicativos: Escribe sobre mismo/a y los compañeros de la clase.									
Module:3	Describir lugares; Expresar existencia y ubicación	4 hours							
Hacer un conocimiento del mundo Hispano. Vocabulario de Mi habitación, Países y Ciudades. Colores, Números Ordinales:									
Del Primero a Décimo (1 - 10). Descripción de lugares y cosas.									
Recursos Gramaticales: Adjetivos posesivos. El uso del verbo SER y ESTAR. Diferencia entre SER y ESTAR. ¿qué, cuál / cuáles, cuántos / cuántas, dónde, cómo, quién, cuándo?									
Recursos Comunicativos: Mi habitación, Mi Ciudad.									
Module:4	Mi familia; Direcciones; Expresar la hora y los gustos	4 hours							
Mi familia. Direcciones. Expresar la hora.									
Los meses del año. Expresar y preguntar sobre gustos e intereses.									
Recursos Gramaticales: Frases preposicionales. Uso del HAY.									
La diferencia entre MUY y MUCHO. Uso del verbo GUSTAR, JUGAR,									
Recursos Comunicativos: Mi familia. Dar opiniones sobre tiempo.									
Module:5	El clima; habilidades y aptitudes; Cualidades y defectos de las personas	4 hours							
Expresar fechas, el tiempo y las direcciones. Presentar y Describir a una persona y lugar.									
Recursos Gramaticales: Los verbos irregulares (E-IE, O-UE, E-I) en el presente.									

Recursos Comunicativos: Mi mejor amigo/a. Expresar fechas. Traducción Inglés al español y español al inglés.				
Module:6	Describir el diario; Las actividades cotidianas;	4 hours		
Describir el diario. Las actividades cotidianas. Identificar objetos, expresar necesidad. Recursos Gramaticales: Los Verbos y pronombres reflexivos y posesivos. Recursos Comunicativos: El horario. Traducción Inglés a español y español a inglés.				
Module:7	La Gastronomía: Ir al Restaurante	4 hours		
La Gastronomía: ¡A Comer! Dar opiniones sobre alimentos y bebidas. Describir mi ciudad y Ubicar los sitios en la ciudad. Recursos Gramaticales: Los verbos irregulares. Estar + gerundio. Poder + Infinitivo. Recursos Comunicativos: En la cafetería, Conversación en un restaurante. Mi ciudad natal. Mi Universidad.				
Module:8	Contemporary Issues	2 hours		
	Total Lecture hours:	30 hours		
Textbook(s)				
1.	Jaime Corpas, Eva Garcia, Agustin Garmendia, AULA INTERNACIONAL 1, Curso de Español, 1 January 2016, GoyalPublishers and DistributorsPvt. Ltd, New Delhi, India			
Reference Books				
1.	Shalu Chopra, VIVA LATINO 1, January 2019, Goyal Publishers and Distributors Pvt.Ltd, New Delhi, India			
2.	Ramón Díez Galán, NuevoDELE A1: Versión 2020. Preparación para el examen. Modelos de examen			
3.	DELE A1 (Spanish Edition), July 14, 2020, Independently Published. Spain. Charo Cuadrad, Pilar Melero, Enrique Sacristan, PROTAGONISTAS A1. LIBRO DEL ALUMNO, 1 January 2018, GoyalPublishers and DistributorsPvt. Ltd, New Delhi, India			
Mode of Evaluation: CAT, Digital Assignment, Quiz, FAT				
Recommended by Board of Studies	30-10-2021			
Approved by Academic Council	No. 64	Date 16-12-2021		

Short Syllabus

BFRE101L French I (2-0-0-2)

Les Alphabets - Les Salutations - Les nombres (0-100000) - L'heure - Les jours de la semaine - Les mois de l'année - Les Pronoms personnels sujets - La conjugaison des verbes réguliers - La Nationalité du Pays - Les articles définis/indéfinis - Les prépositions de lieu et l'article contracté - L'heure en français -La Couleur -La conjugaison des verbes - habiter / venir/Aller etc - Les adjectifs possessifs - L'accord des adjectifs - Les pronoms toniques - La conjugaison du verbe 'faire' avec du, de la, de l', des - L'interrogation avec combien / comment / où etc - L'adjectif démonstratif - L'adjectif interrogatif - La gastronomie française - Les endroits - Le présent progressif - L'article partitif - Trouvez les questions.

BFRE101L	French I	L	T	P	C				
		2	0	0	2				
Pre-requisite	NIL	Syllabus version							
		1.0							
Course Objectives									
The course gives students the necessary background to:									
<ol style="list-style-type: none"> 1. Develop language competencies for effective communication in French. 2. Provide insights into the French culture and make them understand the nuances through communication activities. 3. Enable the students to communicate effectively in general and in a professional context. 									
Course Outcome									
The students will be able to:									
<ol style="list-style-type: none"> 1. Acquaint with the basics of the French Language. 2. Comprehend the various parts of speech and grammar concepts to frame basic sentences in French. 3. Translate and acquire knowledge on a broad range of printed materials for general, specific, and practical information. 4. Acquire and explain the culture of French people through the language studied in the class. 									
Module:1	Saluer et se presenter:	6 hours							
Les Alphabets, Les Salutations, Les nombres (0-100000), L'heure, Les jours de la semaine, Les mois de l'année, Les Pronoms personnels sujets, La conjugaison des verbes réguliers (Les verbes ER) / irréguliers (avoir / être)									
Savoir-faire et savoir-agir :									
Saluer, Se présenter, Présenter quelqu'un, Donner des informations, Discuter de la classe / l'université.									
Module:2	L'activitéinteractive:	6 hours							
La Nationalité du Pays, Les articles définis / indéfinis, Les prépositions de lieu et l'article contracté, L'heure en français, La Couleur, La conjugaison des verbes - habiter / venir/Aller etc.									
Savoir-faire et savoir-agir :									
Localiser des lieux dans une ville, Exprimer l'heure en français et Échanger des informations sur un hébergement.									
Module:3	Les activités quotidiennes:	4 hours							
Les adjectifs possessifs, L'accord des adjectifs, Les pronoms toniques, La conjugaison du verbe 'faire' avec du, de la, de l', des. L'interrogation avec combien / comment / où etc. L'adjectif démonstratif, L'adjectif interrogatif, La traduction simple (français-anglais/anglais-français)									
Savoir-faire et savoir-agir :									
Parler de la famille, Décrire une personne, parler de nos goûts, parler de nos activités.									
Module:4	S'exprimer:	4 hours							
Les parties du corps. Avoir mal à + les parties du corps La conjugaison des verbes pronominaux, La conjugaison des verbes réguliers (ir) et les autres verbes tels que -lire, écrire, pouvoir, vouloir, devoir, et sortir.									
Savoir-faire et savoir-agir :									
Parler de nos quotidiennes, proposer une sortie, inviter, accepter et refuser une invitation.									
Module:5	La culturefrançaise:	3 hours							
La gastronomie française. Les endroits. Le présent progressif, L'article partitif, Mettez les phrases au pluriel et faites des phrases avec les mots donnés, Trouvez les questions.									
Savoir-faire et savoir-agir :									
Décrire une journée extraordinaire, Répondre aux questions générales en français, Faire									

des phrases.	
Module:6	L'activité dialogique: 2 hours
La traduction avancée (français-anglais/anglais-français)	
Savoir-faire et savoir-agir :	
Faire des achats, Demander la direction, Réserver une chambre dans un hôtel, La compréhension écrite et orale.	
Module:7	L'activité de loisir 3 hours
La rédaction / Dialogue: Décrire / parler de: ses goûts et préférences/ une personne / une place/ à la cafeteria / la profession / l'université/ les loisirs.	
Module:8	Faciliter des échanges académiques 2 hours
	Total Lecture hours: 30hours
Textbook(s)	
1.	Nathalie Hirschsprung, Tony Tricot, COSMOPOLITE- 1- Méthode de français, 2017, Hachette Français Langue t rang re, Paris.
Reference Books	
1.	Celine Braud, EDITO 1, Méthode de français, 2016, Didier,Paris.
2.	Marie-Noelle Cocton, GÉNÉRATION 1, Méthode de français, 2016, Didier,Paris.
Mode of Evaluation: CAT , Digital assignment , Quiz , FAT	
Recommended by Board of Studies	30-10-2021
Approved by Academic Council	No. 64 Date 16-12-2021

Short Syllabus

BGER101L German I (2-0-0-2)

Grüßen und Verabschieden - sich und andere vorstellen - Namen, Telefonnummer und EMail-Adresse buchstabieren - Zahlen bis 100 und mehr nennen - über Länder - Sprachen und Nationalitäten sprechen - Über Hobbys und Freizeitaktivitäten sprechen - Wochentage und Monate nennen - die Uhrzeit nennen - über Arbeit - Berufe und Arbeitszeiten sprechen - über Familie sprechen - Über Essen sprechen - Gespräche beim Essen führen - Gespräche beim Einkauf führen - über Vorlieben beim Essen sprechen - Etwas gemeinsam planen - eine Speisekarte verstehen - im Restaurant bestellen und bezahlen - sich im Kaufhaus orientieren - Wortschatz: Glückwünsche – Redemittel - Stockwerke und Waren im Kaufhaus - Wohnungsanzeigen verstehen - Wohnsituationen beschreiben - ein Zimmer beschreiben - Positionen beschreiben - Gefallen und Missfallen ausdrücken - Nach dem Weg fragen - Verkehrsmittel und Verkehrsschilder benennen.

BGER101L	German I	L	T	P	C
		2	0	0	2
Pre-requisite	NIL	Syllabus version		1.0	
Course Objectives					

The course gives students the necessary background to:

1. Demonstrate proficiency in reading, writing, and speaking in basic German.
2. Communicate in German in everyday situations.
3. Understand German culture and adapt in German speaking countries or to work with German speaking people.

Course Outcome

The students will be able to:

1. Understand basic expressions, words, signs and simple conversations.
2. Understand and translate short texts, simple descriptions, directions and illustrated narratives about daily activities.
3. Write grammatically correct sentences, short paragraphs, informal letters/e-mails, post cards etc... on matters of personal relevance and describe places and people in a simple language.
4. Use German in easy day-to-day conversations and demonstrate understanding of German culture.

Module:1	Die erste Begegnung	4 hours
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Grüßen und Verabschieden; sich und andere vorstellen; Namen, Telefonnummer und E-Mail-Adresse buchstabieren; Zahlen bis 100 und mehr nennen; über Länder, Sprachen und Nationalitäten sprechen.

Wortschatz: Begrüßungen, verabschieden, das Deutsche Alphabet, Zahlen, Länder und Sprachen

Grammatik: „W“ Fragen, Aussagesätze, Personalpronomen im Singular und Verbkonjugation (sein/kommen/wohnen/lernen/studieren/sprechen/buchstabieren), Bestimmter Artikel

Schreiben: sich und andere vorstellen

Module:2	Hobbys und Berufe	4 hours
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Über Hobbys und Freizeitaktivitäten sprechen; Wochentage und Monate nennen; die Uhrzeit nennen; über Arbeit, Berufe und Arbeitszeiten sprechen;

Wortschatz: Hobbys und Berufe, Uhrzeiten

Grammatik: Regel-und-Unregelmäßigen verbkonjugationen, haben konjugatio, Bestimmter und Unbestimmter Artikeln, Ja/Nein Fragen, die entsprechende Präpositionen (um/am/im/von...bis), Negation (nicht vs kein), Verbpositionen und Wortfolge

Schreiben: Was machst du in deiner Freizeit?

Module:3	Familie	4 hours
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über Familie sprechen;

Wortschatz: Familie

Grammatik: Possessivpronomen, Nominativ und Akkusativ (Artikel und Personalpronomen)

Schreiben: „Meine Familie“

Module:4	Essen und Trinken	4 hours
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Über Essen sprechen; Gespräche beim Essen führen; Gespräche beim Einkauf führen; über Vorlieben beim Essen sprechen;

Wortschatz: Lebensmittel, Getränke, Mahlzeiten

Grammatik: Verben - möchten/mögen, Akkusativ, Verben mit Akkusativ, Präpositionen mit dem Akkusativ (für/ohne)

Module:5	ZusammenmitFreunden	4 hours
Etwas gemeinsam planen; eine Speisekarte verstehen; im Restaurant bestellen und bezahlen; sich im Kaufhaus orientieren		
Wortschatz: Glückwünsche, Redemittel, Stockwerke und Waren im Kaufhaus Grammatik: Imperativ mit du und ihr, Artikel im Dativ, Personalpronomen im Dativ, Dativpräpositionen (mit, nach, ab, von), Modalverben (können, sollen, wollen) Schreiben: Inoffizielle Emails schreiben		
Module:6	MeineWohnung	4 hours
Wohnungsanzeigen verstehen, Wohnsituationen beschreiben; ein Zimmer beschreiben; Positionen beschreiben, Gefallen und Missfallen ausdrücken;		
Wortschatz: Wohnung, Zimmer und Räume, Möbel und Geräte, Farben Grammatik: Adjektiv mit sein, zu/sehr+Adj, Wechselpräpositionen Schreiben: „Wohnung“		
Module:7	Eine Stadtrundfahrt	4 hours
Nach dem Weg fragen; Verkehrsmittel und Verkehrsschilder benennen;		
Wortschatz: Plätze und Gebäude, Verkehrsmittel, Richtungen, Sehenswürdigkeiten Grammatik: Imperativ mit Sie, Modalverben (müssen/dürfen), Zeitadverbien: zuerst, dann, später... Schreiben: „Meine Stadt“		
Module:8	Training vom Sprechen	2 hours
Total Lecture hours:		30hours
Textbook(s)		
1.	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, Ernst Klett Sprachen GmbH, Netzwerk A1, 2017, Stuttgart.	
Reference Books		
1.	Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, Ernst Klett Sprachen GmbH, Netzwerk A1 Deutsch als Fremdsprache Intensivtrainer, 2019, Stuttgart	
2.	Hartmut Aufderstrasse, Jutta Müller, Thomas Storz, Lagune, 2012.	
3.	Dallapiazza, Rosa-Maria; Jan, Eduard von; Schönher, Til, Hueber Verlag, 2008: Tangram aktuell.	
4.	Hermann Funk, Christina Kuhn, Cornelsen Verlag, Studio d A1, 2010, Berlin.	
Mode of Evaluation: CAT, Digital assignment, Quiz, FAT		
Recommended by Board of Studies	01-11-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

Short Syllabus

BGRE101L

Modern Greek

(2-0-0-2)

Correct usage and pronunciation of Greek letters - Greek symbols used in mathematics, science and engineering - Greek suffixes and prefixes used in International Scientific Vocabulary - International Phonetic Alphabet and phonetics of Modern Greek - Greek monotonic system - word stress rules - capitalization and punctuation rules - Gender - number – case – adjectives - explaining agreement - definite and indefinite articles - personal, interrogative – possessive - demonstrative - indefinite pronouns - Formal and informal greetings - Nationality and Family - Daily Routine and Transportation - Weather, Seasons and Urban Activities.

BGRE101L	Modern Greek	L	T	P	C						
		2	0	0	2						
Pre-requisite	NIL	Syllabus version		1.0							
Course Objectives											
The course gives students the necessary background to:											
<ol style="list-style-type: none"> 1. Master the Greek terminology widely used in their subjects of specialization. 2. Communicate in Modern Greek in their day-to-day life. 											
Course Outcome											
The students will be able to:											
<ol style="list-style-type: none"> 1. Make use of the Modern Greek language in everyday conversation. 2. Understand contents from scientific texts that use Greek letters and words, becoming familiar with fundamental linguistic aspects of the International Scientific Vocabulary, and becoming able to formulate hypotheses about unknown compound words derived from Greek. 3. Understand critical socio-economic issues in contemporary Europe, developing their aptitude for critical thinking. 4. Become more aware of linguistic theory and phonetics and correctly pronounce Greek letters and words, be more conscious and confident in using their English vocabulary derived from Greek and compare Modern Greek with a wide number of other languages through a deeper understanding of the International Phonetic Alphabet. 											
Module:1	Το Ελληνικό αλφάβητο, η φωνητική και η προφορά, το μονοτονικό σύστημα και τα σημεία στίξης - Introduction to the Greek Alphabet, Phonetics, Accentuation & Punctuation	10 hours									
Correct usage and pronunciation of Greek letters; Greek symbols used in mathematics, science and engineering; Greek suffixes and prefixes used in International Scientific Vocabulary; International Phonetic Alphabet and phonetics of Modern Greek; Greek monotonic system (usage of grave accent and diaeresis); word stress rules; capitalization and punctuation rules.											
Module:2	Η Δομή των Φράσεων και η Πρόταση: Γραμματική - Structure and grammar	3 hours									
Gender (masculine, feminine, neuter), number (singular/plural) and case (nominative, genitive, accusative and dative); adjectives: explaining agreement (concord); definite and indefinite articles; personal, interrogative, possessive, demonstrative, indefinite pronouns.											
Module:3	Χαιρετισμοί: πληθυντικός ευγενείας - Formal and informal greetings	3 hours									
<u>Communicative functions:</u> using formal and informal greetings; introducing oneself using affirmative form.											
<u>Morphology and Syntax:</u> Auxiliary verb είμαι; personal pronouns (nominative form); cardinal numerals from 1 to 20.											
Module:4	Συστήνω τον εαυτό μου- Introductions	3 hours									
<u>Communicative functions:</u> asking and providing information about basic personal details (name, age, nationality, studies, profession).											
<u>Morphology and Syntax:</u> 1 st conjugation verbs (ending in -ω, simple present tense); masculine nouns in -ας/-ης/-ος (nominative singular); feminine nouns in -α/-η (nominative singular); neuter nouns in -ο/-ι (nominative singular).											

Module:5	Καταγωγήκαι οικογένεια - Nationality and Family	3 hours
<u>Communicative functions:</u> asking and providing information about nationality and languages known; describing the members of a nuclear or extended family.		
<u>Morphology and Syntax:</u> 2 nd conjugation verbs (ending in -αω, simple present tense); accusative case (singular, parasyllabic nouns); accusative case (singular personal pronouns); adjectives of nationality.		
Module:6	Ηκαθημερινήρουτίνα - Daily Routine and Transportation	3 hours
<u>Communicative functions:</u> asking and providing information about habits and daily routine; telling and asking the time; asking for and giving directions.		
<u>Morphology and Syntax:</u> verbs πάω, τρώω, λέω, ακούω; simple present tense and adverbs of frequency; simple prepositions.		
Module:7	Ο καιρός, οι εποχές του χρόνου και η ζωή στην πόλη - Weather, Seasons and Urban Activities	3 hours
<u>Communicative functions:</u> talking about the weather; asking the date; asking for prices; making calculations and perform a simple commercial transaction.		
<u>Morphology and Syntax:</u> accusative case (time); cardinal numerals up to one million; ordinal numbers; indefinite articles; accusative case (plural parasyllabic nouns).		
Module:8	Διάλεξημε προσκεκλημέν-ο/η ομιλ-ητή/ήτρια: κοινωνίακαιπραγματικότητα της σύγχρονης Ελλάδας – contemporary Issues	2 hours
		Total Lecture hours:
		30 hours
Textbook(s)		
1.	Georgantzi Evangelia, Raftopoulou Eleana, <i>Greek for you - Ελληνικάγιασας: Textbook A1 Beginners</i> , March 2018, New Bilingual Edition (ISBN: 978-9607307682), Neohel, Athens, Greece.	
2.	Georgantzi Evangelia, Raftopoulou Eleana, <i>Greek for you - Ελληνικάγιασας: Workbook A1 Beginners</i> , March 2018, New Bilingual Edition (ISBN: 978-9607307736), Neohel, Athens, Greece.	
Reference Books		
1.	Terpsi Gavala, Konstantinos Oikonomou, <i>Λυδία. Ένα καλοκαίρι στην Ελλάδα!</i> , 2019, first edition, Omilo, Athens, Greece.	
2.	Georgantzi Evangelia, <i>Greek for you - Ελληνικάγιασας: Textbook A0 Early Beginners + CD mp3</i> , 2018, Bilingual Bundle Edition (ISBN: 978-9607307668), Neohel, Athens, Greece.	
Mode of Evaluation: CAT, Digital Assignment, Quiz, FAT.		
Recommended by Board of Studies	01-11-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

Short Syllabus

BITL101L Italian (2-0-0-2)

Salutare - chiedere il nome – presentarsi - chiedere e indicare la provenienza – congedarsi - chiedere il numero di telefono e l'indirizzo e rispondere - chiedere di ripetere un'informazione - Chiedere e dire l'età - indicare occupazione e luogo di lavoro - chiedere e fornire informazioni personali – informarsi delle conoscenze linguistiche altrui e fornire le proprie - scusarsi e ringraziare - chiedere e dire l'età - ordinare al bar e al ristorante - chiedere e ordinare qualcosa in modo cortese - chiedere qualcosa che manca sul tavolo - chiedere il conto - fare una prenotazione telefonica - compitare - parlare del tempo libero - parlare della frequenza con cui si fa qualcosa - Descrivere un'abitazione descrivere i servizi di un - recensire un albergo - chiedere assistenza - Spazio e tempo - Parliamo di me.

BITL101L	Italian	L	T	P	C
		2	0	0	2
Pre-requisite	NIL	Syllabus version		1.0	
Course Objectives					

The course gives students the necessary background to:

1. Communicate in Italian in their day-to-day life.
2. Describe in simple terms (both in written and oral form) aspects of their background, immediate environment and needs.
3. Learn crucial aspects of Italian culture and civilization, as well as the role of the Italian economy in the global market.

Course Outcome

The students will be able to:

1. Use Italian language in everyday conversation.
2. Analyze the evolution of Modern European languages, understanding the important connections between English and Neo-Latin languages by using Italian language in written form, thus becoming more conscious of English vocabulary which is derived from Latin and Italian.
3. Understand important cultural aspects and socio-economic issues in contemporary Europe, developing their aptitude for critical thinking and adopting an internationally oriented approach in learning.
4. Understand the concept of Made in Italy, concerning the world-renowned Italian design, fashion, food, manufacturing, craftsmanship, and engineering industries.

Module:1	Primicontatti- Basic interaction	4 hours
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Communicative functions:

Salutare (greetings); chiedere il nome (asking someone's name); presentarsi (introducing yourself); chiedere e indicare la provenienza (asking and talking about one's provenance); congedarsi (leaving from a conversation); chiedere il numero di telefono e l'indirizzo e rispondere (sharing personal details such as telephone numbers and addresses); chiedere di ripetere un'informazione (asking someone to repeat a sentence or a piece of information).

Grammar and vocabulary skills:

I pronomi soggetto (subject pronouns io, tu, Lei); il presente di essere, avere, chiamarsi al singolare (simple present tense of the verbs essere, avere, chiamarsi); l'alfabeto (the alphabet); gli articoli determinativi (definite articles il & la); gli aggettivi di nazionalità al singolare (adjectives of nationality - singular); gli interrogativi: come, di dove, quale (interrogatives come, dove, qual); gli aggettivi numerali cardinali da 1 a 20 (numeral cardinal adjectives from one to twenty).

Module:2	Personne e professioni – People and professions	4 hours
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Communicative functions:

Chiedere e dire l'età (asking and telling someone's age); indicare occupazione e luogo di lavoro (share information about one's profession and work place); chiedere e fornire informazioni personali (sharing personal details, such as email, phone number etc.); informarsi sulle conoscenze linguistiche altrui e fornire le proprie (sharing information about one's spoken languages); scusarsi e ringraziare (excusing oneself, thanking someone); chiedere e dire l'età (asking and telling about someone's age).

Grammar and vocabulary skills:

I verbi regolari in -are (regular verbs - first conjugation); i verbi essere, avere, fare e stare (auxiliary verbs avere and essere, irregular verbs fare and stare); i sostantivi al singolare (singular nouns); la negazione (negative clauses); articoli determinativi e indeterminativi

(definite and indefinite articles); dimostrativi questo e questa (demonstratives); le preposizioni a e in (prepositions a, in); gli interrogativi che, chi, dove, quanti (interrogatives: what, who, where, howmany); gli aggettivi numerali cardinali fino a 100 (numeral cardinal adjectives up to 100).

Module:3	Cibi e bevande - Gastronomic culture in Italy	4 hours
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Communicative functions:

ordinare al bar e al ristorante (placing an order at a restaurant/café/bar); chiedere e ordinare qualcosa in modo cortese (asking something politely); chiedere qualcosa che manca sul tavolo (making special requests to a waiter); chiedere il conto (requesting the bill); fare una prenotazione telefonica (making a reservation over phone); compilare (spelling a name/address).

Grammar and vocabulary skills:

i verbi regolari in -ere (regular verbs - second conjugation); i verbi volere e preferire (irregular verbs volere and preferire); il plurale dei sostantivi (plural nouns); articoli determinativi plurali (plural definite articles); bene e buono | (adverb bene and adjective buono); gli interrogativi che cosa, quali, quante (interrogative forms: what, which one, howmany).

Module:4	Tempo libero, attività abituali - Free time and routine activities	4 hours
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Communicative functions:

parlare del tempo libero (discussing about free time and leisure); parlare della frequenza con cui si fa qualcosa (talking about the frequency of a certain activity).

Grammar and vocabulary skills:

i verbi regolari in -ire (regular verbs - third conjugation); i verbi andare, giocare, leggere e uscire (verbs andare, giocare, leggere and uscire); gli avverbi di frequenza (adverbs of frequency).

Module:5	La casa e la stanza d'albergo - Describing a room and everyday objects	4 hours
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Communicative functions:

descrivere un'abitazione (describing a home); descrivere i servizi di un albergo (describing a hotel room and the services available); recensire un albergo (writing a simple hotel review); chiedere assistenza (asking for someone's assistance).

Grammar and vocabulary skills:

i verbi regolari in -ire con -isc (regular verbs - third conjugation in -isc) c' / ci sono (usage of there is / there are); i verbi potere / venire (to be able to, to come); le preposizioni di tempo da... a (prepositions da... a); le preposizioni articolate (articulated prepositions); i mesi dell'anno (months of the year); gli aggettivi numerali ordinali (ordinal numeral adjectives); l'interrogativo quanto (usage of quanto); i numeri cardinali maggiori di 100 (cardinal numerals above 100); la data (date and time).

Module:6	Spazio e tempo – Space and Time	4 hours
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Communicative functions:

descrivere la propria città (describing one's city); chiedere un'informazione e reagire (asking for directions in an interactive way); descrivere un percorso (describing a route); rammaricarsi/scusarsi (expressing regret/apologizing); indicare qualcuno a delle altre persone (giving directions); parlare degli orari di apertura e chiusura (talking about opening hours); parlare del tempo atmosferico (talking about weather).

Grammar and vocabulary skills:

ci e il verbo andare (usage of the particle ci in combination with the verb to go); la concordanza degli aggettivi con i sostantivi (adjective-noun agreement); gli aggettivi in -co/-ca (adjectives ending in -co and -ca); il partitivo - l'articolo indeterminativo al plurale (partitives and quantitatives); molto (usage of molto); i verbi dovere e sapere (the verbs dovere and sapere); c' un...? / dov' il...? (usage of is there a...? / where is the...?); gli interrogativi quando e dove (interrogatives: when&where); l'orario - a che ora...? (usage of a che ora...? - at what time...?).

Module:7	Parliamo di me – Habits and Preferences	4 hours
<u>Communicative functions:</u> parlare di gusti e preferenze (talking about preferences and one's tastes); esprimere accordo e disaccordo (expressing agreement and disagreement); chiedere e dire l'ora (asking and telling the time).		
<u>Grammar and vocabulary skills:</u> preposizioni in, a, con (prepositions in, a, con); i giorni della settimana (days of the week); mi piace/mi piacciono (usage of mi piace); l'interrogativo perché (the interrogative perché).		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	30 hours
Textbook(s)		
1.	L. Ziglio, G. Rizzo, <i>Nuovo Espresso 1: Libro dello studente e esercizi</i> , 2018 (under license of ALMA, Italy), ISBN: 978-9386862853, Goyal Publishing House, New Delhi.	
Reference Books		
1.	C.M. Naddeo, E. Orlandino, <i>Dieci lezioni di italiano – Corso di lingua italiana per stranieri A1</i> , 2020, ALMA edizioni, Florence (Italy).	
Mode of Evaluation: CAT, Digital Assignment, Quiz, FAT.		
Recommended by Board of Studies	01-11-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

Short Syllabus

BJAP101L Japanese I (2-0-0-2)

Japanese language and alphabets - Hiragana and katakana - Reading and writing Hiragana and Katakana - 20 Nouns in Hiragana - 10 Nouns in Katakana – NumeralsDaily - greetings and basic phrases - Express about your name – occupation – age - where you live - where you are from - what language you can speak - your family - showing a photo - give compliments - your favorite foods and dishes - your breakfast – lunch - your room - around your home - the time and days - your plans in the week - Demonstrative pronoun -Kochira, Sochira- Achira and Dochira Koko - Soko, Asoko and Doko - Classification of Question words.

BJAP101L	Japanese I	L	T	P	C				
		2	0	0	2				
Pre-requisite	NIL	Syllabus Version		1.0					
Course Objectives									
The course gives students the necessary background to:									
<ol style="list-style-type: none"> 1. Develop interest in Japanese language by teaching them culture and general etiquettes. 2. Develop four basic skills that is reading, writing, listening, and speaking Japanese language. 3. Develop skills to understand and use everyday expressions as well as basic phrases. 									
Course Outcome									
Students will be able to:									
<ol style="list-style-type: none"> 1. Greet in Japanese and remember Japanese alphabets. 2. Introduce themselves as well as can briefly exchange the personal details related to family, home, favorite foods etc., in Japanese. 3. Create simple questions and its answers in Japanese as well as can briefly describe their daily routine in Japanese. 4. Understand the Japanese culture and etiquettes. 									
Module:1	Introduction, Hiragana, Katakana and Kanji	4 hours							
Introduction of Japanese language and alphabets; Hiragana and katakana									
Reading and writing Hiragana and Katakana, 20 Nouns in Hiragana and 10 Nouns in Katakana, Numerals									
Basic rule of Japanese phonetics.									
Module:2	Konnichiwa. Hajimemashite.	4 hours							
Daily greetings and basic phrases to introduce yourself									
Express about your name, occupation, age, where you live, where you are from and what language you can speak									
Body Language such as bowing, pointing to your face, etc.									
Module:3	WatashinoKazoku	4 hours							
Talk briefly about your family, how many members there are and who they are,									
Talk about your family showing a photo. Learn some phrases to give compliments.									
Module:4	Sukinatabemono. Hitotsukudasai.	4 hours							
Talk briefly about your favorite foods and dishes. Talk about your breakfast and where to go for lunch.									
Order food in a fast food restaurant.									
Module:5	Watashinoie. Ojamashimasu.	4 hours							
Say what kind of home you live in. Say what you have in your room and around your home									
Invite your friend to your place / visit your friend's house.									
Module:6	Nanjiniokimasuka. Itsugaiidesuka.	4 hours							
Say the time and days you do something, Talk about your plans in the week									
Talk about your plans and schedule.									
Module:7	KonoHitohaDareDesuka.	4 hours							
Demonstrative pronoun - Kore, Sore, Are and Dore, (This, That, Over there, which) Kono, sono, Ano and Dono (this, that, over there, which) Kochira, Sochira, Achira and Dochira. this way....) Koko, Soko, Asoko and Doko (Here, There.... location).Classification of Question words (Dare, Nani, Itsu, Doyatte, dooshite, Ikutsu, Ikura).									
Module:8	Contemporary Issues	2 hours							
	Total Lecture hours:	30 hours							

Textbook(s)			
1.	The Japan Foundation (2017), Marugoto Japanese Language and Culture Starter (A1) Course book For Communicative Language Activities, New Delhi: Goyal Publishers (9788183078054).		
Reference Books			
1.	The Japan Foundation (2017), Marugoto Japanese Language and Culture Starter A1 Course book For Communicative Language Competences, New Delhi: Goyal Publishers (9788183078047).		
2.	Banno, Eri et al (2020), Genki: An Integrated Course in Elementary Japanese I [Third Edition], Japan: The Japan Times.		
Mode of Evaluation: CAT, Digital Assignment, Quiz, FAT			
Recommended by Board of Studies	30-10-2021		
Approved by Academic Council	No. 64	Date	16-12-2021

Course Code	Course Title	L	T	P	C
BKOR101L	Basic Korean – Level 1	2	0	0	2
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To learn the basic Korean alphabet.
2. To enable to read and speak basic Korean necessary for daily life: salutations, self-introduction.
3. To know basic verbs and noun ending and conjugation
4. To read and write the bulletin board writings, invitations, menu card, simple memo noteand sign boards.

Course Outcomes

1. Read and write Korean.
2. Greet with Korean and introduce her/himself in Korean.
3. Grasp basic grammar and writing in Korean.
4. Understand and produce key expressions for everyday activities.

Module 1	Introduction	3 hours
Introduction to Korean Language, Culture, Cross Cultural Communication. After completing the lessons, students will be able to understand Korean Culture.		
Module 2	Korean Alphabets – Hangeul – I	6 hours
Philosophy of Korean alphabets, Introducing phonics, the character system. In this module, students will learn the Korean alphabet or Korean writing system called 'Hangeul'. After completing the lessons, the students will be able to understand the principles of how each letter was invented. Also, students will be able to read and write Hangeul.		
Module 3	Korean Alphabets – Hangeul – II	6 hours
Philosophy of Korean alphabets, Introducing phonics, the character system. In this module, students will learn the Korean alphabet or Korean writing system called 'Hangeul'. After completing the lessons, the students will be able to understand the principles of how each letter was invented. Also, students will be able to read and write Hangeul.		
Module 4	Basic Grammar	4 hours
Noun, Pronoun Basic Verb and Greetings & Introducing, after completing the lessons, students will be able to understand basic grammar, basic greetings and introducing oneself.		
Module 5	Self-Introduction & Essential expressions - I	3 hours
In this module, Students will learn how to greet and answer those questions in Korean. After completing the lessons, students will be able to introduce themselves, greet a person and talk about someone's nationalities and occupations.		
Module 6	Self-Introduction & Essential expressions - II	3 hours
In this module, Students will learn how to ask someone's nationalities and answer those questions in Korean. After completing the lessons, students will be able to introduce themselves, greet a person and talk about someone's nationalities and occupations.		
Module 7	Location and Positions	3 hours

Talking about location, expressing movement, place marker & writing. In this module, students will learn how to explain where a thing is, where I am and where I go to. Students will learn many vocabularies related with various places.		
Module 8	Contemporary Issues	2 hours
	Total Lecture Hours	30 hours
Reference Books		
Introduction to Sejong Korean		
E-Books		
1.	https://nuri.iksi.or.kr/e-book/ecatalog5.jsp?Dir=303&catimage=&callmode=admin	
2.	https://nuri.iksi.or.kr/e-book/ecatalog5.jsp?Dir=611&catimage=&callmode=admin	
Mode of Evaluation: CAT / Assignment / Quiz / Seminar/ FAT		
Recommended by Board of Studies	03-03-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BKOR102L	Basic Korean – Level 2	2	0	0	2
Pre-requisite	NIL			Syllabus version	
				1.0	

Course Objectives

1. To read and write the bulletin board writings, invitations, menu card, simple memo noteand sign boards.
2. To speak an make a note basic requirements and ordering at shop or restaurant
3. To learn the basic grammar
4. To talk about weather and Time
5. To enable to make an appointment and suggestion.

Course Outcomes

1. Shopping and ordering with numbers what they want.
2. Talk about weather, date, and time in various situations.
3. Describe their plan and explain what they did in last weekend and past
4. Make an appointment with friends and suggest what they want to

Module 1	Shopping and Restaurant	4 hours
In this module, students will learn how to order food and make requests at a restaurant in Korean. After completing the lesson, students will be able to inquire about restaurant menus, order a specific portion of food at a restaurant, and order a drink at a café. Students will learn how to make purchases at various types of stores inKorean. After completing the lesson, you will be able to express pricesper item, purchase a product from a store, and make a specific request while shopping.		
Module 2	Time & Date and Daily Activities	4 hours
In this module, students will learn various Korean vocabulary regarding your daily lives. After completing the lessons, studentswill be able to utilize informal sentence endings, ask and answer about their everyday life. Students will learn about time and date in Korean.		
Module 3	Number and Time	2 hours
In this module, students will learn Two ways of counting numbers and saying time in Korean numbers and Sino numbers. Always use two different names of numbers are commonly used in daily life. Students can count in mathematics and pay Korean currency, Kwon as well.		
Module 4	Introduction to Tenses – I	6 hours
In this module, Students will learn how to explain what they did yesterday or last weekend. After completing the lessons, students will be able to speak about their school time story and what happened to them yesterday and last year.		
Module 5	Introduction to Tenses – II and Past Tense	4 hours
In this module, Students will learn how to explain what they did yesterday or last weekend. After completing the lessons, students will be able to speak about their school time story and what happened to them yesterday and last year.		
Module 6	Making appointment and Suggestions – I	4 hours
Talking about location, expressing movement, place marker and directions.		

Students will learn many vocabularies related with various places.		
Module 7	Making appointment and Suggestions – II	4 hours
Talking about location, expressing movement, place marker & writing about travelling from one place to another. In this module which is an extension of Module 6 , students will learn how to explain where a thing is, where I am and where I go to. Students will learn many vocabularies related with various places.		
Module 8	Contemporary Issues	2 hours
		Total Lecture hours 30 hours
Reference Books		
Introduction to Sejong Korean		
E-Books		
1.	https://nuri.iksi.or.kr/e-book/ecatalog5.jsp?Dir=303&catimage=&callmode=admin	
2.	https://nuri.iksi.or.kr/e-book/ecatalog5.jsp?Dir=611&catimage=&callmode=admin	
Mode of Evaluation: CAT / Assignment / Quiz / Seminar/ FAT		
Recommended by Board of Studies	03-03-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM102E	Indian Classical Music	2	0	2	3
Pre-requisite	Nil				Syllabus version
				1.0	

Course Objectives

1. Bring in awareness of Music and understand the basics
2. Bring in awareness of Indian Classical Music
3. Developing skills to sing with tālām and śruti

Course Outcome

On completion of this course the students will be able to:

1. Acquire basic knowledge on sound, music and history of Indian Music
2. Interpret the structure of hindusthāni, karnātaka saṅgītam and the musical forms in both styles
3. Practice different aspects in music
4. Attain skills in different genres of music
5. Explain the advanced scientific aspects of music
6. Sing songs with perfection

Module:1	The World of Music	4 hours
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Sound-Music – Rhythm - Introduction to Different Genres of Music.

Module:2	History of Indian Classical Music	4 hours
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Indian Classical music History and evolution from Sanskrit tradition to modern era (hindusthāni and karnātaka saṅgītam), Folk Music.

Module:3	Carnatic Classical Music	4 hours
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nādām-svarām-śruti-rāgam,tālām-sinkarnālakasaṅgītam.Compositions (gītāṁsvarajati varṇamkīrttanāmpadāṁtillāna) – Legends of karnātaka saṅgītam.

Module:4	Hindustani Music	4 hours
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Origin-Evolution-musical forms (khayāl,dhrupad,tappa andtarāna) - Tendhāt-s. Majorgharāna-sinhindusthāni Music - Legends in hindusthāni Music.

Module:5	Film Music	4 hours
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Contemporary music, Western music, Background Music- Music Composing.

Module:6	Music and Mind	4 hours
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Emotions – Conditioning -Therapeutic Effects of Music, Science and Music, science in music. Artificial intelligence used in music.

Module:7	Music as a Profession	4 hours
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Concert Platforms, Different Types of Shows, New avenues in Music industry.

Module:8	Contemporary Issues	2 hours
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Guest Lectures by Academician/ Industrial Experts

Total Lecture Hours: **30 hours**

Text Book (s)	
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1. Prof. P. Sambamoorthi (2021), South Indian Music, Volume I – Indian Music Publishing House

2. Vijay Prakash Singha (2018), An Introduction to Hindustani Classical Music: A Guidebook for Beginners, Roli Books.

Reference Books	
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1. Sangeetha Widwan A.S. Panchapakesa Iyer (2014), Ganamrutha Bodhini, Ganamrutha Prachuram.

2. Dr. P T Chelladurai (2010), The Splendor of South Indian Music, Vaigarai Publishers, Dindigul.

3.	Lakshminarayana Subramaniam (2018), Classical Music of India: A Practical Guide, Tranquebar Publisher .
4.	B.Subbarao (1979), Raganidhi, Music Academy, Madras.

Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test

List of Challenging Experiments (Indicative)

1.	Swara exercises (saral variśai, janta variśai, madhyasthāyi variśai, dhātu variśai) listening to music.	6 hours
2.	Tāla exercises(alaṅkāram-sRūpakatālaṁ.ēkatālaṁ, triputatālaṁ)	4 hours
3.	Compositions: (gītarṁ-s.)	2 hours
4.	Compositions: kīrttanam in Telugu	2 hours
5.	Compositions: kīrttanam in Tamil	2 hours
6.	Compositions: kīrttanam in Kannada	2 hours
7.	Compositions: kīrttanam in Malayālaṁ	2 hours
8.	Compositions: kabeer ke dohe and abhang	2 hours
9.	Music composing techniques	4 hours
10.	Basics of audio recording	4 hours
	Total Laboratory Hours	30 hours

Mode of Evaluation: Lab Experiments and Lab Final Assessment Test

Recommended by Board of Studies 23-05-2022

Approved by Academic Council No. 66 Date 16-06-2022

Course Code	Course Title	L	T	P	C
BHUM103L	Micro Economics	3	0	0	3
Pre-requisite	Nil	Syllabus version		1.0	
Course Objectives					

1. To enable students to understand economic concepts from a managerial perspective.
2. To integrate theoretical knowledge with quantitative and qualitative evidence for effective decision making.
3. To evaluate the consequences of market structure, pricing and competition at the domestic and global levels.

Course Outcome

On completion of this course the students will be able to:

1. Describe traditional and modern definitions of economics.
2. Analyse supply and demand forces that determine equilibrium in a market economy.
3. Evaluate the factors affecting firm behaviour, such as production and costs.
4. Develop the skills to apply theories, models, and graphs to analyze the national and international cases.
5. Discuss the behaviour of market, industry and the performance of firms under different market structures.
6. Examine the market failures and the role of government in dealing with those failures.

Module:1	Microeconomic Principles	5 hours
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Introduction to Economics – Definition (Wealth, Welfare, Scarcity and Growth); Economics as Arts versus Science; Positive versus Normative Approaches.

Module:2	Consumer Behavior Theories	8 hours
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Ordinal versus Cardinal approach- Law of Diminishing Marginal Utility - Indifference curve analysis - Consumer equilibrium - Demand Analysis – movement and shift in Demand; exception to law of demand; Demand forecasting; Law of supply – Market equilibrium – Resource Allocation.

Module:3	Elasticity of Demand and Supply	5 hours
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Elasticity of Demand: Price, Income and Cross – Price elasticity's; measurement of elasticity – Elasticity of supply.

Module:4	Production Function	5 hours
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Production Function; Features of Production - The Production Function with One Variable Input and The Production Function with Two Variable Inputs – Law of Returns to Scale – Iso-quant and Iso-cost line - Producer Equilibrium.

Module:5	Cost and Revenue Functions	5 hours
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Cost Functions – Nature of cost – Short Run cost function and Long Run cost curves - Revenue Functions – Types. Break-even analysis.

Module:6	Market Structure – Partial Equilibrium	8 hours
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Products Markets – Perfect and Imperfect Competition- Monopoly, Monopolistic competition, Duopoly and Oligopoly, Efficiency and Regulation Factor market – Factor pricing.

Module:7	General Equilibrium and Economic Welfare	7 hours
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General Equilibrium of Production and Exchange; Externalities - Asymmetric information, Adverse selection - Moral hazard; Pareto Optimality; Social Welfare Function.

Module:8	Contemporary Issues	2 hours
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Total Lecture Hours: **45 hours**

Text Book(s)

1.	N. Gregory Mankiw (2015), "Principles of Microeconomics", South-western Cengage Learning, USA, 7th Edition.
Reference Books	
1.	Jeffrey M Perloff (2019), "Microeconomics", Pearson Education, 17th Edition.
2.	Dominick Salvatore ((2020), "Managerial Economics Principles and World Wide Applications", Oxford University Press, 9th Edition.
3.	Varian H.R. (2015), "Intermediate Microeconomics: A Modern Approach", East West Press Pvt., Ltd, New Delhi, 9th Edition.
Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test	
Recommended by Board of Studies	23-05-2022
Approved by Academic Council	No. 66 Date 16-06-2022

Course Code	Course Title	L	T	P	C				
BHUM104L	Macro Economics	3	0	0	3				
Pre-requisite	Nil	Syllabus version		1.0					
Course Objectives									
<ol style="list-style-type: none"> 1. To enable students to identify the determinants of macroeconomic aggregates and the major challenges associated with the measurement of these aggregates. 2. Enable students to critically evaluate the consequences of macroeconomic aggregates under differing economic conditions. 3. To discuss the linkages between financial markets and the real economy. 									
Course Outcome									
On completion of this course the students will be able to:									
<ol style="list-style-type: none"> 1. Describe the macroeconomics aggregates. 2. Compute different measures of macroeconomic activity such as the national income. 3. Explain the general principles of consumption function and Investment function. 4. Develop the skills to use theories of multiplier and accelerator models to analyze everydayproblems in real world situations and evaluate economic policies. 5. Analyse macroeconomics concepts such as growth and inflation. 6. Evaluate how the government and central bank can influence the economy andthe markets through fiscal and monetary policies. 									
Module:1	Macroeconomic Principles	5 hours							
Introduction to Macroeconomics – Macroeconomic issues – Importance of Macroeconomics – Macroeconomic Aggregates.									
Module:2	National Income	5 hours							
Circular flow of income, National income: Meaning, - Concepts – Nominal and real income -Methods of measurement – Importance – Problems in measurement.									
Module:3	Theory of Income and Employment Determination	5 hours							
Classical dichotomy – Keynesian income determination model – Money illusion, wage price rigidity – stability of equilibrium– stabilization of fiscal policy, Labour market and unemployment – Aggregate demand, aggregate supply and price level.									
Module:4	Consumption and Investment Function	7 hours							
Consumption: Meaning - Components – Determinants - Consumption function: Meaning – Kinds - Investment: Meaning - Components – Determinants - Investment function: Meaning – Kinds –Application.									
Module:5	Multiplier and Accelerator	7 hours							
Multiplier: Meaning – Working of multiplier – Accelerator: meaning – Working of accelerator – Super multiplier.									
Module:6	Inflation and Deflation	7 hours							
Inflation: Meaning - Types - Causes – Philips curve - The long-run Phillips curve. Inflation Expectations. The rational expectations - Deflation: Meaning – Causes – Consequences.									
Module:7	Money, Banking and Financial Market and Institution	7 hours							
Demand and Supply of money – The IS curve. Money Market and the LM curve. Liquidity trap. The IS-LM model – Central Bank - Monetary policy: meaning – Objectives – Variables – The instruments of Monetary control. Financial Markets - Savings, Investment and Financial System – Financial Markets and Financial Intermediaries. Financial Institution. Global Economic Indicators.									

Module:8	Contemporary Issues	2 hours
		Total Lecture Hours: 45 hours
Text Book (s)		
1. Mankiw, G. (2019), Macroeconomics, Worth Publishers, 10 th Edition.		
Reference Books		
1. Frederic S. Mishkin (2017), "The Economics of Money Banking and Financial Markets", Pearson, 12 th Edition. 2. Blanchard, O. (2016), "Macroeconomics", Pearson Education Inc. 17th Edition. 3. Paul A Samuelson Williamson (2017), "Macroeconomics", Gaurav-APM2NBMGSCY9L, 19 th Edition.		
Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test		
Recommended by Board of Studies	23-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

BHUM105L

Public Policy and Administration

(3-0-0-3)

Nature and scope of public administration - Evolution of public administration - Theories of Public Administration - Hierarchy, Unity of command, Span of control, Delegation, Line, staff and auxiliary agencies - Organs of financial administration - Concepts and types of Budgeting - Auditing of budget, Control over public finance - Role of Civil Service in Administration - Public Policy and Public Administration - Public policy process in India.

Course Code	Course Title	L	T	P	C
BHUM105L	Public Policy and Administration	3	0	0	3
Pre-requisite	Nil	Syllabus version		1.0	

Course Objectives

1. To introduce the students to the various aspects of Public Administration and Public Policy
2. To impart knowledge on administrative machinery in India and its contribution to public policy.
3. To study the various State and Central level programmes related to social and economic issues in India.

Course Outcome

On completion of this course the students will be able to:

1. Familiarize with the conceptual aspects and theoretical frameworks of public administration.
2. Describe the principles of public organisation and management.
3. Analyse the public finance management and budgeting system in India.
4. Acquire knowledge on the personal administration system in India, including the recruitment and service condition of central and state civil service cadres.
5. Demonstrate public policy making, implementation and evaluation.
6. Evaluate and interpret various legal and welfare policies framed by the different governments.

Module:1	Background of Public Administration	6 hours
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Meaning, nature and scope of public administration, Private and public administration, Evolution of public administration, New public administration.

Module:2	Theories of Public Administration	6 hours
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Scientific theory, Classical theory, Bureaucratic theory, Human relation theory.

Module:3	Basic Concepts and Principles	6 hours
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Hierarchy, Unity of command, Span of control, Delegation, Line, staff and auxiliary agencies.

Module:4	Financial Administration	6 hours
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Organs of financial administration, Concepts and types of Budgeting, Preparation of budget, Enactment of budget, Execution of budget, Auditing of budget, Control over public finance.

Module:5	Personnel Administration in India	6 hours
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Role of Civil Service in Administration, All India and central services, Recruitment, Training, Promotion, Pay and service conditions.

Module:6	Introduction to Public Policy	6 hours
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Meaning, nature and significance of Public Policy, Evolution of Public Policy and Policy Sciences, Public Policy and Public Administration

Module:7	Public Policy Process in India	6 hours
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Formulation, implementation and evaluation.

Module:8	Contemporary Issues	3 hours
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Total Lecture Hours: **45 hours**

Text Book(s)

1. Bidyut Chakrabarty, Prakash Chand Kandpal (2020), Public Administration in a Globalizing World: Theories and Practices, Sage Publications, New Delhi.

2.	Rumki Basu (2012), Public Administration: Concepts and Theories, Sterling Publication, New Delhi.
Reference Books	
1.	Raymond W Cox III, Susan Buck, Betty Morgan (2015), Public Administration in Theory and Practice, Routledge, New York.
2.	Christoph Knill, JaleTosun (2020), Public Policy: A New Introduction, Bloomsbury Publishing, London.
3.	Bidyut Chakrabarty, Prakash Chand (2019), Public Policy: Concept, Theory and Practice, Sage Publications, New Delhi.
4.	B.L. Fadia and Kuldeep Fadia (2015), Public Administration: Administrative Theories and Concepts, Sahitya Bhawan Publication, Agra.
Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test	
Recommended by Board of Studies	23-05-2022
Approved by Academic Council	No.66
	Date 16-06-2022

BHUM106L Principles of Sociology (3-0-0-3)

Definition – Nature –Scope – Importance - Society – Community- Social Process - Social Structure - Culture and Civilization- Socialization as a Process- Adult Socialization - Primary group and Secondary group - Marriage – Family – Education – Economics – Polity and Religion- Caste system - Social Class- Differences between Caste and Class.

Course Code	Course Title	L	T	P	C
BHUM106L	Principles of Sociology	3	0	0	3
Pre-requisite	Nil	Syllabus version		1.0	
Course Objectives:					

1. To develop awareness on sociological perspectives and sociological concepts.
2. To introduce students to the basic social processes of society, social institutions and patterns of social behavior.
3. To explore and understand sociology not merely as a social science discipline but as a distinctive branch of knowledge.

Course Outcomes:

On completion of this course the students will be able to:

1. Define sociology as a discipline and differentiate from other disciplines.
2. Discuss the field of sociology, major concepts and vocabulary.
3. Explain the relevance of socialization, groups, and institution's influence and constrain on individual agency.
4. Interpret the structural distinctions of caste and class within social dynamics.
5. Analyze various social phenomena through the lens of sociological perspectives.
6. Develop and prescribe models and solutions to address societal issues.

Module:1	Sociology	6 hours
Definition – Nature -Scope - Field - Importance - Relationship with other Social Sciences.		
Module:2	Sociological Concepts	7 hours
Society - Community-Association -Institution - Social Process - Social Structure- Role and Status.		
Module:3	Culture	5 hours
Meaning– Characteristics – Functions - Elements - Cultural Lag - Culture and Civilization.		
Module:4	Socialization	6 hours
Meaning - Socialization as a Process - Factors - Importance – Agents – Types –Adult Socialization.		
Module:5	Social Groups	6 hours
Meaning – Characteristics - Importance- Types: Primary group and Secondary group-In-group and Out-group-Reference group.		
Module:6	Social Institutions	6 hours
Marriage – Family – Education – Economics – Polity and Religion.		
Module:7	Social Stratification	7 hours
Meaning – Characteristics – Functions – Types. Caste system: Meaning – Factors - Characteristics – Origin – Functions and Changes. Social Class: Meaning – Nature – Differences between Caste and Class.		
Module:8	Contemporary Issues	2 hours
Total Lecture Hours: 45 hours		

Text Book(s)

1. Richard T. Schaefer (2021), Sociology – A Brief Introduction, McGraw Hill; 13th Edition.
2. Antony Giddens and Philip W. Sutton (2017), Sociology, Atlantic Publishers & Distributors Pvt. Ltd; 8th Edition.

Reference Books

1. C.N. Shankar Rao (2019), Sociology: Principles of Sociology: With an Introduction to Social Thoughts, S Chand & Company Ltd.

2.	Haralmbos, M. & Holborn (2022), Sociology: Themes and Perspectives, Collins Publishers, 8 th Edition.
Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test	
Recommended by Board of Studies	24-05-2022
Approved by Academic Council	No.66 Date 16-06-2022

BHUM107L

Sustainability and Society

(3-0-0-3)

Sustainability: Definition – Brief History – Sustainable Development in India – Role and Importance of Education in Sustainable Development - Education for Climate Action - Green Economy – Role of Government Initiatives for Labor Welfare in India - Human Rights - Human Trafficking - Gender Equality and Inequality - Education and Employment - Health and Well-being - LGBTQ and Sustainable Development - Social Hazards - Demography and Definition of Indigenous Groups - Challenges and Opportunities for Sustainability.

Course Code	Course Title	L	T	P	C
BHUM107L	Sustainability and Society	3	0	0	3
Pre-requisite	Nil				Syllabus version
					1.0

Course Objectives:

1. To understand holistic and critical perspective on sustainability.
2. To provide with clear understanding of social development and sustainability.
3. To educate the students to think practically and strategically about sustainability.

Course Outcome:

On completion of this course the students will be able to:

1. Familiarize the conceptual aspects of protection and reconcile economic growth, environmental balance and social progress.
2. Develop understanding of the labour welfare and human rights.
3. Discuss social mobility and integration.
4. Analyze and resolve conflict in equal manner.
5. Demonstrate understanding of the importance of education and equality.
6. Evaluate the factors that influence the sustainable society, design, develop the policies to achieve SDGs.

Module:1	Understanding Social Sustainability	6 hours
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Concept and Context of Sustainability: Definition – Brief History – Sustainable Development in India – 17 SDGs - Importance and Challenges.

Module:2	Education	5 hours
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Role and Importance of Education in Sustainable Development – Education and Media for Sustainable Societies – Education for Climate Action.

Module:3	Labor Force and Reforms	6 hours
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Green Tribunals – Green Economy – Problem of Industries and Sustainability - Role of Government Initiatives for Labor Welfare in India.

Module:4	Human Rights	6 hours
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Human Rights: Migrants and Refugees – Human Trafficking – Children's Rights: Prevention and Protection Measures.

Module:5	Gender Equality	7 hours
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Understanding Gender Equality and Inequality – Forms of Discrimination and Suppression - Education and Employment - Health and Well-being - LGBTQ and Sustainable Development.

Module:6	Social Hazards	7 hours
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Challenges: Poverty - Water Scarcity – Worldwide and in Indian Scenario - Impact of Globalization - Rapid Urbanization and Slums –Preventive Measure to Control CO2 Emission - Programmes and Schemes.

Module:7	Integration of Indigenous Groups	6 hours
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Demography and Definition of Indigenous Groups – Understanding Indigenous Knowledge and Health Practices - Challenges and Opportunities for Sustainability.

Module:8	Contemporary Issues	2 hours
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Total Lecture Hours	45 hours
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Text Book(s) :

1. Lintsen, H., Veraart, F., Smits, J. P., & Grin, J. (2018). Well-being, Sustainability and Social Development: The Netherlands 1850–2050. Springer Nature.
2. Kaltenborn, M., Krajewski, M., & Kuhn, H. (2020). Sustainable Development Goals and Human Rights. Springer Nature.

Reference Books :

1. Pandey, U. C., & Kumar, C. (2020), SDG5 - Gender Equality and Empowerment of Women and Girls.
2. García - Tejerolván Francisco, & Hugo DuránZuazo Victor. (2018), Water Scarcity and

	Sustainable Agriculture in Semiarid Environment: Tools, Strategies and Challenges for Woody Crops. Academic Press, an imprint of Elsevier.		
3	Beeson, G. (2020), A Water Story Learning from the Past, Planning for the Future, CSIRO Publishing.		
4	Anders B., Roy, K. (2020), Indigenous Knowledges and the Sustainable Development Agenda. United Kingdom: Taylor & Francis.		
Reading Material:			
1.	Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. Congent Social Sciences, 5 (1), 1653531. https://doi.org/10.1080/23311886.2019.1653531		
2.	https://www.oecd.org/employment/emp/50318559.pdf		
3.	Aliber, Michael. (2002). Poverty-eradication and Sustainable Development.		
4.	https://www.unicef.org/sdgs#sdg1		
5.	https://sdgs.un.org/goals		
Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test			
Recommended by Board of Studies	24-05-2022		
Approved by Academic Council	No. 66	Date	16-06-2022

BHUM108L Urban Community Development (3-0-0-3)

Urban Society -Rural Urban linkages and contrast -Urban Community Development – Urbanisation - Theories of Urbanization - Modernization and Urbanization - Urban Poverty and Inequality - Unemployment- Health - Education-Drug Addiction - Juvenile Delinquency - Urban Administration and Local Bodies - Urban Development Agencies - Urban Development Policies and Programs - Urban Growth and Challenges.

Course code	Course Title	L	T	P	C
BHUM108L	Urban Community Development	3	0	0	3
Pre-requisite	Nil				Syllabus version
					1.0
Course Objectives:					
1. Provides the basic understanding on urban society and its way of living 2. Orient the students about urban community issues 3. Sensitize the students to know about various supporting agencies and its initiatives for urban development.					
Course Outcome:					
On completion of this course the students will be able to; 1. Explain the concepts and approaches of urban community development. 2. Analyze the key issues of urban community. 3. Familiarize the administrative and local bodies structure, power and function of urban community. 4. Describe the core agencies in addressing various problems of urban community 5. Evaluate the policies and programmes of urban governance and development. 6. Develop professional awareness and learning on various developmental initiatives implemented in community.					
Module:1	Urban Society				
5 hours Urban Society: Concept – Characteristics. City: Meaning – Classification -Rural Urban linkages and contrast: Urban Community Development: Concept -Objectives and Historical background.					
Module:2	Urbanization and Urban Living				
5 hours Urbanisation: Concept – Definition- Theories of Urbanization. Urbanism: Characteristics - Urbanization trends in urbanization and Urban Development -Modernization and Urbanization.					
Module:3	Urban Community Issues				
7 hours Urban Poverty and Inequality – Unemployment-Housing - Water – Sanitation-Waste Management – Health - Education-Drug Addiction - Juvenile Delinquency.					
Module:4	Urban Administration and Local Bodies				
4 hours Town Panchayat – Municipalities – Corporations: Structures, Powers and Functions.					
Module:5	Urban Development Agencies				
7 hours Non-Governmental Organisations (NGOs) - Voluntary Organisations - State Industrial Development Corporations (SIDsCs) - Public Works Department (PWD)- Housing and Urban Development Corporation (HUDCO) -Metropolitan Development Authorities - Slum Clearance Board.					
Module:6	Urban Development Policies and Programs				
8 hours Urban Development Policies: Urban Basic Services-Urban Development Policy in India- Urban Development Planning: Town and Country Planning Act, 1971. Urban Development Programmes: Five Year Plans and Urban Development-Urban Basic Services Programmes (UBSP), Jawaharlal Nehru National Urban Renewal Mission (JNNURM) - Nehru Rozgar Yojana (NRY) -Urban Renewal Programme - Problems in Implementation of Urban Community Development Programmes.					
Module:7	Urban Growth and Challenges				
7 hours Smart Cities and Development - Urban Environment and Pollutions – Globalization-Urban Reforms -Disaster Management –Displacement –Migration -Population Growth and its Impact (social and physical) -Suitable Approaches and Strategies.					
Module:8	Contemporary Issues				
		Total Lecture Hours			
		45 Hours			

Text Book(s)		
1.	Vanita Pandey (2021), Urban Sociology, Rawat Publication	
2	Sidhartha.K (2019), Cities Urbanisation and Urban Systems New edition Kitab Mahal Daryaganj Delhi	
Reference Books		
1.	Dr.Mohd Akhter Ali, M.Kamraju, Dr.Muzafar Ahmad Wani (2020), Urbanisation and Urban Systems, Rajesh Publication	
2	Talja Blokland (2017), Community As Urban Practice, Edited by Talja Blokland, Polity Press	
3.	Zacchaeus Ogunnika (2017), Critical Issues in Community Development: An Introduction to Rural and Urban Sociology, Trafford Publishing	
4.	Pablo Shiladitya Bose (2015), Urban Development in India Global Indians in the Remaking of Kolkata, Routledge	
Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test.		
Recommended by Board of Studies	24-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

BHUM109L Social Work and Sustainability (3-0-0-3)

Sustainability in the Social Work profession - Strategies for sustainable community development – Social theory - Social Work and Ecological Approaches - Role of the Social Worker in achieving sustainability – Trans-disciplinary approach and Interlink of sustainability and vulnerability –Social Capital theory and Mobilization - Social Economy theory - Pillars of Sustainability- Sustainable Developmental Goals I - Sustainable Developmental Goals – II.

Course code	Course Title	L	T	P	C			
BHUM109L	Social Work and Sustainability	3	0	0	3			
Pre-requisite	Nil	Syllabus version			1.0			
Course Objectives								
<p>1. To understand the working concept of sustainability at the micro, mezzo, and macro levels of Social Work practice.</p> <p>2. To study the relationships among the concepts of environmental, economic, use of technology, and social sustainability.</p> <p>3. To study the interconnectedness of sustainability with social work methods, values, and ethics.</p>								
Course Outcome								
On completion of this course the students will be able to:								
<p>1. Describe various concepts of Social Work, sustainability and SDGs.</p> <p>2. Attain a sense of responsibility in addressing sustainable goals in developing a better society.</p> <p>3. Discuss the policies and programs from global perspectives.</p> <p>4. Develop skills to work in the community with people of diversity.</p> <p>5. Evaluate policies of social development and human welfare services.</p> <p>6. Design, develop and implement programs and policies for the better world.</p>								
Module:1	Social Work Education and Practice	5 hours						
Sustainability in the Social Work profession - Principles – Methods - Ethics – Values – Strategies for sustainable community development – Social theory –Social-Ecological practice Model.								
Module:2	Social Work, Ecology, and Social Justice	5 hours						
Social Work and Ecological Approaches - Human rights Violations – Rights-based approach - Restorative Approaches in Social Work - Case Studies - Role of the Social Worker in achieving sustainability.								
Module:3	Sustainability and Vulnerability	6 hours						
Introduction -Principles - Limitations - Challenges - Transdisciplinary approach to sustainability and vulnerability –Interlink of Sustainability and vulnerability.								
Module:4	Theories in Sustainability	8 hours						
Theories: Social Capital theory and Mobilization - Bottom of the pyramid approach - Humanistic sustainability theory – Social Economy theory.								
Module:5	Pillars of Sustainability	8 hours						
Pillars: Social – Economic – Environmental – Cultural - Political - Security aspects.								
Module:6	Sustainable Developmental Goals – I	6 hours						
Goal 1: No Poverty - Goal 2: Zero Hunger - Goal 3: Good Health and Well-Being - Goal 4: Quality Education - Goal 5: Gender Equality - Goal 6: Clean Water And Sanitation - Goal 7: Affordable And Clean Energy - Goal 8: Decent Work and Economic Growth.								
Module:7	Sustainable Developmental Goals – II	5 hours						
Goal 9: Industry, Innovation, And Infrastructure - Goal 10: Reduced Inequality - Goal 11: Sustainable Cities And Communities - Goal 12: Responsible Consumption And Production - Goal 13: Climate Action - Goal 14: Life Below Water - Goal 15: Life on Land - Goal 16: Peace and Justice Strong Institutions - Goal 17: Partnerships to achieve the goal.								
Module:8	Contemporary Issues	2 hours						
		Total Lecture Hours			45 hours			
Text Book(s)								
1.	Dominelli, Lena, 2018, Green Social Work: From Environmental Crises to Environmental Justice: Rawat Publications, India							

2.	Walter Leal Filho, Ubiratã Tortato, Fernanda Frankenberger (2021), Integrating Social Responsibility and Sustainable Development - Addressing Challenges and Creating Opportunities, springer publication.
Reference Books	
1.	Parker, Jonathan (2021), Social Work Practice Assessment, Planning, Intervention and Review, 6 th Edition, Sage Publication.
2.	Heslop, Philip & Meredith, Cathryn (2020), Social Work Theory in Practice, SAGE Publications Ltd.
3.	Rao, Bhaskara N (2019), Sustainable Good Governance, Development and Democracy, Sage Publication.
4.	IFSW (2018), Social Work Statement of ethical principles. International Federation of Social Workers, Rheinfelden, Switzerland.
Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test	
Recommended by Board of Studies	23-05-2022
Approved by Academic Council	No. 66
	Date 16-06-2022

BHUM110E Cognitive Psychology (2-0-2-3)

Contemporary Cognitive Psychology, Approaches - Cognitive Neuropsychology- Cognitive Neuroscience, Application of Cognitive Psychology- Understanding perception- The nature and roles of attention - Convergent and Divergent Thinking - Thinking and intelligence- Aspects of Creativity- Memory- Problem Solving and Decision Making- Cognitive Development and disorders.

Course Code	Course Title	L	T	P	C				
BHUM110E	Cognitive Psychology	2	0	2	3				
Pre-requisite	Nil			Syllabus version					
1.0									
Course Objectives									
<ol style="list-style-type: none"> 1. To understand the higher order process in cognition. 2. To enable the students to identify and apply the different aspects of cognitive process. 3. To enable the students to administer various assessments for mental process. 									
Course Outcomes									
On completion of this course the students will be able to:									
<ol style="list-style-type: none"> 1. Explain how information processing works. 2. Comprehend the various cognitive processes such as attention, perception, memory, imagery and meta cognition. 3. Adopt various strategies to enhance problem solving process. 4. Describe cognitive development and disorders. 5. Apply tools and techniques to understand the cognitive processes through psychometric assessment. 6. Conduct practical experiments to assess the cognitive skills. 									
Module:1	Cognitive Psychology	5 hours							
Contemporary Cognitive Psychology, Approaches- Experimental Cognitive Psychology - Computational Cognitive Science- Cognitive Neuropsychology- Cognitive Neuroscience, Application of Cognitive Psychology.									
Module:2	Perception and Attention	4 hours							
Understanding perception, Visual and auditory- Gestalt laws of organization, Perceptual constancy - depth perception, size perception, perception of movement; Various sensory modalities; Extrasensory perception.									
The nature and roles of attention- types of Attention: selective attention models of selective attention divided attention and multitasking, Endogenous and Exogenous Effects in Space.									
Module:3	Thinking and Reasoning	4hours							
Meaning and Definition- Nature- Types: Perceptual or concrete- Conceptual or abstract- Creative – Logical or reasoning - Convergent and Divergent Thinking. Thinking and intelligence: Alterations. Reasoning: Meaning- Inductive reasoning- Deductive reasoning- Abdicative reasoning.									
Module:4	Creativity	3hours							
Meaning and Aspects of Creativity - Stages of Creativity- Creativity and Intelligence- Measurement of Creativity.									
Module:5	Memory	4hours							
Introduction- Types- Sensory memory- Short-term memory- Working memory- Long-term memory- forgetting and false memory- Everyday memory: Autobiographical- Eyewitness testimony. Memory distortions: Reconstructive Retrieval- Encoding Distortions - Source Monitoring - Eyewitness Testimony. Meta cognition. Memory Enhancement Techniques.									
Module:6	Problem Solving and Decision Making	4hours							
Introduction- Steps, Barriers to Problem Solving: Mental Set and Functional Fixedness- Unnecessary Constraints- Irrelevant Information. Problem-Solving Strategies: Heuristic- Algorithm- Abstraction- Hypothesis testing- Means-ends analysis- Root-cause analysis- Trial and error. Decision making, hypothetical thinking and rationality. Decision-making styles.									
Module:7	Cognitive Development and Disorders	4hours							
Cognitive Development Theories- Piaget's cognitive development- Background and key concepts- Skills & Important Milestones. Cognitive disorders -Symptoms, Causes and Effects- Types- Developmental disorders, Motor skill disorders, Dementia - Confusion- poor motor co-ordination- Loss of memory- identity confusion- impaired judgement.									

Module:8	Contemporary Issues	2 hours	
	Total Lecture Hours:	30 hours	
Text Book(s)			
1. Galotti,K.M.(2017),Cognitive Psychology In and Out of the Laboratory, 6 th Edition,Sage. Kellogg, R.T. (2015), Fundamentals of Cognitive Psychology, 3 rd Edition, Sage Publications.			
Reference Books			
1.	Goswami, U. C. (2020), Cognitive Development and Cognitive Neuroscience: The Learning Brain. London; New York: Routledge, Taylor & Francis Group.		
2.	Whiteley, C. (2020), Cognitive Psychology, CGD Publishing, 2 nd edition.		
3.	Eysenck, M. W., & Brysbaert, M. (2018), Fundamentals of Cognition. Milton: Taylor and Francis.		
4.	Stemberg, R.J., Stenberg, K. (2016), Cognitive Psychology, 7 th Edition. Wadsworth.		
5.	Groome, D., & Eysenck, M. W. (2016), An introduction to Applied Cognitive Psychology, London; New York: Routledge, Taylor & Francis.		
Mode of Evaluation: Continuous Assessment Tests, Quizzes, Assignment, Final Assessment Test			
Indicative Experiments			
1.	Assessment of Attention	3hours	
2.	Assessment of Memory	3hours	
3.	Assessment of Creativity	3hours	
4.	Assessment of Perception (Auditory/Spatial/Visual)	3hours	
5.	Assessment of Intelligence	3hours	
6.	Assessment of Critical Thinking	3hours	
7.	Assessment of Problem Solving/Decision Making	3hours	
8.	Assessment of Logical Reasoning/Inductive Reasoning/Diagrammatic Reasoning	3hours	
9.	Assessment of Error checking	3hours	
10.	Assessment of Psycholinguistic Abilities	3hours	
	Total Laboratory Hours	30 hours	
Mode of Evaluation: Continuous Assessment Tests, Final Assessment Test			
Recommended by Board of Studies	23-05-2022		
Approved by Academic Council	No.66	Date	16-06-2022

Course code	Course Title	L	T	P	C				
BMGT101L	Principles of Management	3	0	0	3				
Pre-requisite	NIL			Syllabus version					
				1.0					
Course Objectives									
<ol style="list-style-type: none"> 1. To provide knowledge on management key concepts, evaluation of management thoughts and theories. 2. To understand the various functions of management and framework. 3. To gain a holistic understanding of multidisciplinary nature of management for effective functioning. 									
Course Outcomes									
At the end of the course, the students will be able to <ol style="list-style-type: none"> 1. Understand the basic concepts of management. 2. Analyse the environmental factors that affect the organization and its growth. 3. Identify and apply appropriate techniques to manage an organisation. 4. Critically analyse the problem in each functions of the management. 5. Ascertain the role of technologies in management. 									
Module:1	Management Basics								
Management - nature and purpose, evolution of management concept, approaches to management process, functions and roles of management, influence of external and internal environment on decision making, factors affecting social responsibility and sustainability, and ethical business management.									
Module:2	Planning								
Types of plans, steps in planning, strategic planning process, SWOT matrix, portfolio matrix, Porter's industry analysis and generic competitive strategies, decision making - importance of decision making, development of alternatives and evaluation of alternatives, and decision making under certainty, uncertainty and risk.									
Module:3	Organizing								
Formal and informal organization, organizational levels and span of management, organization reengineering, structure and process of organizing, departmentation, matrix organization, strategic business units, virtual organization, line and staff authority, decentralization and delegation of authority, and organization culture.									
Module:4	Staffing								
Overview to staffing functions, factors affecting staffing, position requirements, job design, job description, selection process and techniques, orientating new employees, performance appraisal and career strategy - appraisal criteria, team evaluation, rewards, and formulating career strategy, managerial training and development, conflict management, managing change, and learning organization.									
Module:5	Leading								
Understanding motivation, motivation theories, leadership traits, styles, and types, committees, groups, and team decision making, communication purpose, communication process, and barriers to effective communication.									
Module:6	Controlling								
Basic control process, critical control points, standards and bench marking, real-time information and control, feedforward or preventive control, control of overall performance, profit and loss control, control through ROI, management audits - balanced scorecard, bureaucratic and clan control, and control techniques and information technology.									
Module:7	Managing Operations and Technology								

Operations management and corporate strategy, value chain management, role of technology in modern management practices, virtual organization and its structure, online business management, applications of digital technology, e-commerce, m-commerce, social media, and artificial intelligence in business management, and challenges to modern management practices.

Module:8	Contemporary Topics	2 hours
		Total Lecture hours: 45 hours

Text Book(s)

1. Harold Koontz and Heinz Weihrich, Essentials of Management: An International and Leadership Perspective, 2020, 11th edition, McGraw-Hill, India.

Reference Books

1. Stephen P. Robbins, Mary Coulter and Agna Fernandez, Fundamentals of Management, 2019, 14th Edition, Pearson Education, India.
2. Robert N. Lussier, Management Fundamentals: Concepts, Applications, & Skill Development, 9th Edition, 2020, Sage Publications, USA
3. Pravin Durai, Principles of Management – Texts and Cases, 2019, 2nd Edition, Pearson Education, India.

Mode of Evaluation: CAT, Written Assignment, Quiz, and FAT

Recommended by Board of Studies	27-05-2022
Approved by Academic Council	No. 66 Date 16-06-2022

Course code	Course Title			L	T	P	C							
BMGT102L	Human Resource Management			3	0	0	3							
Pre-requisite	NIL			Syllabus version										
				1.0										
Course Objectives														
<ol style="list-style-type: none"> 1. To understand the contributions of human resources to organizational effectiveness. 2. To apply various concepts of HR to manage the organization effectively. 3. To create various HRM concepts to enhance personal and organizational effectiveness. 														
Course Outcomes														
At the end of the course, the students will be able to														
<ol style="list-style-type: none"> 1. Appraise and evaluate the basic principles of HRM. 2. Develop appropriate HR planning process for effective recruitment and selection. 3. Design various skills, procedures, and techniques to retain human resources. 4. Evaluate the basic and mandatory labor laws governing human resources. 5. Create a safety environment for managing human resources. 														
Module:1	HRM – Overview			6 Hours										
Nature and scope of HRM, evolution and development of HRM, HR philosophy, policies, procedures and practices, dynamics of HRM environment, business ethics and CSR, equal employment opportunity, work force diversity, HR audit and evaluation, e-HRM, and strategic HRM.														
Module:2	Human Resource Planning Process			6 Hours										
Human resource planning and process - forecasting requirements, succession planning, job analysis, job analysis methods, job descriptions, job design, and global talent management.														
Module:3	Recruitment and Selection			6 Hours										
Recruitment process, methods, databases, job posting and bidding, recruitment sources, technology for recruiting, selection tests, interview planning, screening, selection decision, metrics for evaluating the effectiveness of recruitment, and factors affecting the selection process.														
Module:4	Training and Development (T&D)			6 Hours										
Training and development process, training needs, training methods, training and development delivery systems, implementing T&D programs, metrics for evaluating T&D effectiveness, and factors influencing T&D process.														
Module:5	Performance Management and Appraisal			7 Hours										
Performance appraisal process, establishing criteria for performance appraisal, performance appraisal methods and interview, appraisal problems, performance management, career planning and development, employee engagement, executive development, knowledge management, and importance of knowledge sharing culture for organizational effectiveness.														
Module:6	Compensation and Benefits			6 Hours										
Compensation overview, components of direct financial compensation, contextual influences on direct financial compensation, job evaluation, competitive pay structure, indirect compensation benefits - legal benefits, health care plans, retirement plans, workplace flexibility, and employment law.														
Module:7	Employee Relations, Safety, and Health			6 Hours										
Need for a safe and healthy environment, employee union and union structure, welfare activities, nature of industrial relations and labor laws, internal employee relations, resolving disputes, concept of collective bargaining, workplace bullying and violence,														

social networking and employee wellness, physical fitness programs, employee assistance programs, and HR ethical practices.					
Module:8	Contemporary Topics	2 Hours			
	Total Lecture Hours		45 hours		
Text Book(s)					
1. Gary Dessler & Biju Varrkey, <i>Human Resource Management</i> , 2020, 16 th Edition, Pearson Education, India 2. Neeru Kapoor, <i>Concept Building Approach to Human Resource Management</i> , 2021, 2 nd Edition, Cengage Learning, India					
Reference Books					
1. Sharon Armstrong & Barbara Mitchell, <i>The Essential HR Handbook</i> , 2019, 10 th Edition, Red Wheel/Weiser, USA 2. K Aswathappa and Sadhna Dash, <i>Human Resource Management - Text and Cases</i> , 2021, 9 th Edition, McGraw-Hill, India					
Mode of Evaluation: CAT, Written Assignment, Quiz, and FAT					
Recommended by Board of Studies	27-05-2022				
Approved by Academic Council	No. 66	Date	16-06-2022		

Course code	Course Title	L	T	P	C				
BMGT103L	Organizational Behavior	3	0	0	3				
Pre-requisite	NIL			Syllabus version					
Course Objectives									
<ol style="list-style-type: none"> 1. To familiarize the basic concepts of organizational behavior. 2. To understand, evaluate, and manage individual and group behavior effectively in an organization. 3. To formulate appropriate strategies based on individual and group behaviour. 									
Course Outcomes									
At the end of the course, the students will be able to <ol style="list-style-type: none"> 1. Appraise the basic organizational and individual behaviour. 2. Describe the various dimensions of motivations. 3. Measure and monitor different aspects of stress and emotions. 4. Explain the various elements of groups and teams. 5. Analyze the different dimensions of organizational structure, culture, and change. 6. Formulate leadership traits for effective work culture. 									
Module:1	Organisational Behaviour - Essentials								
Understanding organizational behaviour, learning style, OB model, demographic and cultural diversity in organizations, ethical behaviour, tools of OB research, and challenges and opportunities for OB.									
Module:2	Attitudes, Personality, and Values								
Individual attitudes, attitudes and behaviour, job attitudes, job satisfaction, job dissatisfaction, job satisfaction and job performance, personality frameworks, personality traits in OB, personality and situations, understanding values, values and workplace, and international values.									
Module:3	Motivation								
Theories of motivation - need-based and process-based theories, designing a motivating environment, motivating employees through job design, employee involvement, benefits, and rewards to employees, and goal setting.									
Module:4	Managing Stress and Emotions								
Meaning of stress, sources of stress, consequences of stress at work, avoiding and managing stress, understanding emotions, sources of emotions, and emotional intelligence.									
Module:5	Group Behaviour, Work Teams, and Communications								
Group development, group size and dynamics, difference between groups and teams, types of teams, team design characteristics, management of teams, and barriers to effective teams, communication - functions, directions, and modes of communication, barriers to effective communication, power and politics, and conflict and negotiation.									
Module:6	Organizational Structure, Culture, and Change								
Different types of organizational structures - common and alternate designs, organizational designs and employee behaviour, organizational culture - role of culture in organizations, creating and sustaining organizational culture, organizational change - forces, resistance,									

and approaches to organizational change.			
Module:7	Leadership	6 hours	
Theories of leadership - traditional and contemporary styles, positive and responsible leadership, attributes of a leader, developing leaders across the organization, leadership grid, and challenges to understanding leadership.			
Module:8	Contemporary Topics:	2 hours	
Guest lectures from Industry and, Research and Development Organisations			
	Total Lecture Hours	45 hours	
Text Book(s)			
1.	Stephen P. Robbins and Timothy A. Judge, <i>Organizational Behaviour</i> , 2019, 14 th Edition, Pearson Education, India		
2.	Knud Sinding, Robert Kreitner, and Angelo Kinecki, <i>Organisational Behaviour</i> , 2018, 6 th Edition, McGraw-Hill Education, UK		
Reference Books			
1.	<i>Organizational Behavior</i> , Open Textbook, University of Minnesota Libraries Publishing, 2017, ISBN 13: 9781946135155		
2.	J.Stewart Black et.al., <i>Organizational Behavior</i> , OpenStax Textbook, Rice University, USA, Web Version Last updated: Feb 23, 2021		
3.	Christopher P. Neck, Jeffrey D. Houghton and Emma L. Murray, <i>Organizational Behavior: A Skill-Building Approach</i> , 2019, 2 nd Edition. Sage Publications, USA		
Mode of Evaluation: CAT, Written Assignment, Quiz, and FAT			
Recommended by Board of Studies	27-05-2022		
Approved by Academic Council	No. 66	Date	16-06-2022

Course code	Course Title	L	T	P	C		
BMGT104L	Marketing Management	3	0	0	3		
Pre-requisite	NIL	Syllabus version		1.0			
Course Objectives							
1. To comprehend the basics of marketing and its related concepts. 2. To develop marketing plan for the given situation. 3. To carry out market research survey.							
Course Outcomes							
At the end of the course, the students will be able to							
1. Create marketing strategy for the given business scenario. 2. Analyze the factors that affect the marketing program of an organization. 3. Identify market gaps and develop product ideas with appropriate STP strategies. 4. Formulate marketing mix strategies for a given business situation. 5. Develop promotional mix for a given business case. 6. Ascertain the latest trends in marketing.							
Module:1	Marketing Basics						
Understanding marketing, scope of marketing, company orientation towards the marketplace, core concepts of marketing, types of market, marketing mix, value chain, core competencies, marketing strategy, and marketing plan.							
Module:2	Environment Scanning and Market Research						
SWOT analysis, environment analysis - micro and macro factors, Porter's five forces framework, marketing research process, and demand measurement.							
Module:3	Connecting with Customers and Building Strong Brands						
Building customer value, satisfaction, and loyalty, maximizing customer life time value (CLV), consumer buying decision process, segmentation, targeting, and positioning (STP) strategy - levels and bases of segmentation, market targeting, positioning, repositioning, understanding brand equity, building and managing brand equity.							
Module:4	Setting Product and Pricing Strategies						
Product classifications, product levels, product line and mix, product life cycle (PLC), product-market growth strategies - Ansoff matrix and BCG matrix, new product development (NPD), understanding pricing, pricing strategies and methods, and responding to price change.							
Module:5	Channel Management						
Channel functions and flows, channel levels, channel design, channel integration and systems, distribution strategies, channel intermediaries - wholesalers and retailers, understanding private labels, and channel conflict and resolution strategies.							
Module:6	Integrated Marketing Communications (IMC)						
Advertising - ad types, advertising medium, and evaluation of ads, Sales Promotion - salesforce promotion, trade promotion, and consumer promotion, Direct Marketing - kiosk, catalogues, e-mail, SMS, vending machines, and telemarketing, Public Relations - publicity, newsletter, CSR, sponsorships, and advertorials, Digital Advertising - Types of digital media, display ads, search engine ads, social media marketing, and artificial intelligence based marketing techniques, and Personal Selling.							
Module:7	Marketing for long-term Success						
Holistic marketing organization, socially responsible business models, cause-related							

marketing, social marketing, marketing implementation and control, and future of marketing.		
Module:8	Contemporary Topics	2 hours
	Total Lecture hours: 45 hours	
Text Book(s)		
1.	Philip Kotler and Keller Kevin, <i>Marketing Management</i> , 2021, Global Edition (16 th), Pearson Education, UK	
2.	Ramaswamy, V. S., and S. Namakumari, <i>Marketing Management: Indian Context, Global Perspective</i> , 2018, 6 th Edition, SAGE Publications India Pvt Limited, India	
Reference Books		
1.	Hermawan Kartajaya, Iwan Setiawan and Philip Kotler, <i>Marketing 5.0: Technology for Humanity</i> , 2021, 1 st Edition, Wiley, USA	
2.	Lilien, Gary L., Arvind Rangaswamy, and Arnaud De Bruyn, <i>Principles of Marketing Engineering and Analytics</i> , 2017, 3 rd Edition, DecisionPro Inc.	
Mode of Evaluation: CAT, Written Assignment, Quiz, and FAT		
Recommended by Board of Studies	27-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course code	Course Title	L	T	P	C				
BMGT105L	Consumer Behavior	3	0	0	3				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
<ol style="list-style-type: none"> 1. To learn the dynamics of consumer behavior and market. 2. To critically evaluate various factors influencing the buying behavior of individuals. 3. To execute consumer research survey based on the given problem. 									
Course Outcomes									
At the end of the course, the students will be able to <ol style="list-style-type: none"> 1. Appraise the basics of consumer behavior and consumer decision making process. 2. Analyze psychological and personal factors that influence consumer behavior. 3. Evaluate social, cultural, and digital influence on consumer behavior. 4. Associate various theories of consumer behavior in consumer decision making process. 5. Comprehend the significance of marketing and consumer ethics. 6. Apply consumer research process for a given problem. 									
Module:1	Consumer Behavior - Basics	5 hours							
Evolution of consumer behavior, dynamism in consumer behavior, consumer behavior and technology, market segmentation, targeting, and positioning, customer value, satisfaction, and retention, effects of marketing mix on consumer behavior, consumer decision making and integration of various disciplines, and consumer decision making process.									
Module:2	Psychological Influence - Perception and Learning	6 hours							
Meaning of perception, components of perception, perception process, theories of perception, perception level, challenges in formulating consumer perception, perception and semiotics, perception and positioning, perceived quality and perceived risk, meaning of learning, elements of learning, categories of learned behavior, dimensions of learning, theories of learning, and learning and memory.									
Module:3	Psychological Influence - Motivation, Beliefs, and Attitude	6 hours							
Types of motives, drivers of motivation, categories and theories of motivation, consumers' emotions, motivation and decision making, types of beliefs and consumer behavior, elements and characteristics of attitude, attitude formation, tri-component model of attitude, multi-attribute models, cognitive dissonance, and conflict resolution.									
Module:4	Personal, Social, and Cultural Influence	9 hours							
Understanding personality, elements of personality, personality theory, self-concept, personality traits, anthropomorphism, elements and categories of lifestyle, values and lifestyle, approaches to marketing strategies based on personality and lifestyle, types of reference groups, role of reference groups, impact of reference groups on marketing strategies, family and consumer behavior, family structure, family life cycle, cultural influence on consumer behavior, cultural theories, Indian culture and socialization, and effect of cross-cultures on consumer behavior.									
Module:5	Digital and Social Media Influence	6 hours							
Media integration and consumer behavior, theoretical frameworks - TRA and UG, consumer behavior on digital platforms, blogs and consumer behavior, virtual and brand communities influence on consumer behavior, usage of mobile and its influence on consumer behavior, virtual shopping and its influence on consumer behavior, luxury and consumer behavior, and changing tri-component model of attitude.									
Module:6	Information Processing and Decision Making	6 hours							
Understanding information processing, information processing theories, information processing and persuasive communication, information processing and memory, methods of									

information processing, information retrieval, levels of decision making, decision making methods, and consumer decision making models.

Module:7	Marketing Ethics and Consumer Behavior Research	5 hours
Socially responsible marketing, consumers' privacy, misleading labels, camouflaged advertising, consumer ethics, and consumer research and process.		
Module:8	Contemporary Topics	2 hours
Total Lecture Hours: 45 hours		

Text Book(s)

1.	Schiffman Leon G., Wisenblit Joe, Kumar S. Ramesh, <i>Consumer Behavior</i> , 2018, 12 th Edition, Pearson Education, India
2.	Jain, Varsha, and Jagdish Sheth. <i>Consumer Behavior: A digital Native</i> , 2019, 1 st Edition, Pearson Education, India

Reference Books

1.	David L Mothersbaugh, Del I. Hawkins, Amit Mookerjee, <i>Consumer Behavior: Building Marketing Strategy</i> , 2019, 13 th Edition, McGraw-Hill, India
2.	Hoyer, Wayne D., Deborah J. MacInnis, and Rik Pieters, <i>Consumer Behavior</i> , 2016, 7 th Edition, Cengage Learning, USA
3.	Marieke de Mooij, <i>Consumer Behaviour and Culture: Consequences for Global Marketing and Advertising</i> , 2019, 3 rd Edition, SAGE, USA

Mode of Evaluation: CAT, Written Assignment, Quiz, and FAT

Recommended by Board of Studies	27-05-2022
Approved by Academic Council	No. 66

Date 16-06-2022

Course code	Course Code	L	T	P	C				
BMGT106L	Digital Marketing	3	0	0	3				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
<ol style="list-style-type: none"> 1. To evaluate digital marketing and digital media. 2. To get exposed to various digital marketing channels. 3. To develop online ads and assess the performance of ads. 									
Course Outcomes									
At the end of the course, the students will be able to <ol style="list-style-type: none"> 1. Create digital marketing strategies for a given business scenario. 2. Develop search engine marketing strategy with the use of SEO and AdWords. 3. Formulate strategies for various digital marketing channels. 4. Develop ad campaigns on any one of the social media platforms and analyze its outcomes. 5. Know the tabs on google analytics dashboard and measure campaign performance. 6. Ascertain contemporary technologies of DM and its effects on DM. 									
Module:1	Digital Marketing (DM) Fundamentals	6 hours							
Marketing basics, introduction to DM, origin and development of DM, traditional Vs digital marketing, digital marketing channels, digital customer journey and mapping, digital marketing funnel, creating buyer persona, types of digital media (paid, shared, owned, and earned), IMC in DM, developing DM strategy and objectives, and challenges to DM.									
Module:2	Search Engine Optimization (SEO)	6 hours							
Building websites and web pages, web hosting, subdomains and subfolders, website navigation, social media icons, advanced website features, setting up google analytics, search engine work mechanism, pillars of SEO, on-page and off-page optimization, SEO - visual and voice search, SEO tactics - white-hat and black-hat SEO, SEO - UX and UI, content marketing for SEO success, and external link building.									
Module:3	Display Advertising & Search Engine Advertising	7 hours							
Display advertising media, digital/ad metrics, types of display ads, targeting categories, geographic and language tagging, programmatic display advertising, ad server, ad exchange, challenges to display advertising. Search engine payments, google AdWords, Ad placements, Ad ranks, enhancing ad campaign, performance reports, and e-commerce ads Vs google ads.									
Module:4	Social Media Marketing – Facebook, LinkedIn, & Instagram	8 hours							
Developing social media ad strategy - listening, goal setting, strategy, implementation, measurement, social entertainment, and gamification. Facebook marketing - organic marketing, paid marketing, marketing with 3D posts, FB ads manager, FB pixel, FB business manager, and useful design tools. Importance of LinkedIn presence, LinkedIn strategy, LinkedIn website demographics, content strategy, LinkedIn native videos, LinkedIn analytics, and ad campaign. Instagram: objectives, content strategy, style guidelines, hashtags, sponsored ads, and apps.									
Module:5	Twitter, Mobile, and Video Marketing	6 hours							
Twitter building blocks, content strategy, Twitter usage, Twitter ads, Twitter analytics, Twitter tools and tips for marketers. Mobile advertising model, mobile marketing (MM) media (paid and owned), MM features, mobile apps, website and mobile responsive ads, MM strategy, and MM analytics. Needs of video marketing (VM), VM channels, VM strategy, and types of marketing videos, video production process, video optimization, and video analytics.									
Module:6	Digital Analytics and Online Reputation Management (ORM)	6 hours							

Data collection, key metrics, affiliate marketing, multi-channel attribution, types of tracking codes, and competitive intelligence. ORM Vs SEO, social commerce: reviews and ratings, user generated content, blogs, marketing partners, native advertising, landing page, and influencer marketing.		
Module:7	Technological Advancements in DM	4 hours
Voice search, beacon strategy, micro-moment marketing, cross device marketing, anthropomorphic AI, virtual reality (VR), augmented reality (AR), mixed reality (MR), extended reality (XR), chat bots, block chain technology, and role of virtual agents in customer relationship management.		
Module:8	Contemporary Topics	2 hours
Total Lecture hours: 45 hours		
Text Book(s)		
1.	Seema Gupta, <i>Digital Marketing</i> , 2020, 2 nd Edition, McGraw-Hill Education, India	
2.	Alan Charlesworth, <i>Digital Marketing: A practical Approach</i> , 2018, 3 rd Edition, Routledge, UK	
Reference Books		
1.	Jeremy Kagan and Siddharth Shekhar Singh, <i>Digital Marketing: Strategy and Tactics</i> , 2020, 1 st Edition, Wiley, USA	
2.	David Meerman Scott, <i>The new rules of marketing and PR: How to use Content Marketing, Podcasting, Social Media, AI, Live Video, And NewsJacking to reach buyers directly</i> , 2020, 7 th Edition, Wiley, USA	
3.	Dave Chaffey and Paul Russell Smith, <i>Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing</i> , 2017, 5 th Edition, Routledge, UK	
Mode of Evaluation: CAT, Written Assignment, Quiz, and FAT.		
Recommended by Board of Studies	27-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course code	Course Title	L	T	P	C				
BMGT107L	Business Analytics	3	0	0	3				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
<p>1. To summarize, analyze, and report the data for effective business decision-making.</p> <p>2. To comprehend the advanced analytical tools available for various business problems.</p> <p>3. To evaluate various analytical tools and choose the appropriate tool(s) for the given problem and data.</p>									
Course Outcomes									
At the end of the course, the students will be able to <ol style="list-style-type: none"> 1. Compare various BA tools and evaluate various data types and scales. 2. Examine the characteristics of data to summarize it effectively. 3. Apply various supervised and unsupervised learning algorithms to business problems. 4. Use different techniques of BA to any one of the management domains. 5. Create and interpret the data analysis report to make business decisions. 									
Module:1	Overview to Business Analytics (BA)	5 hours							
Need for business analytics, BA Vs data science, BA Vs big data, terminologies - business intelligence, machine learning algorithms - supervised and unsupervised learning, and data mining, pillars of BA, roadmap for analytics, data types and scales, data cleansing and data preparation.									
Module:2	Descriptive Analytics	9 hours							
Descriptive analytics - measures of central tendency and dispersion, data visualization and exploration - histogram, bar chart, scatter plot, pie chart, box plot, and tree plot, probability, probability distributions, hypotheses testing, significance value (<i>p</i> -value) and relationship among variables.									
Module:3	Regression Techniques	6 hours							
Simple linear regression and multiple linear regression (MLR), - theory, assumptions, goodness of fit, and model comparison. Applications of simple linear regression, MLR, using business problem and data.									
Module:4	Classification Techniques	8 hours							
Binary logistic regression, decision tree, KNN, Naïve Bayes, LDA - theory and evaluations of classifiers (ROC and confusion matrix). Applications of binary logistic regression decision tree, KNN, Naïve Bayes, and LDA using business problem and data.									
Module:5	Clustering and Dimensionality Reduction	6 hours							
Basics and uses of cluster analysis (K-means and Hierarchical clustering), and dimensionality reduction (FA and PCA). Interpretations to the outputs of K-means clustering, Hierarchical clustering, FA, and PCA.									
Module:6	Applications of BA	6 hours							
Domain Applications of BA: HR analytics / marketing and retail analytics / web and social media analytics / financial analytics.									
Module:7	Report Writing	3 hours							
Report writing - summary, problem identification, objectives, data visualization and exploration, methodology, interpretations, findings, and conclusions.									
Module:8	Contemporary Topics	2 hours							
		Total Lecture Hours:	45 hours						
Text Book(s)									

1.	Dinesh Kumar U, <i>Business Analytics: The Science of Data-Driven Decision Making</i> , 2017, 1 st Edition, Wiley, India.		
2.	Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, and David R. Anderson, <i>Essentials of Business Analytics</i> , 2017, 2 nd Edition, Cengage Learning Inc., USA.		
Reference Books			
1.	Evans, J. R., <i>Business Analytics: Methods, Models and Decisions</i> , 2021, 3 rd Edition, Pearson Education, USA.		
2.	Albright, S. C., and Winston, W. L., <i>Business Analytics: Data Analysis and Decision Making</i> , 2020, 7 th Edition, Cengage Learning India Pvt. Ltd, India.		
3.	Shmueli, G., Bruce, P. C., Yahav, I., Patel, N. R., and Lichtendahl, K. C., <i>Data Mining for Business Analytics: Concepts, Techniques, and Applications in R</i> , 2017, 1 st Edition, Wiley, USA.		
Mode of Evaluation: CAT, Written Assignment, Quiz, Project, Seminar, Group Discussion, Case Study, and FAT			
Recommended by Board of Studies	27-05-2022		
Approved by Academic Council	No. 66	Date	16-06-2022

Course Code	Course Title	L	T	P	C				
BCLE214L	Global Warming	3	0	0	3				
Pre-requisite	NIL	Syllabus version			1.0				
Course Objectives									
The objectives of this course is to :									
<ol style="list-style-type: none"> 1. Learn atmospheric dynamics and transport of heat. 2. Evaluate climate changes using models and predict global warming. 3. Acquire the concept of mitigation measures for global warming. 									
Course Outcomes									
Upon completion of this course, the student will be able to :									
<ol style="list-style-type: none"> 1. Understand the principles of atmospheric dynamics and demonstrate the intimidations of global warming at global and regional level. 2. Understand the need for mitigation and vulnerability assessment of regional and global warming. 3. Critically evaluate the scientific insights of the IPCC, global policies on global warming and mitigation. 4. Develop climatic models to predict global warming. 5. Relate knowledge of science and engineering for mitigation of global warming. 									
Module:1	Introduction								
5 hours									
Introduction to global warming—Significance of ozone in environment—Depletion of ozone layer-Greenhouse gases-Vienna convention and Montreal protocol-Role of hydrological cycle with greenhouse gases-Carbon cycle.									
Module:2	Characteristics of atmosphere and its effects								
8 hours									
Physical and chemical characteristics of atmosphere-Biogeochemistry-Atmospheric stability-Temperature profile of the atmosphere—Temperature inversion effects—Isobaric heating and cooling—Adiabatic lapse rates-Radiation, convection and advections-Sun & solar radiation-Energy balance—Terrestrial radiation and the atmosphere.									
Module:3	Elements of global warming								
7 hours									
Total carbon dioxide emissions by energy sector—industrial, commercial, transportation, residential—Impacts—air quality, hydrology, green space—Causes of global and regional climate change—Changes in patterns of temperature, precipitation and sea level rise—Greenhouse effect.									
Module:4	Impacts of global warming								
7 hours									
Roots of global warming—Temperature alteration in the atmosphere—Melting of ice Pole-sea level rise-Impacts on Ecosystem—Water Resources-Methods and Scenarios—Uncertainties in the impacts of global warming—Risk of irreversible changes –Vulnerability assessment.									
Module:5	Forecasting global warming with climate change models								
6 hours									
Developing climate models—Climate system model—Climate simulation and drift—Evaluation of climate model simulation—Regional (RCM)—Global (GCM)—Global average response to warming—Climate change observed to date.									
Module:6	Global Policies and regulations towards global warming								
5 hours									
National and national legislative frameworks—UNFCCC—IPCC—Kyoto protocol—Kyoto mechanisms, clean development mechanisms, IPCC details and actions—Carbon credits—International and Regional cooperation.									
Module:7	Mitigation measures of global warming								
5 hours									

Carbon sequestration and Carbon capture and storage (CCS)-Clean development mechanism (CDM)–Carbon trading–Future clean technology–Renewable and alternative energy, Green building, eco-friendly plastic.		
Module:8	Contemporary issues	2 hours
Total Lecture Hours		45 hours
Text Book(s)		
<ol style="list-style-type: none"> 1. Robin Moilveen, Fundamentals of weather and climate, 2010, Second Edition, Oxford University Press, UK. 2. Neelin David J, Climate Change and Climate Modelling, 2011, First Edition, Cambridge University Press, UK. 		
Reference Books		
<ol style="list-style-type: none"> 1. Thomas Stocker, Introduction to Climate Modelling, Advances in Geophysical and Environmental Mechanics and Mathematics. 2011, Springer, UK. 2. Robert T. Watson, Marufu C. Zinyowera, Impacts, Richard H. Moss, Adaptation and mitigation of climate change–Scientific Technical Analyses, 1996, Cambridge University Press, Cambridge, USA. 3. J.M. Wallace, P.V. Hobbs, Atmospheric Science, 2006, Second Edition, Elsevier / Academic Press, USA. 		
Mode of Evaluation: CAT, Assignment, Quiz, FAT.		
Recommended by Board of Studies	24.02.2022	
Approved by Academic Council	No. 66	Date 16-06-2022

BCLE215L

Waste Management

(3-0-0-3)

Introduction to Waste Management – Sources, Segregation, Disposal, Regulations; MSW Management – Bio-mining, Waste Management and Reduction; Hazardous waste management – Storage, Transport, Treatment techniques, Health effects; Radioactive Waste Management - Nuclear power plants and fuel production, ICRP and AERB; Wastewater Management - Zero Liquid Discharge, Disposal methods; Emerging waste – Types, Recycling and Recovery; Closed Loop Approach - Circular Economy, Supply Chain, SDG, Economic Policies.

Course Code	Course Title	L	T	P	C						
BCLE215L	Waste Management	3	0	0	3						
Pre-requisite	NIL			Syllabus version							
		1.0									
Course Objectives											
The objectives of this course is to :											
<ol style="list-style-type: none"> 1. Understand the different sources of the waste. 2. Analyse the socio-economic and environmental factors for waste management. 3. Imply the shift of waste management in the closed loop approach. 											
Course Outcomes											
Upon completion of this course, the student will be able to :											
<ol style="list-style-type: none"> 1. Understand the potential impacts of waste management. 2. Develop the environmental, social and economic framework towards sustainable development. 3. Apply sustainable development tools in regulating the waste management. 4. Implement life cycle analysis in waste management. 5. Involve in the concepts of closed loop approach and circular economy. 											
Module:1	Introduction to Waste Management										
5 hours											
Perspective of waste generation–Sources, impacts, characteristics, segregation and disposal of waste–Linear economy –Urbanization and new challenges in waste management–Problems associated with the waste–Relevant Regulations.											
Module:2	Municipal Solid Waste Management										
7 hours											
Sources; composition; generation-Rates; collection of waste; separation-Transfer and transport of waste-Treatment and disposal options-Landfill-Bio-mining-Incineration-Biomedical waste-Source, generation and classification-Waste management and reduction techniques.											
Module:3	Hazardous Waste Management										
6 hours											
Characterization of waste-Compatibility and flammability of chemicals-Storage-Transport-Secured Landfills-Treatment techniques-Fundamental concepts on fate and transport of chemicals-Health effects.											
Module:4	Radioactive Waste Management										
6 hours											
Sources, measures and health effects-Nuclear power plants and fuel production-Waste generation from nuclear power plants–Low level and high level waste-Management-Radiation standard by ICRP and AERB-Regulatory framework.											
Module:5	Wastewater Management										
5 hours											
Sources and characteristics of wastewater–Primary wastewater treatment–Secondary wastewater treatment–Sludge treatment alternatives–Industrial wastewater treatment–Zero Liquid Discharge–Wastewater disposal methods.											
Module:6	Emerging waste										
9 hours											
Sources and Characteristics of Plastic waste, marine plastic waste, microplastic, E-waste, Agriculture waste, Glass waste, Metal waste, Oil and gas exploration and production of waste, Space waste, Construction material waste-Recycling non-biodegradable waste, Tyre recycling, End of life textiles, Recovery of value added products, Reuse of waste.											
Module:7	Closed Loop Approach Towards Circular Economy										
5 hours											
Introduction to the Circular Economy-Transition from Linear to Circular Economy-Closed loop supply chain–Integrated waste refinery-Sustainable Development Goals (SDGs)-											

Circular Economy policies towards Sustainable Development.		
Module:8	Contemporary issues	2 hours
Total Lecture Hours		45 hours
Text Book(s)		
1. Salah M. El-Haggar, Sustainable Industrial Design and Waste Management Cradle-to-cradle for Sustainable Development, 2007, Elsevier Academic Press, USA.		
Reference Books		
1. Trevor M. Letcher and Daniel A. Vallero, Waste- A Handbook for Management, 2019, Second Edition, Elsevier Academic Press, USA. 2. Alexandros Stefanakis and Ioannis Nikolaou, Circular Economy and Sustainability Volume 2: Environmental Engineering, 2021, First Edition, Elsevier Academic Press, USA.		
Mode of Evaluation: CAT, Assignment, Quiz, FAT.		
Recommended by Board of Studies	24.02.2022	
Approved by Academic Council	No. 66	Date 16-06-2022

BCLE216L

Water Resources Management

(3-0-0-3)

Water, A Multi-Dimensional Resource - Multi-dimensional management, Climate change; Surface Water and Groundwater Global and Indian Scenario – Water quality, Water footprint; Water Resources Assessment - Network design, Stream flow gauging, Geophysical exploration; Water in Agricultural systems - Water for food production, Water pollution from agricultural production; Water economics – Distinction between values and charges, Private Sector involvement; Water legal and regulatory settings - Water policy for Irrigation, Groundwater laws and rain water harvesting; Demand Management – Crisis management, Cost of water, Future trends.

Course Code	Course Title	L	T	P	C
BCLE216L	Water Resource Management	3	0	0	3
Pre-requisite	NIL		Syllabus version		
			1.0		

Course Objectives

The objectives of this course is to :

1. Acquire the basic principles of water resources and its planning and management.
2. Enhance the knowledge on recent technologies in assessing the water resources.
3. Identify the challenges facing water management in varied climate types around the world.

Course Outcomes

Upon completion of this course, the student will be able to :

1. Understand the planning of water resources and need for water resource management.
2. Understand the water resource potential in global, India scenario and explore the water resources using different technologies.
3. Acquire a knowledge international and national water law and its policy.
4. Explain the concept of water in agricultural and economic aspects.
5. Predict the future trends of water demand and its management during crisis.

Module:1	Water, A Multi-Dimensional Resource	5 hours
Water resources planning-Multi-dimensional management-Water withdrawal and consumption by sector-Stress, international policy-Climate change, oceans, challenges and need for water resource management.		
Module:2	Global and Indian Scenario for Water Resources	4 hours
Surface Water and Groundwater Global and Indian Scenario-Quality of water resources-Water use and sustainable reuse methods-Usable water resources by continent and country-Water footprint.		
Module:3	Water Resources Assessment	5 hours
Network design-Stream flow gauging-Weir design-Gauges-Current gauging-Salt dilution-Geophysical exploration-Test drilling-Application of remote sensing techniques.		
Module:4	Water in Agricultural Systems	7 hours
Water for food production, virtual water trade for achieving global water security, irrigation efficiencies, irrigation methods and current water pricing, water for livestock and processing, water pollution from agricultural production		
Module:5	Water Economics	8 hours
Economic characteristics of water good and services-Nonmarket monetary valuation methods-Water economic instruments-Policy options for water conservation and sustainable use, pricing, distinction between values and charges-Private sector involvement in water resources management.		
Module:6	Water Legal and Regulatory Settings	8 hours
National and International Framework for Water Law; Basic structure of water law- An overview of water law in India -Evolution of water law, key features of water law, evolving water law and policy-Water policy for Irrigation, decentralization and participation in irrigation management, and the policy measures proposed to establish water user associations. National level initiatives for regulation of groundwater, State groundwater laws and rainwater harvesting.		

Module:7	Demand Management	6 hours
Balancing supply and demand-Economic theory of supply and demand-management by use of tariffs-Timing, long-term, operational time-frame-Crisis management-Cost of water-Future trends-Economic value of water-Loss control-Water harvesting.		
Module:8	Contemporary issues	2 hours
Total Lecture Hours		45 hours
Text Book(s)		
1. David Stephenson, Water Resources Management, 2004, A. A. Balkema Publishers, Netherlands.		
Reference Books		
1. Louis Theodore, Ryan Dupont R., Water Resource Management Issues, Basic Principles and Applications, 2020, CRC Press, Taylor & Francis Group, New York. 2. Philippe Cullet and Sujith Koonan, Water Law in India- An Introduction to Legal Instruments, 2017. Second Edition, Oxford University Press, New Delhi. 3. Subramanya. K., Engineering Hydrology, 2020, Fifth Edition, McGraw Hill Education Pvt. Ltd., New Delhi.		
Mode of Evaluation: CAT, Assignment, Quiz, FAT.		
Recommended by Board of Studies	24.02.2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Short Syllabus

BECE201L Electronic Materials and Devices (3-0-0-3)

Atomic Structure, Bonding and Types of solid, Single Crystal Growth, Drude Model , Hall effect, Skin effect, Energy bands, Semiconductor materials, Doping, Carrier statistics, Carrier transport, Semiconductor Junctions, Bipolar Junction Transistors (BJT), BJT characteristics and models, MOS Capacitors, MOS Field Effect Transistors (MOSFET), MOSFET characteristics and models, Short channel effects, Advanced Materials

BECE201L	Electronic Materials and Devices	L	T	P	C			
		3	0	0	3			
Pre-requisite	Nil	Syllabus version						
		1.0						
Course Objectives								
<ol style="list-style-type: none"> 1. To introduce the students with concepts of electronic materials and their properties 2. To demystify semiconductor device physics and electronics. 3. To equip the students with the tools for solving problems of semiconductor devices and circuits. 4. To familiarize the students with various electronic devices and their circuit applications. 								
Course Outcome								
Students will be able to:								
<ol style="list-style-type: none"> 1. Comprehend the basics of electronic materials, crystal structure, electrical and thermal conduction in solids. 2. Draw and analyze the band diagrams of semiconductor devices. 3. Understand and model the carrier transport mechanisms in semiconductors. 4. Design and model the PN-junctions for given specifications. 5. Develop small signal models for BJT and also design BJT amplifiers under different Configurations. 6. Model MOS capacitors, MOSFETs; learn and mitigate the short channel effects and design future technology nodes. 								
Module:1	Electrical and Thermal conduction in Solids	6 hours						
Crystalline state – Crystalline defects – Single Crystal Growth - Czochralski Growth – Amorphous Semiconductor - Classical Theory: Drude Model – Temperature dependence of resistivity – The Hall Effect and Hall Devices – Thermal conduction – Electrical conductivity of non-metals – Skin Effect – Thin metal films.								
Module:2	Semiconductor Fundamentals	7 hours						
Introduction to Solids, Crystals, and Electronic materials – Formation of energy bands – Energy band Model – Effective mass - Direct and indirect bandgap – Elemental and compound semiconductors, Intrinsic and extrinsic semiconductors. The density of states, Carrier statistics, Fermi level, Equilibrium carrier concentration, Quasi-equilibrium, and Quasi-Fermi level.								
Module:3	Carrier Transport Mechanism	6 hours						
Charge carriers in semiconductors – Drift and Diffusion of carriers – Mobility – Generation, Recombination and injection of carriers – Carrier transport equations – Excess carrier lifetime.								
Module:4	Junction diodes	8 hours						
PN Junction – Equilibrium and biased – Contact potential and space charge phenomena, Current – Voltage relationship, Diode capacitances, One-sided PN junction, Avalanche and Zener breakdown, Zener diode, small-signal model of PN junction. Metal-Semiconductor Contact: Schottky diode, current-voltage characteristics, Ohmic contacts. Varactor diode, Tunnel diode, Photo Diode, Solar Cells.								
Module:5	Bipolar Junction Transistor	5 hours						
Device structure and physical operation, Current – Voltage relationship – CB, CE, and CC configuration – Nonideal effects – Base width modulation – Ebers-Moll model. Small signal models, Device capacitances – Equivalent circuit model.								
Module:6	Field Effect Transistor	7 hours						
JFET, MOS Capacitors: Energy-band diagrams, flat-band, accumulation, depletion, inversion, threshold voltage, Capacitance-Voltage characteristics. MOSFETs: Current-Voltage characteristics, velocity saturation, leakage currents, short channel effects – V_t roll-off and drain-induced barrier lowering, scaling limits, alternative technologies. Equivalent circuit model-second order effects.								

Module:7	Other Electronic Materials	4 hours
Dielectrics, Insulators, Ferroelectric Materials, Supercapacitors, Graphene, Carbon Nanotubes, Superconductors		
Module:8	Contemporary Topics	2 hours
Guest lecture from industry and R & D organizations		
	Total Lecture hours:	45 hours
Text Book(s)		
1.	S.O.Kasap, Principles of Electronic Materials and Devices , 2018, 4 th Edition, McGraw Hill Education.	
Reference Books		
1.	Simon Sze, Ming-Kwei Lee, Semiconductor Devices, Physics and Technology,2012, 3 rd Edition, Wiley International Student Version.	
2.	Ben G Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, 2015, 7 th Edition, Pearson.	
3.	Adel S. Sedra, Kenneth C. Smith & Arun N. Chandorkar, Microelectronic Circuits: Theory and Applications,2014, 7 th Edition, Oxford University Press, New York.	
4.	Donald A. Neamen, Semiconductor Physics and Devices, 2017,4th Edition, McGraw Hill.	
Mode of Evaluation: CAT / written assignment / Quiz / FAT / Project / Seminar / group discussion / fieldwork (include only those that are relevant to the course. Use ',' to separate the evaluations. Eg. CAT, Quiz and FAT.		
Recommended by Board of Studies	09-11-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

Short Syllabus

BECE202L Signals and Systems (2-1-0-3)

Continuous time and discrete time signals, continuous time and discrete time systems, convolution and correlation of signals, Fourier Series, Fourier Transform and Discrete time Fourier transform, Magnitude and phase response of transfer function, Hilbert transform and processing of bandpass signals, Laplace and Z-transforms.

BECE202L	Signals and Systems	L	T	P	C				
		2	1	0	3				
Pre-requisite	BMAT102L	Syllabus version							
		1.0							
Course Objectives									
<ol style="list-style-type: none"> 1. To understand the basic attributes of signals and systems. 2. To analyse the signals and systems in time and transformed domains such as Fourier, Laplace and Z- transform. 3. To understand the concept of sampling process. 									
Course Outcome									
On studying this course, students will be able to									
<ol style="list-style-type: none"> 1. Differentiate between various types of signals and understand the implication of operations on signals. 2. Understand the terms like causal, dynamic, linear, time invariant and stability of systems. Also, students will be able to compute impulse response of both continuous time and discrete time systems. 3. Perform the transformation of CT and DT signals from time domain to frequency domain and understand the concept of distribution of energy as a function of frequency. 4. Convert the CT signals to DT signals and vice versa and understand their consequences. 5. Processing of bandpass signals through bandpass systems. 6. Solve differential and difference equations, with initial conditions, using Laplace and Z transforms respectively. 									
Module:1	Continuous Time and Discrete Time signals	7 hours							
Signal classification – Types of signals: Unit impulse, unit step, ramp, sign, and exponential signals – Operations on signals – Analogy between vectors and signals –Concept of linearly dependent and independent vectors, Orthogonality – Mean square error – Computation of energy, power, periodicity, Norms and moments of signals, – Distance metrics for signals.									
Module:2	Continuous Time and Discrete Time systems	7 hours							
Classification of systems – Linearity, time invariance, stability, Invertibility, Causality and memory systems. Interconnection of systems. Systems defined by differential & difference equations- Impulse and step response of the systems. Transmission of signals through LTI systems - Convolution and Correlation for CT and DT systems									
Module:3	Fourier Series	5 hours							
The response of LTI systems to complex exponentials, Fourier series representation of Continuous Time Periodic Signals, Gibb's phenomena, Properties of CTFS, Fourier series representation of Discrete Time Periodic Signals, Properties of DTFS, Power spectral density.									
Module:4	Fourier Transforms	6 hours							
Representation of aperiodic continuous signals: The Continuous Time Fourier Transform, The Fourier Transform for Periodic Signals, Properties of CTFT, Systems characterized by linear constant-coefficient Differential Equations.									
Representation of aperiodic discrete signals: The Discrete Time Fourier Transform, The Fourier Transform for Periodic Signals, Properties of DTFT, DTFT of systems characterized by linear constant-coefficient Difference Equations. Energy spectral density.									
Module:5	Hilbert Transform and processing of Band Pass signals	6 hours							
Magnitude and phase response of the systems, Group delay, Representation of bandpass									

signals: In-phase and quadrature phase components, Hilbert transform – Pre and complex envelopes. Processing of bandpass signals through bandpass systems.		
Module:6	Sampling	4 hours
Impulse train sampling -Zero order hold, Nyquist criteria – Aliasing - Reconstruction – Ideal filtering		
Module:7	Laplace and Z-Transform	8 hours
Laplace transform: Definition – ROC – Properties – S-plane causality and BIBO stability – Transfer function – Unilateral Laplace transform: Solution of differential equations with initial conditions. Z-transform: Definition - S-plane to Z-plane mapping - ROC – Properties of Z-transform. System analysis – Transfer function - Causality- BIBO stability – Unilateral Z-transform, Solution of. Difference equations with initial conditions.		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1.	Alan V.Oppenheim, Alan S.Willsky, with S.Hamid Nawab, "Signals and Systems", Prentice-Hall of India.2 nd Edition,2016.	
2.	M.J.Roberts, Govind Sharma, "Fundamentals of Signals and Systems", 2 nd Edition, Tata McGraw-Hill,2017.	
Reference Books		
1.	Simon Haykin, Barry Van Veen, "Signals and Systems", 2 nd edition, Wiley Publications, 2021.	
2.	P. Rama Krishna Rao and Shankar Prakriya, "Signals and Systems", second edition - Mc-Graw Hill, 2017.	
3	Simon Haykin, "Communication systems", 4 th edition, Wiley Publications.	
4	Lathi BP, "Signals, Systems and Communications", 2 nd Edition, BS Publications 2019.	
Mode of assessment: Continuous assessment / FAT / Assignments, Oral examination and others		
Recommended by Board of Studies	09-11-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

Short Syllabus

BECE203L Circuit Theory (3-1-0-4)

Steady state and transient sinusoidal analysis and network theorems using phasors, Resonance , Graph theory and its applications in circuit solving, Two-port networks and interconnection of networks, Passive filters and attenuators, Applications of Laplace and Fourier transforms, Fourier series analysis of electrical circuits.

BECE203L	Circuit Theory	L	T	P	C					
		3	1	0	4					
Pre-requisite	BEEE101L, BEEE101P		Syllabus version							
			1.0							
Course Objectives										
<ol style="list-style-type: none"> 1. To prepare the students to analyse the given electrical network using phasors and graph theory. 2. To introduce the students with the basic knowledge of Laplace transform, Fourier Transform and Fourier series and to analyse the network using suitable technique. 3. To prepare the students to analyse the two-port networks, passive filters, and attenuators. 										
Course Outcome										
<ol style="list-style-type: none"> 1. Apply the knowledge of various circuit analysis techniques such as mesh analysis, nodal analysis, and network theorems to investigate the given network. 2. Analyse the resonance and transient response of the first order, second order circuits 3. Able to solve the networks using graphical approach. 4. Design and analyse two-port networks, passive filters and attenuators. 5. Able to analyse the given network by transforming from time domain to S domain. 6. Analyse the given network using Fourier series and transforming from time domain to frequency domain. 										
Module:1	Sinusoidal Steady-State Analysis	10 hours								
Review of steady state sinusoidal analysis using phasors. Node voltage and Mesh current analysis, special cases. Network theorems: Superposition, Thevenin, Norton and maximum power transfer theorems.										
Module:2	Transient Response of first order, second order circuits and Resonance	10 hours								
Time response in inductance (L) and capacitance (C), steady state response of circuits with RLC components. Response (forced & natural) of first order circuits (RL & RC): series, parallel, source free, complex circuits with more than one resistance, power sources and switches. Response of second order circuit (RLC): series, parallel and complex circuits. Series and parallel resonance condition.										
Module:3	Network Graphs	6 hours								
Definition of terms. Matrices associated with graphs: incidence, reduced incidence, fundamental cut-set and fundamental tie-set.										
Module:4	Two-Port Networks	8 hours								
Significance and applications of one port and two port networks. Two port network analysis using Admittance (Y) parameters, Impedance (Z) parameters and Hybrid (h) parameters. Interconnection of Two port networks										
Module:5	Filters, Attenuators and equalizers	8 hours								
Concept of filtering. Filter types: Low-pass, High-pass, Band-pass and Band-stop and their characteristics. Design of attenuators: T, π , Lattice and Bridged-T types, Equalizers.										
Module:6	Circuit Analysis in the S domain	8 hours								
Introduction to Laplace transform (LT), poles, zeros and transfer functions. Analysis of first and second order circuits subjected to periodic and aperiodic excitations using Laplace transforms.										
Module:7	Application of Fourier series and Fourier transforms in Circuit Analysis	8 hours								
Trigonometric Fourier series, Symmetry conditions, Applications in circuit solving, Fourier transforms. Properties, Applications in circuit solving, Comparisons of Fourier and Laplace transforms.										

Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	60 hours
Text Book(s)		
1. Charles K. Alexander, Matthew N. O. Sadiku, "Fundamentals of Electric Circuits," 2020, Seventh Edition, McGraw Hill Higher Education.		
Reference Books		
1.	W.H.Hayt, J.E.Kemmerly & S.M.Durbin, "Engineering Circuit Analysis", 2019, Ninth Edition, McGraw Hill Higher Education.	
2.	Allan R. Hambley, "Electrical Engineering – Principles & applications", 2016, Sixth Edition, Pearson Education, Noida, India.	
Mode of Evaluation: Internal Assessment (CAT, Quizzes, Digital Assignments) & Final Assessment Test (FAT)		
Recommended by Board of Studies	09-11-2021	
Approved by Academic Council	No. 64	Date 16-12-2021

Short Syllabus

BECE102L Digital Systems Design (3-0-0-3)

Digital Logic - Boolean algebra, Gate level minimization; Verilog HDL – Data flow modelling, Test bench; Design of combinational logic circuits – Full Adder, Full Subtractor, Multiplexers, Modeling of Combinational logic circuits using Verilog HDL; Design of Data path circuits - N-bit Parallel Adder/Subtractor; Design of Sequential logic circuits – Shift Registers, state table and state diagrams; Design of FSM - Modeling of FSM using Verilog HDL; Programmable Logic devices - FPGA Generic architecture.

Course Code	Course Title	L	T	P	C
BECE102L	Digital Systems Design	3	0	0	3
Pre-requisite	Nil				Syllabus version
1.0					
Course Objectives					
<ol style="list-style-type: none"> Provide an understanding of Boolean algebra and logic functions. Develop the knowledge of combinational and sequential logic circuit design. Design and model the data path circuits for digital systems. Establish a strong understanding of programmable logic. Enable the student to design and model the logic circuits using Verilog HDL. 					
Course Outcome					
At the end of the course the student will be able to					
<ol style="list-style-type: none"> Optimize the logic functions using and Boolean principles and K-map. Model the Combinational and Sequential logic circuits using Verilog HDL. Design the various combinational logic circuits and data path circuits. Analyze and apply the design aspects of sequential logic circuits. Analyze and apply the design aspects of Finite state machines. Examine the basic architectures of programmable logic devices. 					
Module:1	Digital Logic				8 hours
Boolean Algebra: Basic definitions, Axiomatic definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Simplification of Boolean functions. Gate-Level Minimization: The Map Method (K-map up to 4 variable), Product of Sums and Sum of Products Simplification, NAND and NOR Implementation. Logic Families: Digital Logic Gates, TTL and CMOS logic families.					
Module:2	Verilog HDL				5 hours
Lexical Conventions, Ports and Modules, Operators, Dataflow Modelling, Gate Level Modelling, Behavioural Modeling, Test Bench.					
Module:3	Design of Combinational Logic Circuits				8 hours
Design Procedure, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Decoders, Encoders, Multiplexers, De-multiplexers, Parity generator and checker, Applications of Decoder, Multiplexer and De-multiplexer. Modeling of Combinational logic circuits using Verilog HDL.					
Module:4	Design of data path circuits				6 hours
N-bit Parallel Adder/Subtractor, Carry Look Ahead Adder, Unsigned Array Multiplier, Booth Multiplier, 4-Bit Magnitude comparator. Modeling of data path circuits using Verilog HDL.					
Module:5	Design of Sequential Logic Circuits				8 hours
Latches, Flip-Flops - SR, D, JK & T, Buffer Registers, Shift Registers - SISO, SIPO, PISO, PIPO, Design of synchronous sequential circuits: state table and state diagrams, Design of counters: Modulo-n, Johnson, Ring, Up/Down, Asynchronous counter. Modeling of sequential logic circuits using Verilog HDL.					
Module:6	Design of FSM				4 hours
Finite state Machine(FSM):Mealy FSM and Moore FSM , Design Example : Sequence detection, Modeling of FSM using Verilog HDL.					
Module:7	Programmable Logic Devices				4 hours
Types of Programmable Logic Devices: PLA, PAL, CPLD, FPGA Generic Architecture.					

Module:8	Contemporary issues	2 hours
Total Lecture hours:		45 hours
Textbook(s)		
1.	M. Morris Mano and Michael D. Ciletti, Digital Design: With an Introduction to the Verilog HDL and System Verilog, 2018, 6 th Edition, Pearson Pvt. Ltd.	
Reference Books		
1.	Ming-Bo Lin, Digital Systems Design and Practice: Using Verilog HDL and FPGAs, 2015, 2nd Edition, Create Space Independent Publishing Platform.	
2.	Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, 2009, 2nd edition, Prentice Hall of India Pvt. Ltd.	
3.	Stephen Brown and ZvonkoVranesic, Fundamentals of Digital Logic with Verilog Design, 2013, 3rd Edition, McGraw-Hill Higher Education.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course Code	Course Title			L	T	P	C							
BECE102P	Digital Systems Design Lab			0	0	2	1							
Pre-requisite	Nil			Syllabus version										
Course Objective														
<ul style="list-style-type: none"> To apply theoretical knowledge gained in the theory course and get hands-on experience of the topics. 														
Course Outcome														
At the end of the course the student will be able to														
<ol style="list-style-type: none"> Design, simulate and synthesize combinational logic circuits, data path circuits and sequential logic circuits using Verilog HDL. Design and implement FSM on FPGA. Design and implement small digital systems on FPGA. 														
Indicative Experiments														
1.	Characteristics of Digital ICs, Realization of Boolean expressions			2 hours										
2.	Design and Verilog modeling of Combinational Logic circuits			4 hours										
3.	Design and Verilog modeling of various data path elements - Adders			2 hours										
4.	Design and Verilog modeling of various data path elements - Multipliers			2 hours										
5.	Implementation of combinational circuits – (FPGA / Trainer Kit)			2 hours										
6.	Implementation of data path circuit - (FPGA / Trainer Kit)			2 hours										
7.	Design and Verilog modeling of simple sequential circuits like Counters and Shift registers			2 hours										
8.	Design and Verilog modeling of complex sequential circuits			2 hours										
9.	Implementation of Sequential circuits - (FPGA / Trainer Kit)			2 hours										
10.	Design and Verilog modeling of FSM based design – Serial Adder			2 hours										
11.	Design and Verilog modeling of FSM based design – Traffic Light Controller / Vending Machine			4 hours										
12.	Design of ALU			4 hours										
Total Laboratory Hours							30 hours							
Mode of Assessment: Continuous Assessment and Final Assessment Test														
Recommended by Board of Studies	14-05-2022													
Approved by Academic Council	No. 66	Date	16-06-2022											

Short Syllabus

BECE204L Microprocessors and Microcontrollers (3-0-0-3)

Overview of Microprocessors - Introduction to 8-bit/16-bit Microprocessor; Microprocessor Architecture and Interfacing: Intel x86 - 8086 Architecture and Addressing modes; Microcontroller Architecture: Intel 8051 – RAM ROM Organization, Assembly programming; Microcontroller 8051 Peripherals – Timers, Counters; I/O interfacing with Microcontroller 8051 - LCD, Sensor with Signal Conditioning Interface; ARM Processor Architecture - Overview of ARM architecture; ARM Instruction Set - Assembly Programming.

Course Code	Course Title	L	T	P	C
BECE204L	Microprocessors and Microcontrollers	3	0	0	3
Pre-requisite	BECE102L	Syllabus version			1.0
Course Objectives:					

1. To acquaint students with architectures of Intel microprocessors, microcontroller and ARM processors.
2. To familiarize the students with assembly language programming in 8051 microcontroller and ARM processor.
3. To interface peripherals and I/O devices with the 8051 microcontroller.

Course Outcome:

At the end of the course, the student should be able to

1. Comprehend the various microprocessors including Intel Pentium Processors
2. Infer the architecture and Programming of Intel 8086 Microprocessor.
3. Comprehend the architectures and programming of 8051 microcontroller.
4. Deploy the implementation of various peripherals such as general purpose input/output, timers, serial communication, LCD, keypad and ADC with 8051 microcontroller
5. Infer the architecture of ARM Processor
6. Develop the simple application using ARM processor.

Module:1 Overview of Microprocessors	3 hours
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Introduction to Microprocessors, 8-bit/16-bit Microprocessor, Overview of Intel Pentium, I (i3, i5, i7) Series Processor.

Module:2 Microprocessor Architecture and Interfacing: Intel x86	8 hours
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16-bit Microprocessor: 8086 - Architecture and Addressing modes, Memory Segmentation, Instruction Set, Assembly Language Processing, Programming with DOS and BIOS function calls, minimum and maximum mode configuration, Programmable Peripheral Interface (8255), Programmable Timer Controller (8254), Memory Interface to 8086.

Module:3 Microcontroller Architecture: Intel 8051	7 hours
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Microcontroller 8051 - Organization and Architecture, RAM-ROM Organization, Machine Cycle, Instruction set: Addressing modes, Data Processing - Stack, Arithmetic, Logical; Branching – Unconditional and Conditional, Assembly programming.

Module:4 Microcontroller 8051 Peripherals	5 hours
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I/O Ports, Timers-Counters, Serial Communication and Interrupts.

Module:5 I/O interfacing with Microcontroller 8051	7 hours
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LCD, LED, Keypad, Analog-to-Digital Convertors, Digital-to-Analog Convertors, Sensor with Signal Conditioning Interface.

Module:6 ARM Processor Architecture	5 hours
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ARM Design Philosophy; Overview of ARM architecture; States [ARM, Thumb, Jazelle]; Registers, Modes; Conditional Execution; Pipelining; Vector Tables; Exception handling.

Module:7 ARM Instruction Set	8 hours
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ARM Instruction- data processing instructions, branch instructions, load store instructions, SWI Instruction, Loading instructions, conditional Execution, Assembly Programming.

Module:8 Contemporary issues	2 hours
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	Total Lecture hours:	45 hours
Text Book(s)		
1.	A.K. Ray, K.M. Bhurchandi, Advanced Microprocessor and Peripherals, 2012, 2 nd Edition, Tata McGraw-Hill, India.	
2.	Mohammad Ali Mazidi, Janice G. Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems, 2014, 2 nd Edition, Pearson, India.	
Reference Books		
1.	Muhammad Ali Mazidi, ARM Assembly Language Programming & Architecture: 1, 2016, 2nd Edition, Microdigitaled.com	
2.	A. Nagoor Kani, 8086 Microprocessors and its Applications, 2017, Second Edition, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, India.	
3.	Joseph Yiu, The Definitive Guide to ARM® Cortex®-M0 and Cortex-M0+ Processors, 2015, 2 nd Edition, Elsevier Science & Technology, UK	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course Code	Course Title	L	T	P	C
BECE204P	Microprocessors and Microcontrollers Lab	0	0	2	1
Pre-requisite	BECE102L		Syllabus version		
			1.0		

Course Objectives

1. To familiarize the students with assembly language programming using microprocessor and microcontroller.
2. To familiarize the students with Embedded C language programming using microcontroller.
3. To interface peripherals and I/O devices with the microcontroller and microprocessor.

Course Outcome

Student will be able to

1. Showcase the skill, knowledge and ability of programming microcontroller and microprocessor using its instruction set.
2. Expertise with microcontroller and interfaces including general purpose input/ output, timers, serial communication, LCD, keypad and ADC.

Indicative Experiments [Experiments using 8086/8051/ARM]

1	Assembly language programming of Arithmetic/logical operations.	6 hours
2	Assembly language programming of memory operations.	4 hours
3	Assembly language programming/ Embedded C programming for interfacing the peripherals: General purpose input/ output, timers, serial communication, LCD, keypad and ADC.	10 hours
4	Hardware implementation of peripheral interfacing: General purpose input/ output, timers, serial communication, LCD, keypad and ADC.	10 hours
Total Laboratory Hours		30 hours

Mode of Assessment: Continuous Assessment and Final Assessment Test

Recommended by Board of Studies	14-05-2022		
Approved by Academic Council	No. 66	Date	16-06-2022

Short Syllabus

BECE205L Engineering Electromagnetics (3-0-0-3)

Vector Calculus - Spherical coordinate systems; Electrostatics - Electric Fields due to different Charge distributions, Laplace and Poisson's equation; Magnetostatics - Biot-Savart's Law, Ampere's Circuit Law and Applications; Time Varying Fields - Faraday's Law and Lenz law, Polarization; Transmission Lines - Transmission Line Equations, Characterization of lossless, low loss and distortionless transmission lines; Smith Chart & Matching Circuits - Smith Chart configuration and applications; Waveguides - TEM, TE and TM waves.

Course Code	Course Title	L	T	P	C		
BECE205L	Engineering Electromagnetics	3	0	0	3		
Pre-requisite	BPHY101L, BPHY101P			Syllabus version			
					1.0		
Course Objectives							
<ol style="list-style-type: none"> 1. Introduce the basic concepts and properties of Electrostatics & Magnetostatics. 2. Study the propagation of EM wave through time varying Maxwell's equations and to analyze the EM Wave propagation in different conducting and dielectric media. 3. Familiarize the concept of transmission and reflection in various transmission lines and to design different transmission lines and matching circuits using Smith chart. 							
Course Outcome							
At the end of the course, the student will be able to							
<ol style="list-style-type: none"> 1. Evaluate and analyse Electric Fields & Electric Potential due to different Charge distributions. 2. Compute and analyze magnetic fields in different materials and media. 3. Analyze the EM wave propagation in conducting as well as in dielectric materials through time varying Maxwell's equations. 4. Illustrate the wave mechanism in different transmission lines at high frequencies using transmission line parameters. 5. Design Impedance matching circuits using Smith chart. 6. Analyze the field components of different waveguides based on various modes of E and H field. 							
Module:1	Vector Calculus						
Cartesian, Cylindrical, and Spherical coordinate systems. Divergence, Gradient and Curl.							
Module:2	Electrostatics						
Coulomb's Law, Electric Fields due to Different Charge Distributions, Gauss Law and Applications, Electrostatic Potential, Potential Gradient, Equipotential surfaces, Electric Dipole, Polarization in Dielectrics, Boundary conditions, current density, continuity equation. Laplace and Poisson's equation, Capacitance, Method of Images.							
Module:3	Magnetostatics						
Biot-Savart's Law, Ampere's Circuit Law and Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic Dipole, Magnetization in materials, Boundary conditions, Inductances and Magnetic Energy.							
Module:4	Time Varying Fields						
Faraday's Law and Lenz law, Maxwell's Equations in Integral and differential form, Wave equation, Uniform plane wave propagation in lossy dielectrics, Lossless Dielectrics, Good Conductors and free space. Polarization, Power and Poynting Vector.							
Module:5	Transmission Lines						
Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase velocity, input impedance, Reflection Coefficient, VSWR. Characterization of lossless, low loss and distortionless transmission lines. Significance of short circuit and open circuit lines of length $\lambda/8$, $\lambda/4$ and $\lambda/2$. Coaxial line, Planar transmission lines –Types, Microstrip Lines: field distribution, design equations, Q factor, losses in microstrip lines.							
Module:6	Smith Chart & Matching Circuits						
Smith Chart configuration and applications: Input impedance, admittance, VSWR, Reflection							

Coefficient, return loss, standing wave pattern. Matching Circuit Design- Quarter wave, Impedance Transformer, Single Stub, Double Stub and Lumped element matching.

Module:7	Waveguides	5 hours
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TEM, TE and TM waves, Parallel plate waveguide, Rectangular waveguide, Characteristics of wave guide- guide wavelength, cut off wave length, cut off frequency, wave impedance, phase constant, phase velocity, group velocity. Circular waveguide and Cavity resonator (Qualitative study)

Module:8	Contemporary issues	2 hours
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	Total Lecture hours:	45 hours
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Text Book(s)

1. William Hayt and John Buck, Engineering Electromagnetics, 2017, 8th Edition, Tata McGraw Hill, New Delhi, India.

Reference Books

1. Mathew O Sadiku, Elements of Electromagnetics, Oxford University press, New York, USA.
2. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, , PEI, India
3. D. M. Pozar, Microwave engineering, 2013, 4th Edition, Wiley & Sons, USA.

Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test

Recommended by Board of Studies	14-05-2022
Approved by Academic Council	No. 66

Date 16-06-2022

Short Syllabus

BECE206L Analog Circuits (3-0-0-3)

DC and AC analysis of amplifiers - BJT Circuits, MOSFET Circuits; MOSFET Power Amplifiers - Power Transistors; MOSFET Active Biasing and Differential Amplifiers - Introduction to Current Mirror, Large Signal and Small Signal Analysis of Differential Amplifier; Operational Amplifier Characteristics and Applications - Ideal and Nonideal characteristics of OP-AMP; Comparators and Waveform Generators - Comparator and its applications; Active filters and Data converters - Filter classifications, D/A and A/D conversion techniques; Special Function ICs - IC 555 timer.

Course Code	Course Title	L	T	P	C
BECE206L	Analog Circuits	3	0	0	3
Pre-requisite	BECE201L	Syllabus version		1.0	

Course Objectives

1. To study the basic principle of BJT and MOSFET amplifiers using suitable biasing techniques and to perform ac analysis.
2. To understand the operation and design of various classes of MOSFET power amplifier circuits.
3. To introduce MOSFET active biasing and design a MOSFET differential amplifier circuit and analyze its frequency response.
4. To study the characteristics of Operational Amplifier and its applications
5. To acquaint and demonstrate the concepts of waveform generators, filter configurations, Timer, data converters, and Voltage regulators.

Course Outcome

At the end of the course the student will be able to

1. Design the BJT and MOSFET amplifier circuits using suitable biasing techniques and analyze their frequency response characteristics.
2. Distinguish among different classes of MOSFET power amplifiers and employ them for various applications.
3. Analyze the different active biasing techniques and MOSFET-based differential amplifiers and their frequency response characteristics.
4. Comprehend the ideal characteristics of OP-AMPS and design the fundamental circuits based on OP-AMPS.
5. Design and analyze different waveform generator circuits using operational amplifiers.
6. Analyze the basic concept of filter circuits, multivibrators using 555 timer, and data converter circuits.

Module:1 DC and AC analysis of amplifiers **9 hours**

BJT Circuits: DC biasing, AC coupling and small-signal analysis of amplifiers, Frequency response of a CE amplifier, the three frequency bands, Unity gain frequency, Miller Capacitance, Multistage amplifiers. MOSFET Circuits: DC biasing, AC coupling and small-signal analysis of amplifiers, Frequency response of a CS amplifier, Unity gain frequency, Miller Capacitance, Multistage amplifiers.

Module:2 MOSFET Power Amplifiers **4 hours**

Power Amplifiers, Power Transistors, Classes of Amplifiers, Class A Power Amplifiers, Class B, Class AB Push-Pull Complementary Output Stages.

Module:3 MOSFET Active Biasing and Differential Amplifiers **6 hours**

Introduction to Current Mirror – Basic, Wilson and Cascode Current Mirror, MOSFET Basic Differential Pair, Large Signal and Small Signal Analysis of Differential Amplifier, Differential Amplifier with active load.

Module:4 Operational Amplifier Characteristics and Applications **7 hours**

Operational amplifier, Ideal and Nonideal characteristics of OP-AMP, DC and AC characteristics - Operational amplifier with negative feedback: Voltage Series, Voltage Shunt feedback amplifier - Applications of OP-AMP - summing, scaling, and averaging amplifiers, I/V and V/I converter, Integrator, Differentiator, Instrumentation amplifiers and Precision Rectifiers.

Module:5	Comparators and Waveform Generators	6 hours
Comparator and its applications - Schmitt trigger - Free-running, One-shot Multivibrators - Barkhausen Criterion - Sinewave generators - Phase-shift and Wein-bridge oscillators - Square, Triangular and Saw-tooth wave function generators.		
Module:6	Active filters and Data Converters	6 hours
Filter classifications: First and second order Low-pass and High pass filter designs, Band-pass filter, Notch filter. Sample-and-hold circuits, DAC characteristics, D/A conversion techniques, A/D characteristics, A/D conversion techniques.		
Module:7	Special Function ICs	5 hours
IC 555 timer, Astable and Monostable operations, and applications. IC voltage regulator - LM317.		
Module:8	Contemporary issues	2 hours
Total Lecture		
45 hours		
Textbook(s)		
1.	Adel S. Sedra, Kenneth C. Smith and Arun N. Chandorkar, Microelectronic Circuits: Theory and Applications, 2014, 7 th Edition, Oxford University Press, New York.	
Reference Books		
1.	J. D. Roy Choudhury, Linear Integrated Circuits, 2018, 5 th Edition, New-Age International Publishers, New Delhi.	
2.	Donald A Neamen, Microelectronics: Circuit Analysis and Design, 2010, 4 th Edition, Mc Graw-Hill.	
3.	P. Malvino, D. J. Bates, Electronic Principles, 2017, 7 th Edition, Tata Mc Graw-Hill.	
4.	R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 2015, 11 th Edition, Pearson Education.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course Code	Course Title	L	T	P	C						
BECE206P	Analog Circuits Lab	0	0	2	1						
Pre-requisite	BECE201L	Syllabus version		1.0							
Course Objective											
<ul style="list-style-type: none"> To apply knowledge gained in the theory course and get hands-on experience of the topics. 											
Course Outcome											
At the end of the course the student will be able to											
<ol style="list-style-type: none"> Design and analyse the frequency response of amplifiers and differential amplifiers. Determine the efficiency of different classes of power amplifiers. Design and analyse the waveform generator circuits. 											
Indicative Experiments											
1.	Design of single-stage and multistage amplifiers using BJT and to analyse its frequency response characteristics.	4 hours									
2.	Design of single-stage and multistage amplifiers using MOSFET and to analyse its frequency response characteristics.	4 hours									
3.	Design of a Power Amplifier and estimation of its power conversion efficiency	2 hours									
4.	Design of differential amplifier using MOSFET and determine its CMRR and also perform the frequency response analysis.	4 hours									
5.	Design of closed-loop amplifiers using Op-amp and perform experimentation to determine voltage gain.	2 hours									
6.	Design of circuits using op-amp to determine the DC and AC characteristics.	4 hours									
7.	Design of Instrumentation amplifier for the given specifications.	2 hours									
8.	Design of Comparator and Schmitt trigger circuits using Op-amp.	4 hours									
9.	Design of waveform generators and filters using op-amp	2 hours									
10.	Design of circuits using IC 555 timer for different applications.	2 hours									
Total Laboratory Hours											
Mode of Assessment: Continuous Assessment and Final Assessment Test											
Recommended by Board of Studies	14-05-2022										
Approved by Academic Council	No. 66	Date	16-06-2022								

Short Syllabus

BECE207L Random Processes (2-1-0-3)

Continuous and discrete multiple random variables - Introduction to Random Variables; Operations on multiple random variables - Linear Transformation of Gaussian Random Variables; Random Processes Temporal Characteristics - Power Density Spectrum and its Properties; Linear Systems with Random Inputs - Linear system Fundamentals; Noise and Modelling of Noise Sources - Noise Definitions; Optimum Linear Systems - Signal to Noise Ratio.

Course Code	Course Title	L	T	P	C				
BECE207L	Random Processes	2	1	0	3				
Pre-requisite	BMAT202L, BMAT202P, BECE202L		Syllabus version		1.0				
Course Objectives									
<ol style="list-style-type: none"> To familiarize the students with two and multi-random variable theory. To enable the students process the random signals in time and frequency domains. To make the students understand the noise concepts and design a matched filter to increase the Signal to Noise Ratio (SNR). 									
Course Outcome									
The students will be able to									
<ol style="list-style-type: none"> Compute the probability density functions for multiple random variables. Perform transformation on multiple random variables and complex random variables. Interpret the random processes in terms of stationarity, statistical independence, and correlation. Compute the power spectral density of the random signals. Interpret the effect of random signals on LTI systems output both in the time and frequency domain. Design the Optimum linear systems for extracting signals in the presence of noise. 									
Module:1 Continuous and Discrete Multiple Random Variables 6 hours									
Introduction to Random Variables – Vector Random Variables- Joint Distribution and its Properties-Joint Density and its Properties-Joint Probability Mass Function – Conditional Distribution and Density-Statistical Independence –Distribution and Density of Function of Random Variables – Central Limit Theorem.									
Module:2 Operations on Multiple Random Variables 7 hours									
Joint Moments for continuous and discrete random variables – Joint Central Moments – Joint Characteristics Function – Jointly Gaussian Random Variables – Transformations of Multiple Random Variables – Linear Transformation of Gaussian Random Variables – Complex Random Variables.									
Module:3 Random Processes – Temporal Characteristics 7 hours									
Random Process: Classifications. Stationarity and Independence. Time Averages and Ergodic Random process. Characterizing a Random Process: The Mean, Correlation Functions, Covariance Functions, and their Properties-Different processes: Gaussian Random Process- Poisson Random Process, Weiner Process, and Markov process, and Complex Random Process.									
Module:4 Random Processes – Spectral Characteristics 7 hours									
Power Density Spectrum and its Properties-Cross PSD and its properties, Relationship between Correlation and Power Spectrum- Power Spectral density of a WSS discrete Time random processes and Sequences. Power Spectrum of Complex Processes.									
Module:5 Linear Systems with Random Inputs 5 hours									
Linear system Fundamentals-Linear systems with continuous-Time and discrete-Time random inputs. Random Signal Response of Linear Systems-Product Device response to a Random Signal-Spectral Characteristic of System Response. Response of quadratic, half wave, full-wave, and sigmoid detectors to Gaussian signals.									
Module:6 Noise and Modelling of Noise Sources 6 hours									
Noise Definitions- White noise and colored noise. System Evaluation using Random noise - Spectral Characteristic of System Response for Noise-Noise Bandwidth – Bandpass – Band									

limited – Narrow Band Processes. Resistive Noise Sources – Arbitrary Noise Sources – Effective Noise Sources-Noise Temperature-Noise Figure-Incremental Modelling of Noisy Networks- Modelling of Practical Noisy Networks.			
Module:7 Optimum Linear Systems	5 hours		
Signal to Noise Ratio – Mean Square Error- Optimization by Parameter Selection- Matched Filter for Colored Noise- Matched Filter for White Noise-Practical Applications.			
Module:8 Contemporary issues	2 hours		
	Total Lecture hours: 45 hours		
Text Book(s)			
1.	P.Z. Peebles, Probability, Random Variables, and Random Signal Principles, 2017, 4 th edition, McGraw Hill, New Delhi, India.		
Reference Books			
1.	Papoulis and S.U. Pillai, Probability, Random variables and stochastic processes, 2017, 4 th edition, McGraw Hill, New Delhi, India.		
2.	Hwei Hsu, Probability, Random variables, Random Processes, 2017, Schaum's outline series, McGraw Hill, New Delhi, India.		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test			
Recommended by Board of Studies	14-05-2022		
Approved by Academic Council	No. 66	Date	16-06-2022

Short Syllabus

BECE301L Digital Signal Processing (3-0-0-3)

Discrete Signals, Systems and frequency analysis – Z transform, Frequency domain sampling; Discrete Fourier Transform, Properties and its applications – DFT Properties; Design of Analog Filters - Butterworth and Chebyshev approximations; Digital transformation of IIR filters - Spectral transformation of Digital filters; Design of FIR filters - Design of FIR filters using windowing techniques; Realization structures for Discrete Time Systems - Parallel all pass realization of IIR systems; Multirate digital signal processing - Implementation of Sampling Rate Conversion.

Course Code	Course Title	L	T	P	C
BECE301L	Digital Signal Processing	3	0	0	3
Pre-requisite	BECE202L	Syllabus version		1.0	
Course Objectives					

1. To summarize and analyze the concepts of signals, systems in time and frequency domain with the corresponding transformations.
2. To inculcate the design concepts of analog, digital IIR, FIR filters.
3. To instill diverse structures for realizing digital filters.
4. To infuse the novice concepts of Multirate digital signal processing.

Course Outcome

Students will be able to

1. Classify and analyse Signals & Systems along with their time and frequency domain transformations.
2. Simplify Fourier transform computations using swift algorithms.
3. Examine various analog filter design techniques and their digitization.
4. Design FIR and IIR digital filters.
5. Realize digital filters using various system interconnections.
6. Design and formulate Multirate systems.

Module:1	Discrete Signals, Systems and frequency analysis	6 hours
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Review of Discrete-Time Signals & Systems and frequency analysis - Z- transform: ROC stability / causality analysis, Frequency domain sampling - Sampling rate conversion - Aperiodic correlation estimation - Cepstrum processing - Band limited discrete time signals.

Module:2	Discrete Fourier Transform, Properties and its applications	6 hours
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DFT – Properties - Linear filtering methods - Frequency analysis of signals using DFT - FFT Algorithm - Radix-2 FFT - Sparse FFT - Practical applications.

Module:3	Design of Analog Filters	6 hours
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Design techniques for analog filter - Butterworth and Chebyshev approximations - Frequency transformation, Properties - Constant group delay and zero phase filters.

Module:4	Digital transformation of IIR filters	5 hours
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IIR filter design: Bilinear transformation, Impulse Invariance - Spectral transformation of Digital filters

Module:5	Design of FIR filters	5 hours
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FIR Filter Design: Design characteristics of FIR filters with linear-phase – Frequency response of linear phase FIR filters – Design of FIR filters using windowing techniques: Rectangular, Bartlett Hamming, Hanning, Blackmann, Kaiser - Phase delay, Group delay

Module:6	Realization structures for Discrete-Time Systems	7 hours
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Direct, Cascade, Parallel, Lattice and Lattice - Ladder Structures: All pass filter - IIR tapped-cascaded structure. Parallel all pass realization of IIR systems.

Module:7	Multirate digital signal processing	8 hours
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Introduction-Implementation of Sampling Rate Conversion: Polyphase Filter Structures - Interchange of Filters and Downsamplers / Upsamplers - Polyphase Structures for Decimation and Interpolation Filters - Structures for Rational Sampling Rate Conversion. Discrete Cosine Transform - Wavelet Transform

Module:8	Contemporary issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1. John G. Proakis, Dimitris G Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 2022, 5 th Edition, Pearson, USA		
Reference Books		
1. A textbook of Digital Signal Processing, R.S.Kaler, M.Kulkarni, Umesh Gupta, 1 st edition, 2019, Dream tech Press, Wiley, India		
2. James McClellan, Ronal Schaeffer, Mark Yoder, Digital Signal Processing first, 2016, 2 nd edition, Pearson, USA		
3. Lizhe Tan, Jean Jiang, Digital Signal Processing: Fundamentals and applications, 3 rd edition, 2018, Academic Press, USA		
4. S.K.Mitra, Digital Signal Processing, 2013, 4 th edition, TMH, New Delhi, India		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course code	Course Title	L	T	P	C				
BECE301P	Digital Signal Processing Lab	0	0	2	1				
Pre-requisite	BECE202L			Syllabus version					
				1.0					
Course Objectives									
1. To learn the usage of appropriate tools for realizing signal processing modules.									
Course Outcome									
Students will be able to									
1. Generate the various elementary signals using the DSP processor.									
2. Implement the sampling and reconstruction process.									
3. Design and implement the various systems using the imbibed signal processing concepts.									
Indicative Experiments									
1.	Introduction to TMS320C6748 processor and code composer studio IDE.	2 hours							
2.	Generation of elementary signals and illustration of simple signal processing operations on TMS320C6748 processor	6 hours							
3.	Sampling and Reconstruction of CT signals, DTFT analysis	6 Hours							
4.	Biomedical / Speech / Audio Signal Analysis	6 Hours							
5.	Computational analysis using FFT	3 Hours							
6.	Design of IIR filter	3 Hours							
7.	Design of FIR filter using windowing techniques	4 Hours							
Total Laboratory Hours									
30 Hours									
Mode of Assessment: Continuous Assessment and Final Assessment Test									
Recommended by Board of Studies	14-05-2022								
Approved by Academic Council	No. 66	Date	16-06-2022						

Short Syllabus

BECE302L Control Systems (2-1-0-3)

Control Systems - Basic components of a control system; Mathematical Modeling of Physical Systems - Difference and differential equations for LTI SISO and MIMO systems; Time Domain Response - Time domain specifications, Steady state error; Characterization of Systems – Stability, Root locus analysis; Frequency Domain Response - Phase and gain margin, Bode Plot; Controllers and Compensators Design - P, PI, PID controllers; State Space Analysis - Solutions of state equations of LTI system.

Course Code	Course Title	L	T	P	C
BECE302L	Control Systems	2	1	0	3
Pre-requisite	BECE202L			Syllabus version	
				1.0	

Course Objectives

1. To study the use of transfer function model for the analysis of physical systems and to introduce the components of control system.
2. To provide adequate knowledge in the time response of systems and steady state error analysis along with the understanding of closed-loop and open-loop system analysis in frequency domain.
3. To introduce the design of controllers and compensators for the stability analysis.
4. To introduce state variable representation of physical systems and study the stability analysis in state space approach.

Course Outcomes

Students will be able to

1. Differentiate between open-loop and closed-loop control systems and obtain the transfer function from the mathematical modeling of physical systems.
2. Determine transient and steady state responses of the system with first and second order and also to analyze its error coefficients.
3. Characterize the system stability using R-H criteria and root locus techniques.
4. Analyze the frequency domain response of the control systems.
5. Design the controllers and compensators to estimate the system stability.
6. Analyze the system in state space model through the concept of controllability and observability.

Module:1	Control Systems	3 hours
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Basic components of a control system, Applications, Open-loop control system and closed-loop control system, Examples of control system (air conditioner, cruise control, phase-locked loop, etc.), Effects of feedback on overall gain, Types of feedback control system, Linear and non-linear control systems.

Module:2	Mathematical Modeling of Physical Systems	8 hours
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Difference and differential equations for LTI SISO and MIMO systems, Mathematical modeling of electrical and mechanical systems, Equivalence between the elements of different types of systems, Transfer function of linear systems, Open-loop transfer function and closed-loop transfer function, Block diagram representation, Block diagram reduction techniques, Signal flow graph using Mason's gain formula.

Module:3	Time Domain Response	6 hours
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Transient response and steady state responses, Time domain specifications, Types of test inputs, Response of first order and second order systems, Steady state error, Static error coefficients, Generalized error coefficients.

Module:4	Characterization of Systems	5 hours
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Stability – concept and definition, Poles, Zeros, Order and Type of systems; R-H criteria, Root locus analysis.

Module:5	Frequency Domain Response	7 hours
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Frequency response – Performance specifications in the frequency domain, Phase margin and gain margin, Bode plot, Polar plot and Nyquist plot, Stability analysis in frequency domain.

Module:6	Controllers and Compensators Design	7 hours
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Controllers – P, PI, PID, Realization of basic compensators, Cascade compensation in time domain and frequency domain, Feedback compensation, Design of lag, lead, lag-lead series compensators.		
Module:7	State Space Analysis	7 hours
Dynamic system modeling in state space representation: Diagonal canonical form, Jordan canonical form, Solutions of state equations of LTI system, Conversion from state space model to transfer function model and vice versa, Stability analysis in state spaces: Concept of eigenvalues and eigenvectors, State transition matrix using Cayley-Hamilton theorem, Controllability and observability.		
Module:8	Contemporary issues:	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1.	Norman S. Nise, Control Systems Engineering, 2019, 8 th Edition, John Wiley & Sons, New Jersey, USA	
Reference Books		
1.	Farid Golnaraghi and Benjamin C. Kuo, Automatic Control Systems, 2017, 10 th Edition, McGraw-Hill Education, India.	
2.	I.J. Nagarth and M. Gopal, Control Systems Engineering, 2018, 6 th Edition, New Age International Pvt. Ltd., New Delhi, India.	
3.	Gene Franklin, J. Powell and Abbas Emami-Naeini, Feedback Control of Dynamic Systems, 2019, 8 th Edition, Pearson Education, New Delhi, India.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Short Syllabus

BECE303L VLSI System Design (3-0-0-3)

VLSI Design Overview and MOSFET Theory - Concepts of Regularity, Modularity and Locality; CMOS Logic gates - CMOS Sequential Logic Design, Latches and Flip Flops; CMOS Fabrication and Layout - CMOS Process Technology, Layout Design Rule; CMOS Circuits Performance Analysis - Logical Effort and Transistor Sizing; CMOS Logic Families - Transmission Gates based Logic Design; Timing Analysis - Introduction to Static timing analysis; Semiconductor Memory Design- Introduction and types.

Course Code	Course Title	L	T	P	C
BECE303L	VLSI System Design	3	0	0	3
Pre-requisite	BECE204L, BECE204P		Syllabus version		1.0

Course Objectives :

1. To introduce the basic concepts and techniques of modern integrated circuit design.
2. Describe the fundamental principles underlying digital design using CMOS logic and analyze the performance characteristics of these digital circuits.
3. Verify that a design meets its functionality, timing constraints, both manually and through the use of computer-aided design tools.

Course Outcomes :

Students will be able to

1. Analyze the CMOS digital electronics circuits, including logic components and their interconnect using mathematical methods and circuit analysis models
2. Create models of moderately sized CMOS inverters with specified noise margin and propagation delay.
3. Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect.
4. Analyse the various logic families and efficient techniques at circuit level for improving power and speed of combinational and sequential logic.
5. Implement the CMOS digital circuits with the specified timing constraints.
6. Design memories with efficient architectures to improve access times, power consumption

Module:1 VLSI Design Overview and MOSFET Theory 8 hours

VLSI Design Flow, Design Hierarchy, Concepts of Regularity, Modularity and Locality, VLSI Design Styles, Design Quality, MOSFET : Device Structure, Electrical behaviour of MOS transistors, Capacitance- Voltage Characteristics and Non-ideal Effects; Effects of scaling on MOSFETs and Interconnects.

Module:2 CMOS Logic Gates 8 hours

CMOS Inverter: DC Transfer Characteristics, Static and Dynamic Behaviour, CMOS Basic Gates, Compound Gates, CMOS Sequential Logic Design – Latches and Flip Flops

Module:3 CMOS Fabrication and Layout 5 hours

CMOS Process Technology N-well, P-well Process, latch up in CMOS technology, Stick Diagram for Boolean Functions using Euler Theorem, Layout Design Rule

Module:4 CMOS Circuits Performance Analysis 5 hours

Delay Estimation, Logical Effort and Transistor Sizing, Performance Estimation - Static & Dynamic Power Dissipation.

Module:5 CMOS Logic Families 8 hours

Pass Transistor Logic, Transmission Gates based Logic Design, pseudo NMOS, Cascode Voltage Switch Logic Dynamic and domino logic, clocked CMOS (C^2MOS) logic and np – CMOS logic.

Module:6 Timing Analysis 4 hours

Introduction to Static timing analysis, Setup Time, Hold Time, calculation of critical path, slack, setup and hold time violations.

Module:7 Semiconductor Memory Design 5 hours

Introduction, Types - Read-Only Memory (ROM) Circuits, Static Read-Write Memory (SRAM) and Dynamic Read-Write Memory (DRAM) Circuits.		
Module:8	Contemporary issues	2 hours
		Total Lecture Hours: 45 hours
Text Book(s)		
1. Neil H.Weste, Harris, A. Banerjee, CMOS VLSI Design, A circuits and System Perspective, 2015, 4 th Edition, Pearson Education, Noida, India.		
Reference Book		
1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, Digital Integrated Circuits: A Design Perspective Paperback, 2016, 2 nd Edition, Pearson Education, India.		
2. Sung-Mo Kang, Yusuf Liblebici, Chulwoo Kim, CMOS Digital Integrated Circuits: Analysis and Design, 2019, Revised 4th Edition, Tata Mc Graw Hill, New Delhi, India.		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course Code	Course Title	L	T	P	C				
BECE303P	VLSI System Design Lab	0	0	2	1				
Pre-requisite	BECE204L, BECE204P	Syllabus version			1.0				
Course Objectives :									
<ul style="list-style-type: none"> The objective of this laboratory is to apply the theoretical knowledge and explore various design style of CMOS Integrated Circuits (IC) design using the latest EDA tools 									
Course Outcome :									
On completion of this lab course the students will be able to									
<ol style="list-style-type: none"> Analyze the performance of CMOS Inverter circuits on the basis of their operation and working. Design the semiconductor memory cell, combinational, sequential and arithmetic circuit using CMOS design rules. Construct layout of CMOS inverter, universal and basic logic gates. 									
Indicative Experiments									
1	Parameter extraction for basic cell structure (NMOS and PMOS devices). <ul style="list-style-type: none"> Analysis of MOS with width variation, body effect and estimation of channel length modulation 	2 hours							
2	Design and Analysis of CMOS inverter for arbitrary sizing. <ul style="list-style-type: none"> Estimation of Power, Delay, Noise Margin. Impact of load on performance metrics. 	4 hours							
3	Analysis of CMOS inverter for given specification. <ul style="list-style-type: none"> Impact of sizing on Power, Delay, Noise Margin 	2 hours							
4	Analysis of inverter chains using progressive sizing to improve delay performance.	2 hours							
5	Design and Analysis of Universal gates in static CMOS logic <ul style="list-style-type: none"> Effect of input reordering. 	2 hours							
6	Design and Analysis of Boolean Expression (Simple Arithmetic Unit) in static CMOS logic.	2 hours							
7	Design and Analysis of Pass transistor and Transmission gate based circuits	4 hours							
8	Design and Analysis of CMOS sequential circuits (Latches and Flip Flops)	4 hours							
9	Design a CMOS Memory cell (SRAM, DRAM) and verify its operation.	4 hours							
10	Design Layout of CMOS inverter and perform post-layout analysis, DRC, Layout Vs. Schematic, Monte Carlo analysis, Corner analysis and etc.	4 hours							
Total Laboratory Hours									
Mode of Assessment: Continuous Assessment and Final Assessment Test									
Recommended by Board of Studies	14-05-2022								
Approved by Academic Council	No. 66	Date	16-06-2022						

Short Syllabus

BECE304L Analog Communication Systems (3-0-0-3)

Communication Systems - Elements of a communication system, Need for modulation;
Amplitude Modulation (AM) - Generation of AM signals; Bandwidth and Power Efficient AM
Systems - Balanced modulator and Ring modulator, Synchronous detection; Angle Modulation
Principles of Frequency Modulation (FM) and Phase Modulation (PM); Transmitters and Receivers
- Radio transmitter and receiver; Noise in Communication Systems - Noise and its
types, AM and FM receivers; Pulse Modulation Systems - Sampling theorem , Types of
Sampling.

Course Code	Course Title	L	T	P	C
BECE304L	Analog Communication Systems	3	0	0	3
Pre-requisite	BECE206L, BECE206P			Syllabus version	1.0

Course Objectives:

1. To explore the architectural elements and models used in analog communication systems.
2. To analyse bandwidth, current, power and transmission efficiency of analog modulations.
3. To understand the functionalities of transmitters and receivers.
4. To comprehend the effect of noise in analog communication systems.

Course Outcomes:

Students will be able to

1. List and analyse the key elements of analog communication system.
2. Design the various Amplitude Modulation Schemes and evaluate in terms of its power, bandwidth and transmission Efficiency.
3. Examine the various angle modulation schemes.
4. Infer the working principle of radio transmitters and receivers.
5. Analyse the effect of noise on various analog modulations.
6. Analyse various pulse modulation and multiplexing techniques.

Module:1	Communication Systems	4 hours
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Need and importance of communication, Elements of communication system - Types of communication systems, Electromagnetic spectrum used in communication, Concept of bandwidth and power, Need for modulation.

Module:2	Amplitude Modulation (AM)	7 hours
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Amplitude modulation – Single- tone and Multi-tone, Mathematical representation of AM signal, Bandwidth, current, power and transmission efficiency of AM. Generation of AM signal – Square law modulator, Switching modulator. AM demodulation – Envelope detector and Square law demodulator.

Module:3	Bandwidth and Power Efficient AM Systems	7 hours
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DSB-SC generation – Balanced modulator and Ring modulator. DSB-SC demodulation – Synchronous detection, Effect of phase drift. SSB-SC generation – Filter, Phase shift and Third method. SSB-SC demodulation - Synchronous detection. VSB generation and demodulation. Power, bandwidth and transmission efficiency of DSB-SC, SSB-SC and VSB.

Module:4	Angle Modulation	10 hours
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Principles of Frequency Modulation (FM) and Phase Modulation (PM) – Relation between FM and PM, Frequency deviation and bandwidth of FM, Narrow band and Wide band FM, Bessel functions and Carson's rule. FM generation and detection. Comparison of amplitude and angle modulation.

Module:5	Transmitters and Receivers	5 hours
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Radio transmitter - Classification of transmitters - Low level and High level AM Transmitters, FM Transmitter. Radio receiver - Receiver characteristics, Tuned Radio Frequency (TRF) Receiver, Superheterodyne receiver (AM and FM), Choice of IF and oscillator frequencies, Tracking and Alignment – AGC, AFC. Pre-emphasis and De-emphasis.

Module:6	Noise in Communication Systems	6 hours
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Noise and its types- Noise voltage and power, Signal-to-Noise Ratio (SNR), Noise figure, Noise temperature. Figure of Merit in DSB-SC, SSB-SC, AM and FM receivers.

Module:7	Pulse Modulation Systems	4 hours
Sampling theorem - Types of Sampling. Pulse modulation schemes – generation and detection PAM, PPM and PWM, Conversion of PWM to PPM. Multiplexing Techniques – FDM and TDM.		
Module:8	Contemporary Issues	2 hours
	Total lecture hours:	45 hours
Text Books		
1.	George Kennedy, Bernard Davis, Electronic Communication Systems, 2017, 6 th Edition, Mc Graw Hill Education, New Delhi, India.	
Reference Books		
1.	Simon Haykin, Communication Systems, 2019, 5 th Edition, Wiley, India.	
2	P. Ramakrishna Rao, Analog Communication, 2017, Tata McGraw Hill Education Pvt Ltd., India.	
3	Herbert Taub and Donald Schilling, Principles of Communication Systems, 2017, 4 th Edition, Mc Graw Hill Education, India.	
4	HweiKsu and Debjani Mitra, Analog and Digital Communication, 2017, 3 rd Edition, McGraw Hill Education, India.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date
		16-06-2022

Course Code	Course Title	L	T	P	C				
BECE304P	Analog Communication Systems Lab	0	0	2	1				
Pre-requisite	BECE206L, BECE206P	Syllabus version							
Course Objectives:									
<ol style="list-style-type: none"> Procedurally troubleshoot, construct and analyse modulators and demodulators in analog communication systems. Examine the effect of modulation index and noise in analog communication systems. Inculcate hands-on experience, by integrating theory into practical experiments. 									
Course Outcome:									
Students will be able to									
<ol style="list-style-type: none"> Obtain an insight into the functionalities and validate the performance of analog modulators and demodulators. Determine the noise measures for analog communication systems. Sample an analog signal and implement the multiplexing concepts. 									
Indicative Experiments									
1.	Design of AM, DSB-SC, SSB-SC modulators and demodulators	8 Hours							
2.	Design of FM, PM modulators and demodulators	4 Hours							
3.	Design of Superheterodyne receiver - Mixer, Pre-emphasis and De-emphasis	4 Hours							
4.	Analyse the noise characteristics of analog communication systems – SNR, Noise voltage, Noise figure and Noise temperature	4 Hours							
5.	Design of PAM,PPM,PWM modulators and demodulators	6 Hours							
6.	Implementation of TDM and FDM	4 Hours							
Total Laboratory Hours									
Mode of Assessment: Continuous Assessment and Final Assessment Test									
Recommended by Board of Studies	14-05-2022								
Approved by Academic Council	No. 66	Date	16-06-2022						

Short Syllabus

BECE305L Antenna and Microwave Engineering (3-0-0-3)

EM Radiation and Antenna Parameters - Radiation mechanism and pattern; Linear and Planar Arrays - Two element array, N element linear array; HF, UHF and Microwave Antennas - Wire Antennas, Aperture antennas; Microwave Sources - TWT, Klystron amplifier; Microwave Passive components - ABCD, 'S' parameter and its properties; Microwave Passive circuits - T junction and resistive power divider, Filter design; Microwave Active Circuits - Microwave transistors and amplifiers.

Course Code	Course Title	L	T	P	C			
BECE305L	Antenna and Microwave Engineering	3	0	0	3			
Pre-requisite	BECE205L	Syllabus version			1.0			
Course Objectives								
<ol style="list-style-type: none"> To introduce and discuss the mechanism for antenna parameters, radiating principles, fundamental characteristics and design concepts of HF, UHF, Microwave antennas and arrays. To design and analyse various passive and active microwave circuits. To familiarize the operational principles of microwave sources and to characterize microwave networks. 								
Course Outcome								
Students will be able to								
<ol style="list-style-type: none"> Examine the radiation mechanism of electromagnetic fields and identify the various antenna parameters. Apply the design criteria to Linear, HF, UHF, microwave antenna and arrays. Comprehend the performance of different microwave sources and ferrite devices. Design and analyze the passive components at microwave frequencies. Design and analyze the various passive circuits at microwave frequencies. Infer the importance of high frequency transistors to design microwave amplifiers. 								
Module:1	EM Radiation and Antenna Parameters	8 hours						
Radiation mechanism - single wire, two wire and current distribution, Hertzian dipole, Dipole and monopole - Radiation pattern, beam width, field regions, radiation power density, radiation intensity, directivity and gain, bandwidth, polarization, input impedance, efficiency, antenna effective length and area, antenna temperature. Friis transmission equation, Radar range equation.								
Module:2	Linear and Planar Arrays	6 hours						
Two element array, N-element linear array - broadside array, End fire array - Directivity, radiation pattern, pattern multiplication. Non-uniform excitation - Binomial, Chebyshev distribution, Arrays: Planar array, circular array, Phased Array antenna (Qualitative study).								
Module:3	HF, UHF and Microwave Antennas	7 hours						
Wire Antennas - long wire, loop antenna - helical antenna. Yagi-Uda antenna, Frequency independent antennas - spiral and log periodic antenna - Aperture antennas – Horn antenna, Parabolic reflector antenna - Microstrip antenna.								
Module:4	Microwave Sources	5 hours						
Microwave frequencies and applications, Microwave Tubes: TWT, Klystron amplifier, Reflex Klystron & Magnetron. Semiconductor Devices: Gunn diode, Tunnel diode, IMPATT – TRAPATT - BARITT diodes, PIN Diode.								
Module:5	Microwave Passive components	6 hours						
Microwave Networks - ABCD, 'S' parameter and its properties. E-Plane Tee, H-Plane Tee, Magic Tee and Multi-hole directional coupler. Principle of Faraday rotation, isolator, circulator and phase shifter.								
Module:6	Microwave Passive circuits	7 hours						
T junction and resistive power divider, Wilkinson power divider, branch line coupler (equal & unequal), Rat Race Coupler, Filter design: Low pass filter (Butterworth and Chebyshev) - Richards transformation and stepped impedance methods.								

Module:7	Microwave Active Circuits	4 hours
Microwave transistors, Microwave amplifiers: Two port power gains, stability of the amplifier, Microwave oscillators.		
Module:8	Contemporary issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1.	C.A. Balanis, Antenna Theory - Analysis and Design, 2016, 4 th Edition, Wiley& Sons, New York, USA.	
2.	D. M. Pozar, Microwave engineering, 2013, 4 th Edition, Wiley & Sons, USA.	
Reference Books		
1.	R Ludwig, Gene Bogdanov, RF Circuit design: Theory and applications, 2013, 2 nd Edition, Pearson India.	
2.	John D Krauss, Antennas for all Applications, 2008, 4 th Edition, Tata McGraw Hill, India.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course Code	Course Title	L	T	P	C				
BECE305P	Antenna and Microwave Engineering Lab	0	0	2	1				
Pre-requisite	BECE205L				Syllabus version 1.0				
Course Objectives									
<ol style="list-style-type: none"> 1. To apply the theoretical knowledge and explore the designing principles of various antennas and microwave devices. 2. To design the various microwave antenna and devices using a suitable design tools. 									
Course Outcome									
Students will be able to									
<ol style="list-style-type: none"> 1. Measure the various parameters and comprehend the radiation pattern of wired antennas. 2. Measure the performance of microwave passive devices using test bench setup and also simulate and analyze microwave passive and active circuits. 3. Design the microwave circuits to suit the needs of industry. 									
Indicative Experiments									
Hardware Experiments:									
1.	Measurement of antenna input impedance	2 hours							
2.	Measurement of antenna radiation pattern	2 hours							
3.	Measurement of S-parameters for E-plane, H-plane and Magic Tee	4 hours							
4.	Measurement of S-parameters for Directional Coupler	2 hours							
5.	Measurement of S-parameters for Isolator and Circulator	2 hours							
6.	Measurement of S-parameters of MIC devices	4 hours							
Experiments using Simulation tools:									
7.	Design of Wilkinson power divider	2 hours							
8.	Design of branch line and Rat race coupler	2 hours							
9.	Design of low pass filters: Richards and Stepped impedance method	2 hours							
10.	Design of matching circuits using quarter wave & single stub.	4 hours							
11.	Design of dipole antenna	2 hours							
12.	Design of Rectangular patch antenna	2 hours							
Total Laboratory Hours									
30 hours									
Mode of Assessment: Continuous Assessment and Final Assessment Test									
Recommended by Board of Studies	14-05-2022								
Approved by Academic Council	No. 66	Date	16-06-2022						

Short Syllabus

BECE306L Digital Communication Systems (3-0-0-3)

Sampling Process – Elements and types of communication systems; Waveform Coding Techniques – PCM, DPCM , DM; Line Codes - Unipolar, Polar, Bipolar using NRZ and RZ; Baseband System - Nyquist criterion for zero ISI, eye pattern; Bandpass system - BASK, BPSK, BFSK, QPSK, MSK; Spread Spectrum and Multiple Access Techniques – DSSS, FHSS, TDMA, FDMA, CDMA, SDMA; Introduction to Information Theory - Fundamentals of error correction , Hamming codes.

Course Code	Course Title	L	T	P	C
BECE306L	Digital Communication Systems	3	0	0	3
Pre-requisite	BECE206L, BECE206P				Syllabus version
					1.0

Course Objectives:

1. To understand the transmitter and receiver blocks of various waveform coding techniques.
2. To analyze various line coding techniques in time and frequency domains.
3. To identify the role of baseband, bandpass formats and information theory for effective transmission of signals, combat ISI and to increase the reliability of transmission.
4. To understand the principles and importance of spread spectrum and multiple access in the context of communication.

Course Outcomes:

Students will be able to

1. Comprehend the sampling and quantization process to recover the original signal
2. Analyse the performance of various waveform and Line coding techniques.
3. Design the various baseband pulses for ISI free transmission over finite bandwidth channels.
4. Examine the BER and bandwidth efficiency of the Bandpass modulation techniques.
5. Analyse the digital communication system with spread spectrum modulation.
6. Infer the elements of information theory.

Module:1 Sampling Process **4 hours**

Block diagram of a digital communication system, bandwidth of signals. Sampling theorem - quadrature sampling of bandpass signals, Reconstruction of a message from its samples, Practical aspects of sampling and signal recovery.

Module:2 Waveform Coding Techniques **6 hours**

Pulse Code Modulation (PCM) - Uniform quantization, Quantization noise, Signal-to-Noise Ratio, Robust quantization. Differential pulse code modulation (DPCM), Delta Modulation (DM) - Quantization noise in DM, Adaptive Delta Modulation.

Module:3 Line Codes **6 hours**

Representation of line codes – Unipolar, Polar, Bipolar using NRZ and RZ, Manchester, Polar Quaternary codes, Differential encoding, Properties and applications of line codes – Power spectral density of line codes.

Module:4 Baseband System **5 hours**

Baseband data transmission of binary data - Inter Symbol Interference (ISI), Nyquist criterion for zero ISI, Raised cosine filtering, correlative coding (duo binary and modified duo binary coding), eye pattern – Equalization.

Module:5 Bandpass system **12 hours**

Gram-Schmidt Orthogonalization Procedure. Correlation and Matched filter receiver. Coherent modulation techniques - BASK, BPSK, BFSK, QPSK, MSK, Higher-order PSK and QAM, BER and Bandwidth efficiency analysis. Non-coherent modulation techniques – BASK, BFSK, DPSK.

Module:6 Spread Spectrum and Multiple Access Techniques **5 hours**

Principles of spread spectrum - Generation of PN sequence and its properties, Direct Sequence Spread Spectrum (DSSS), Processing gain, Probability of error, Anti-jam characteristics, Frequency- Hop Spread Spectrum (FHSS). Multiple access techniques - TDMA, FDMA, CDMA, SDMA.

Module:7	Introduction to Information Theory	5 hours
Entropy, Mutual information and channel capacity theorem. Fundamentals of error correction - Hamming codes.		
Module:8	Contemporary issues	2 hours
		Total lecture hours: 45 hours
Text Book(s)		
1. Simon Haykin, Digital Communications, 2017, 1 st Edition, John Wiley, India.		
Reference Books		
1.	John G. Proakis, Masoud Salehi, Digital Communication, 2018, 5 th Edition (Indian edition), Mc Graw Hill Education, India.	
2.	Bernard Sklar and Fredric J. Harris, Digital Communications: Fundamentals and Applications, 2020, 3 rd Edition, Pearson , UK.	
3.	B P Lathi, Zhi Ding, Modern Digital And Analog Communication Systems, 2017, 4 th Edition, Oxford university Press, India.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Course Code	Course Title	L	T	P	C					
BECE306P	Digital Communication Systems Lab	0	0	2	1					
Pre-requisite	BECE206L, BECE206P			Syllabus version						
				1.0						
Course Objectives										
<ol style="list-style-type: none"> 1. To implement various waveform coding techniques. 2. To analyze various baseband and bandpass signals for effective communication. 3. To understand the principles and importance of multiple access techniques in the context of communication. 										
Course Outcome										
Students will be able to										
<ol style="list-style-type: none"> 1. Construct and analyse various waveform coding techniques. 2. Design the circuits for band pass modulators and evaluate their performance. 3. Implement spread spectrum techniques for multiple access communication. 										
Indicative Experiments										
1.	Generation and reconstruction of PCM, DPCM and DM			4 Hours						
2	Generation of baseband signals using various line coding formats for the given binary sequence			4 Hours						
3.	Generation and detection of bandpass modulation techniques			12 Hours						
4.	BER analysis of bandpass modulation techniques			2 Hours						
5	Generation of PN sequence and verification of its properties			4 Hours						
6.	Implementation of multiple access schemes			4 Hours						
Total Laboratory Hours					30 hours					
Mode of Assessment: Continuous Assessment and Final Assessment Test										
Recommended by Board of Studies	14-05-2022									
Approved by Academic Council	No. 66	Date	16-06-2022							

Course Code	Course Title	L	T	P	C
BECE317L	Wireless and Mobile Communications	3	0	0	3
Pre-requisite	BECE306L, BECE306P			Syllabus version	
				1.0	

Course Objectives:

1. To familiarize the concepts of wireless communication.
2. To teach students the fundamentals of multipath fading and propagation models.
3. To acquaint students with different generations of mobile networks.
4. To describe the diversity and MIMO schemes as applied in wireless communication.

Course Outcome:

The students will be able to

1. Infer the wireless channel using path loss models and interpret the impact of multipath channel parameters.
2. Examine the functions and services of cellular networks.
3. Demonstrate the principles of multicarrier modulation.
4. Select a suitable diversity technique to combat the multipath fading effects.
5. Identify suitable MIMO techniques to enhance the spectrum efficiency.
6. Describe the features of next generation wireless technologies.

Module:1	Mobile Radio Propagation: Large Scale Fading	9 hours
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Overview of Wireless Communication, Cellular concept – Frequency reuse – Channel assignment strategies – Handoff strategies – Interference and system capacity – Trunking and grade of service – Improving coverage and capacity in cellular system. Propagation mechanisms, Free space model, Two ray model, Outdoor and indoor propagation models, Link budget design.

Module:2	Mobile Radio Propagation : Small Scale Fading	6 hours
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Small scale multipath propagation, Parameters of multipath channels, Types of small scale fading, Rayleigh and Rician fading.

Module:3	Wireless Systems and Standards	5 hours
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AMPS, GSM, GPRS, EDGE, UMTS, LTE, LTE-A.

Module:4	OFDM Technology	5 hours
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Introduction and Challenges in Multicarrier Systems, OFDM System Model - IFFT/ FFT Transceiver Mathematical Model - Cyclic Prefix, PAPR and reduction techniques - SNR and BER performance - ICI-SC-FDMA.

Module:5	Diversity Techniques	6 hours
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Multiple Antenna Wireless Systems-System Model, Types of Diversity: Antenna, Frequency, Time; Deep Fade Analysis with Diversity, Optimal Receiver Combining, MRC, EGC, Diversity Order.

Module:6	MIMO Technology	7 hours
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MIMO System Model – Zero Forcing and Minimum Mean Square Error receivers - Singular Value Decomposition - Channel Capacity - Optimal Water filling Power Allocation - Beam forming - Spatial Multiplexing, BLAST Architectures, Distributed MIMO.

Module:7	Next Generation Wireless Communication	5 hours
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5G Wireless Technologies - NR Standard, filter bank multicarrier, Non-orthogonal multiple access, D2D, small cells, mmWave, Index Modulation - 6G Key enablers - Reconfigurable

intelligent surfaces.		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45hours
Text Book(s)		
1. Rappaport, T.S., Wireless Communications: Principles and Practice, 2018, (Reprint), Pearson Education, Noida, India.		
Reference Books		
1. Andrea Goldsmith, Wireless Communications, 2020, 2 nd Edition, Cambridge University Press		
2. Aditya K. Jagannatham, "Principles of Modern Wireless Communications Systems", 2015, McGraw Hill Education		
3. T L Singal, Wireless Communications, 2014, (Reprint), Tata McGraw Hill Education, 1 st edition, New Delhi, India.		
4. Keith Q T Zhang, Wireless Communications: Principles, Theory and Methodology, 2016, 1 st edition, John Wiley & Sons, West Sussex, UK.		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-07-2022	
Approved by Academic Council	No. 67	Date 08-08-2022

Course Code	Course Title	L	T	P	C				
BECE317P	Wireless and Mobile Communications Lab	0	0	2	1				
Pre-requisite	BECE306L, BECE306P			Syllabus version					
					1.0				
Course Objectives									
1. To analyse the fundamentals of multipath fading and propagation models. 2. To understand the principles of multicarrier modulation. 3. To demonstrate the diversity techniques and MIMO Technology.									
Course Outcome									
Students will be able to									
1. Examine and estimate wireless channel using path loss models. 2. Demonstrate the principles of multicarrier modulation. 3. Implement the diversity techniques and MIMO concept in different wireless applications.									
Indicative Experiments									
1.	Study how call blocking probability varies as the load on a GSM network is continuously increased using Network Simulator	4 Hours							
2.	To study the effect of various fading channels such as Rayleigh, Ricean and various noise channel such as AWGN and Laplacian noise	4 Hours							
3.	Simulate to compute the pathloss of urban, suburban and rural environment for LTE/WiMAX/WLAN system using free space, Ericsson, COST 231, ECC, Hata and SUI model	4 Hours							
4.	Testing and validating principles of Pathloss in Mobile Radio Propagation through Smartphone and CRFO	2 Hours							
5.	Throughput analysis of LTE network with respect to varying distance between the ENB and UE (User Equipment)	2 Hours							
6	Write a program to analyse the Bit Error Rate (BER) performance of OFDM using BPSK, QPSK and QAM modulation schemes.	4 Hours							
7.	Write a program to analyse the following techniques to reduce the PAPR in OFDM. (i)Selective Mapping (SLM) technique (ii) Partial Transmit (PTM) Technique. (iii) Windowing Technique.	2 Hours							
8.	Comparison of MRC and EGC schemes with SISO fading	2 Hours							
9.	Comparison of ZF and MMSE MIMO receivers	4 Hours							
10	HF Radio Channel Simulation using a real-time radio simulator	2 Hours							
Total Laboratory Hours									
Mode of Assessment: Continuous Assessment and Final Assessment Test									
Recommended by Board of Studies	28-07-2022								
Approved by Academic Council	No. 67	Date	08-08-2022						

Course Code	Course Title	L	T	P	C	
BECE318L	Optical Fiber Communications	3	0	0	3	
Pre-requisite	BECE306L, BECE306P			Syllabus version		
				1.0		
Course Objectives						
<ol style="list-style-type: none"> 1. To understand the principles of optical fibers and their signal degradation. 2. To familiarize with the fundamentals of optical sources and detectors used in communications. 3. To learn WDM techniques and its components in contemporary optical communication systems. 						
Course Outcomes						
At the end of the course, the students will be able to:						
<ol style="list-style-type: none"> 1. List the fundamental optical laws, structures and waveguides. 2. Comprehend the various signal degradation in the fiber optical communication. 3. Design the optical transmitters and receivers and evaluate their performances. 4. Estimate the system requirements for point to point communication. 5. Examine the significance of WDM techniques and their applications. 6. Comprehend and analyse the performance of the various optical amplifiers. 						
Module:1 Optical Fiber: Structures, Waveguides 6 hours						
Key elements of optical fiber system-Ray optics, Mode theory, Geometrical-Optics Description, Fiber Types - specialty fibers.						
Module:2 Signal Degradation 7 hours						
Attenuation-Absorption, Scattering, Bending losses, Dispersion-Material, Waveguide Dispersion, Polarization Mode Dispersion, Intermodal dispersion, Mode Transit time, Dispersion-Induced Limitations, Nonlinear Optical Effects- SRS, SBS, SPM, CPM, FWM.						
Module:3 Optical Transmitters 6 hours						
Sources: LED-Structures-Quantum Efficiency, Power and Modulation Bandwidth- LASER-DFB, DBR, VCSEL, Quantum Efficiency, Modulators - Direct and external modulators, Transmitter Design.						
Module:4 Optical Receivers 7 hours						
Photodetector-PIN, APD, Receiver Design, Receiver Noise-CNR&SNR), Receiver Sensitivity, Quantum limit, Sensitivity Degradation, Receiver Performance-Probability of error, Bit Error rate, Eye-Diagram.						
Module:5 Digital links and Measurements 6 hours						
Digital links: Point-to-Point Links-System Consideration-Link power budget-Rise time budget, System performance- Attenuation, Dispersion measurements-OTDR.						
Module:6 WDM Concepts and Components 7 hours						
Overview of WDM, Fiber Coupler-Wave guide coupler-Star couplers, Isolators and Circulators - Fiber Bragg Grating, Filters, Multiplexers, WDM System Performance Issues- Compensation techniques.						
Module:7 Optical Amplifiers 4 hours						
Semiconductor Optical Amplifiers, Raman Amplifiers, Erbium-Doped Fiber Amplifiers.						
Module:8 Contemporary Issues 2 hours						

	Total Lecture hours:	45 hours
Text Book(s)		
1.	Gerd Keiser, Optical Fiber Communications, 2017, 5 th Edition, McGraw Hill Education, India.	
Reference Books		
1.	Conway, E., Optical Fiber Communications Principles and Practice, 2018, 1 st Edition, ED-TECH Press, United Kingdom.	
2.	Singal, T. L. Optical Fiber Communications: Principles and Applications, 2017, Cambridge University Press, India.	
3.	Keiser, G., Fiber Optic Communications, 2021, 1 st Edition, Springer, Singapore	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies		28-07-2022
Approved by Academic Council	No. 67	Date 08-08-2022

Course Code	Course Title	L	T	P	C				
BECE318P	Optical Fiber Communications Lab	0	0	2	1				
Pre-requisite	BECE306L, BECE306P			Syllabus version					
1.0									
Course Objectives									
<ul style="list-style-type: none"> 1. To design the optical communication system and study the signal degradation. 2. To familiarize wavelength division multiplexing techniques and associate components. 3. To estimate the link power budget and rise time budget. 									
Course Outcome									
At the end of the course, the students will be able to:									
<ul style="list-style-type: none"> 1. Establish the optical link and estimate the design parameters. 2. Analyse the optical amplifiers and evaluate their characteristics. 3. Design and analyse the WDM techniques and components. 									
Indicative Experiments									
1.	Design of optical transmission link to analyse the BER performance for different line coding techniques, modulation based on wavelength and length of the fiber.	6 hours							
2.	Design and analysis of gain, noise figure and saturation of optical amplifier – EDFA, SOA.	4 hours							
3.	Performance analysis of wavelength division multiplexing (WDM) techniques and passive optical components (Optical coupler, Isolator, Circulator, FBG & OADM)	8 hours							
4.	Analyse the different dispersion compensation techniques and fiber non-linear effects.	8 hours							
5.	Design of point-to-point optical system, estimate the power and rise-time budget and detect the fiber faults using OTDR.	4 hours							
Total Laboratory Hours									
30 hours									
Mode of Assessment: Continuous Assessment and Final Assessment Test									
Recommended by Board of Studies	28-07-2022								
Approved by Academic Council	No. 67	Date	08-08-2022						

Short Syllabus

BECE401L Computer Communications and Networks (3-0-0-3)

Layered Network Architecture - Network Topologies, ISO/OSI Reference Model; Internetworking devices – Repeater, Hubs, Switches, Bridges; Data Link Layer Logical Link Control - Error Detection Techniques; Data Link Layer Medium Access Control – Ethernet, Wireless LAN; Network Layer – Internetworking; Transport Layer - Connection oriented and Connectionless Service; Application Layer – SMTP, FTP, HTTP.

Course Code	Course Title	L	T	P	C
BECE401L	Computer Communications and Networks	3	0	0	3
Pre-requisite	BECE306L, BECE306P	Syllabus Version			1.0
Course Objectives:					

1. To familiarize the students with the basic terminologies and concepts of OSI, TCP/IP reference model and functions of various layers.
2. To make the students understand the design and performance issues associated with the functioning of LANs and WLANs.
3. To introduce the students to analyze the IP addressing and basics of transport and application layer protocols.

Course Outcome:

The students will be able to:

1. Infer the basic concepts of OSI and TCP reference model in computer network protocols and internetworking devices.
2. Examine the LAN bridges such as Transparent Bridges and Source Routing Bridges
3. Deploy the error & flow control mechanism and medium access control.
4. Configure the network with IP address and find the shortest path.
5. Analyze transport layer protocols and congestion control algorithms
6. Understand the fundamentals of DNS, FTP, SMTP, HTTP and network security.

Module:1	Layered Network Architecture	6 hours
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Evolution of data Networks – Network Topologies –Switching Techniques – Multiplexing – Categories of networks – ISO/OSI Reference Model – TCP/IP Model – Addressing – Network performance metrics.

Module:2	Internetworking devices	5 hours
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Repeaters – Hubs – Switches – Bridges: Transparent and Source Routing– Routers.

Module:3	Data Link Layer- Logical Link Control	6 hours
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Error Detection Techniques – ARQ protocols – Framing – HDLC –Point to Point protocol.

Module:4	Data Link Layer- Medium Access Control	8 hours
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Random access Protocols – Ethernet (IEEE 802.3) – Wireless LAN (IEEE 802.11); Scheduling approaches to MAC – Controlled Access – Token Bus/Ring (IEEE 802.4/5).

Module:5	Network Layer	8 hours
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Internetworking – IP Addressing – Subnetting – IPv4 and IPv6– Routing – Distance Vector and Link State Routing – Routing Protocols.

Module:6	Transport Layer	5 hours
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Connection oriented and Connectionless Service – User Datagram Protocol – Transmission Control Protocol – Congestion Control – QoS parameters.

Module:7	Application Layer	5 hours
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Domain Name System – Simple Mail Transfer Protocol – File Transfer Protocol – Hypertext Transfer Protocol; Network Security and Cryptography– Virtual LAN – VPN – Enterprise Network: Types and Trends – Private Network.

Module:8	Contemporary Issues	2 hours
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	Total Lecture:	45 hours
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Text Book(s)	
1.	Alberto Leon-Garcia, Communication Networks, 2017, 2 nd Edition, Tata McGraw-Hill, USA.
Reference Books	
1. Dimitri P. Bertsekas & Robert Gallager, Data Networks, 2013, 2 nd Edition, Prentice Hall, USA.	
2.	W. Stallings, Data and Computer Communications, 2017, 10 th Edition, Pearson Prentice Hall, USA.
3.	Behrouz A Forouzan, Data Communications and Networking, 2017, 5 th Edition, Tata McGraw-Hill, USA.
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test	
Recommended by Board of Studies	14-05-2022
Approved by Academic Council	No. 66 Date 16-06-2022

Course Code	Course Title	L	T	P	C
BECE401P	Computer Communications and Networks Lab	0	0	2	1
Pre-requisite	BECE306L, BECE306P	Syllabus Version			1.0
Course Objectives:					

1. To familiarize the students with the basic terminologies and concepts of OSI, TCP/IP reference model and functions of various layers.
2. To make the students understand the design and performance issues associated with the functioning of LANs and WLANs.
3. To introduce the students to analyze the IP addressing and basics of transport and application layer protocols.

Course Outcome:

The students will be able to:

1. Analyze the performance of internetworking devices and network topologies using simulation tools.
2. Analyze the performance of error detection and medium access control protocols using simulation tools.
3. Implement and analyze the routing algorithms and transport layer protocols using simulation tools.

List of Challenging Experiments (Indicative)

Task 1	Simulation and performance analysis (in terms of PDR, delay) of different network topologies and queuing mechanisms.	6 hours
Task 2	Analyze the spanning tree algorithm by varying the priority among the switches.	4 hours
Task 3	Simulation of framing and error detection schemes.	4 hours
Task 4	Simulation and performance analysis of different Medium Access Control schemes.	4 hours
Task 5	Implementation of various routing algorithms to compute the shortest path.	6 hours
Task 6	Analysis of transport layer protocols and congestion control.	6 hours
Total Laboratory Hours		30 hours

Mode of Assessment: Continuous Assessment and Final Assessment Test

Recommended by Board of Studies	14-05-2022
Approved by Academic Council	No. 66

Short Syllabus

BECE208E Data Structures and Algorithms (2-0-2-3)

Implementing Data Structures - Stack, Queues, Trees; Algorithm Analysis - Recurrences, Substitution, Recursion tree; Algorithms with Numbers - Sorting and Searching, Divide and Conquer algorithms; Algorithms on Strings - Pattern Matching, Huffman Encoding; Graph Algorithms - Decomposition of graphs, BFS & DFS, Minimum Spanning Algorithms; Algorithms for Optimization - Dynamic programming, Linear programming; Search Heuristics - Intelligent exhaustive search, Local search heuristics.

Course Code	Course Title	L	T	P	C		
BECE208E	Data Structures and Algorithms	2	0	2	3		
Pre-requisite	BCSE101E			Syllabus version			
				1.0			
Course Objectives							
<ol style="list-style-type: none"> 1. To emphasize the scope and significance of Data Structures and Algorithms for real world problems. 2. To enable a good understanding of the fundamental data structures. 3. To enable a study of algorithms for various kinds of applications. 4. To impart skill to theoretically analyze and evaluate performance of algorithms 							
Course Outcome							
At the end of the course, students will be able to							
<ol style="list-style-type: none"> 1. Identify a suitable data structure technique that can solve a given problem. 2. Design an efficient algorithm for a given problem statement. For given problem develop algorithms and theoretically analyze the efficiency. 3. Develop efficient algorithms for handling different formats of data like text, numbers etc. 4. Learn the systematic way of organizing large amounts of data. 5. Correlate and map real word problems to algorithmic solutions. 6. Provide efficient algorithmic solution for real-world problems. 							
Module:1	Implementing Data Structures	5 hours					
Linked list, Stack, Queues, Trees, Maps, Hash Tables.							
Module:2	Algorithm Analysis	3 hours					
Analysis Algorithms - Asymptotic notations – Recurrences -Substitution - Recursion-tree – The master method							
Module:3	Algorithms with Numbers	3 hours					
Sorting and Searching- Insertion sort, Binary Search, Divide and Conquer algorithms-Merge sort, Quick Sort.							
Module:4	Algorithms on Strings	4 hours					
Pattern Matching- KMP, Rabin-karp algorithm, Huffman Encoding.							
Module:5	Graph Algorithms	5 hours					
Decomposition of graphs, Paths in graphs: BFS & DFS, Minimum Spanning Algorithms: Prim's & Kruskal's - Single-Source (Dijkstra's) & All-pairs (Floyd & Warshall's).							
Module:6	Algorithms for Optimization	5 hours					
Brute force, Dynamic programming, Greedy algorithms: Fractional Knapsack & Linear programming.							
Module:7	Search Heuristics	3 hours					
Introduction to NP Completeness, Search Heuristics, Intelligent exhaustive search, Local search heuristics.							
Module:8	Contemporary issues	2 hours					
		Total Lecture hours:		30 hours			

Text Book(s)			
1.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, MIT Press, Fourth edition ,2022		
2.	Mark A. Weiss, Data Structures & Algorithm Analysis in C++, 4th Edition, 2013, Pearson Education.		
Reference Books			
1.	Michael T Goodrich, Roberto Tamassia & Michael H Goldwasser, Data Structures and Algorithms in Java, Wiley 2014.		
2.	Kent. D. Lee, Steve Hubbard, Data Structures and Algorithms with Python, Springer, 2015.		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test			
Indicative Experiments			
1.	Implementing Linked list - Stacks & Queues, Trees, Maps & Hash Tables by demonstrating applications for each.	12 hours	
2.	Performance evaluation of Divide and Conquer Algorithms	4 hours	
3.	Text Processing - Compression & Encryption	4 hours	
4.	Implementing Graph Algorithms	3 hours	
5.	Implementation of Algorithms: Dynamic Programming, Greedy & Linear Programming	3 hours	
6.	Search Algorithms	4 hours	
Total Laboratory Hours	30 hours		
Mode of Assessment: Continuous Assessment and Final Assessment Test			
Recommended by Board of Studies	14-05-2022		
Approved by Academic Council	No. 66	Date	16-06-2022

Short Syllabus

BECE209E

Structured and Object-Oriented Programming (2-0-4-4)

C Programming Fundamentals, Arrays and Strings – Variables, Expressions, Branching and Looping, Arrays, Strings and its operations; Functions and Pointers – Types, Storage Classes, Pointers and arrays; Structures and Unions - Access of Structure Variables, Arrays of Structure, Structures and Functions; Overview of Object-Oriented Programming - Classes and Objects, Constructors and Destructors, Dynamic Memory Allocation; Inheritance and Polymorphism – Types, Inheritance and constructors; Generic Programming - Function templates, class templates; Exception handling and files - Try and catch blocks, File handling functions, Sequential and Random access.

Course Code	Course Title	L	T	P	C
BECE209E	Structured and Object Oriented Programming	2	0	4	4
Pre-requisite	NIL			Syllabus version	1.0

Course Objectives:

1. To summarize the usefulness of branching and looping statements in one dimension and multi-dimensional array programming.
2. To equip students with dynamic memory management through an expertise on pointers.
3. To introduce students the importance of polymorphism and inheritance in an object oriented programming.
4. To teach students the way of supervising exceptions through exception handlers and files through file handlers.

Course Outcomes:

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

1. Implement branching and looping statements to handle 1D and 2D arrays.
2. Realize the importance of pointers to manage the memory dynamically.
3. Comprehend the use of structures and unions to encapsulate different data types in programming.
4. Apply polymorphism and inheritance which are imbibed in object oriented programming.
5. Infer and handle different exceptions.
6. Access files in terms reading and writing through various file handlers.
7. Comprehend various elements of object-oriented programming paradigm and propose solutions through inheritance and polymorphism.

Module:1 C Programming Fundamentals, Arrays and Strings 4 hours

Variables - Reserved words, Data Types, Operators, Operator Precedence - Expressions - Type Conversions - I/O statements - Branching and Looping: if, if-else, nested if, if-else ladder, switch statement, goto statement - Loops: for, while and do...while, break and continue statements. Arrays: One Dimensional array - Two-Dimensional Array — Strings and its operations.

Module:2 Functions and Pointers 4 hours

User Defined Functions: Declaration — Definition — call by value and call by reference - Types of Functions - Recursive functions - Storage Classes - Scope, Visibility and Lifetime of Variables. Declaration and Access of Pointer Variables, Pointer arithmetic — Dynamic memory allocation — Pointers and arrays - Pointers and functions.

Module:3 Structures and Unions 3 hours

Declaration, Initialization, Access of Structure Variables - Arrays of Structure - Arrays within Structure - Structure within Structures - Structures and Functions — Pointers to Structure.

Module:4 Overview of Object-Oriented Programming 6 hours

Features of OOP - Classes and Objects - "this" pointer - Constructors and Destructors - Static Data Members, Static Member Functions and Objects - Inline Functions — Call by reference - Functions with default Arguments - Functions with Objects as Arguments - Friend Functions and Friend Classes. Dynamic Memory Allocation.

Module:5 Inheritance and Polymorphism 6 hours

Inheritance - Types of Inheritance: Single inheritance, Multiple Inheritance, Multi-level Inheritance, Hierarchical Inheritance - Multipath Inheritance - Inheritance and constructors

Module:6	Generic Programming	4 hours
Function templates and class templates, Standard Template Library.		
Module:7	Exception handling and files	3 hours
Introduction to exceptions, Try and catch blocks, throw statement, File handling functions. Sequential and Random access.		
	Total Lecture hours:	30 hours
Text Book		
1	Herbert Schildt, C: The Complete Reference, 2017, 4 th Edition, McGraw Hill Education.	
2	Herbert Schildt, C++: The Complete Reference, 2017, 4 th Edition, McGraw Hill Education.	
Reference Books		
1	Yashavant Kanetkar, Let Us C: 2020, 17 th Edition, BPB Publications, 2020.	
2	Stanley Lippman and Josee Lajoie, C++ Primer, 2012, 5 th Edition, Addison-Wesley publishers	
3	Byron S Gottfried, Programming with C, 2018, 2018, 4 th Edition, Schaum's outline series.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Indicative Experiments		
1.	Programs using basic control structures, branching and looping	
2.	Experiment the use of 1-D, 2-D arrays and strings and Functions	
3.	Demonstrate the application of pointers	
4.	Experiment structures and unions	
5.	Programs on basic Object-Oriented Programming constructs.	
6.	Demonstrate various categories of inheritance	
7.	Program to apply kinds of polymorphism.	
8.	Develop generic templates and Standard Template Libraries.	
9.	Demonstrate the use of Exception handling.	
10.	Demonstrate the working of file handling.	
	Total Hours	60 hours
Mode of Assessment: Continuous Assessment and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022

Short Syllabus

BECE309L Artificial Intelligence and Machine Learning (3-0-0-3)

Foundations of AI - Agents and rationality, Agent Architecture Types; Problem-solving by Searching - Search algorithms, strategies; Knowledge Representation - Agents based on Propositional Logic; Probability reasoning and uncertainty - Knowledge representation in uncertainty, Decision making; Data Preparation for Machine Learning - Data Cleaning, Integration, Transformation; Learning from Examples - Forms of Learning, Regression, Decision Trees, Ensemble Learning; Deep Learning - Convolutional Networks, Recurrent Neural Networks.

Course Code	Course Title	L	T	P	C				
BECE309L	Artificial Intelligence and Machine Learning	3	0	0	3				
Pre-requisite	BMAT201L	Syllabus version		1.0					
Course Objectives									
<ol style="list-style-type: none"> 1. To get acquainted with different types of intelligent agents. 2. To understand the importance and significance of Machine learning. 3. To preface the essentials of Deep Learning. 									
Course Outcome									
At the end of the course, students will be able to									
<ol style="list-style-type: none"> 1. Comprehend different intelligent agents and its variants. 2. Solve the real-world problem using the various search algorithms. 3. Infuse various symbolic knowledge representation. 4. Employ intelligent agents for decision making. 5. Handle real-time issues using various learning methodologies. 6. Apply deep learning algorithms for solving real-world problems. 									
Module:1 Foundations of AI	4 hours								
Introduction – Agents and rationality – Task environment – Agent Architecture Types.									
Module:2 Problem-solving by Searching	7 hours								
Search Space – Search algorithms, strategies – Search in complex environments.									
Module:3 Knowledge Representation	6 hours								
Knowledge-based agents, Agents based on Propositional Logic – First-order logic.									
Module:4 Probability reasoning and uncertainty	6 hours								
Quantifying uncertainty, Knowledge representation in uncertainty, Decision making – Simple, complex.									
Module:5 Data Preparation for Machine Learning	4 hours								
Basics of Vectors & Matrices – Overview: Data Cleaning, Integration, Transformation & Reduction.									
Module:6 Learning from Examples	9 hours								
Forms of Learning – Dimensionality reduction - Regression – Statistical Methods: Naïve-Bayes, Nearest Neighbor, Decision Trees – Random Forest, Clustering, Ensemble Learning, Case studies – Machine Learning in Signal Processing, Intelligent Antenna.									
Module:7 Deep Learning	7 hours								
Simple Feed Forward Networks – Computational graphs for Deep Learning – Convolutional Networks – Recurrent Neural Networks – Kernel Machines – Hidden Markov Models.									
Module:8 Contemporary issues	2 hours								
		Total Lecture hours:		45 hours					
Text Book(s)									
1.	Stuart J Russell, Peter Norvig, Artificial Intelligence – A modern approach, 2015, 3 rd edition, Pearson, India.								
Reference Books									
1.	Vinod Chandra S.S, Anand Hareendran S., Artificial Intelligence: Principles and								

	Applications, 2020, 2 nd Edition, PHI Learning Pvt. Ltd., India.
2.	Alpaydin ethem, Introduction to Machine Learning, 2019, 3 rd edition, PHI Learning Pvt. Ltd., India.
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test	
Recommended by Board of Studies	14-05-2022
Approved by Academic Council	No. 66 Date 16-06-2022

Course Code	Course Title	L	T	P	C				
BECE310L	Satellite Communications	3	0	0	3				
Pre-requisite	BECE306L, BECE306P	Syllabus version		1.0					
Course Objectives									
<ol style="list-style-type: none"> 1. To learn the conceptual knowledge of communication through satellites. 2. To provide a detailed understanding of navigation - both inertial and by navigation satellites. 3. To analyze typical challenges of satellite based systems. 									
Course Outcomes									
<p>At the end of the course, students will be able to</p> <ol style="list-style-type: none"> 1. Analyse the concept of orbits, launch vehicles and satellites 2. Comprehend the design of satellite subsystems 3. Imbibe the basics of digital transmission related to satellite communication 4. Analyse the navigation satellite services. 5. Analyse the impact of diverse parameters on satellite link design 6. Apply the satellite systems for various applications 									
Module:1	Orbital Mechanics	6 hours							
<p>Overview of satellite communication - Orbital mechanics - Equations of the orbit - Kepler's laws of planetary motion - Orbital elements - Look angle determination - Orbital perturbation and determination</p>									
Module:2	Orbital Launchers	3 hours							
<p>Launches and launch vehicles- Launch vehicle selection factors - Satellite positioning into geostationary orbit - Orbital effects in communication systems performance - Doppler shift -Range variations - Solar eclipse and sun transit outage.</p>									
Module:3	Elements of Communication Satellite Design	5 hours							
<p>Satellite subsystems - Attitude and orbit control electronics - Telemetry and tracking - Power subsystems - Communication subsystems - Satellite antennas - Reliability and redundancy- Frequency modulation techniques.</p>									
Module:4	Digital Transmission Basics	4 hours							
<p>Modulation and Multiplexing -Multiple access techniques – FDMA, TDMA, CDMA, SDMA, ALOHA and its types – Onboard processing- Satellite switched TDMA – Spread spectrum transmission and reception for satellite networks.</p>									
Module:5	Satellite Link Design	9 hours							
<p>Basic transmission theory – System noise temperature and G/T Ratio- Noise figure and noise temperature- Calculation of system noise temperature – G/T ratio for earth stations - Link budgets - Uplink and downlink budget calculations - Error control for digital satellite links - Prediction of rain attenuation and propagation impairment counter measures.</p>									
Module:6	VSAT and NGSO System	7 hours							
<p>Overview of VSAT systems-VSAT Network Architectures, One Way Implementation, Two-Way Implementation, Delay Considerations, VSAT Earth Station Engineering -NGSO Satellite Systems Constellation/ Constellation Design Considerations - Starlink, One Web</p>									
Module:7	Direct Broadcast Satellite Television systems and GPS	9 hours							

DBS Satellite Systems: DVB-S2X Standards -System Design for High-Throughput Applications , Antenna Considerations, Modulation Scheme Considerations, Error Coding Considerations, Remote Sensing Application, Navigation Satellite Systems GPS-Position Calculations and Accuracy, Navigation Messages, Receiver Design,- IRNSS		
Module:8	Contemporary Issues	2 hours
Lecture hours:		Total
45 hours		
Text Book(s)		
1.	Pratt, C.W. Boastian and Jeremy Allnutt "Satellite Communication", 2018, 2nd edition, John Wiley and Sons, Bangalore, India.	
Reference Books		
1.	D.Roddy, "Satellite Communications", 2011, 4th edition (sixth reprint), Tata McGraw Hill, New York.	
2.	Anil K. Maini, Varsha Agrawal, "Satellite Communications", 2018, Wiley India Pvt. Ltd, New Delhi, India	
3	G. Maral, M. Bousquet, Z. Sun, "Satellite Communications Systems: Systems, Techniques and Technology", 2020 (6th Edition), John Willy and sons, New York.	
4	Teresa M. Braun , "Satellite Communications Payload and System", 2021, 2 nd edition, John Wiley and Sons, USA	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE311L	Radar Systems	3	0	0	3
Pre-requisite	BECE305L, BECE305P			Syllabus version	
				1.0	

Course Objectives

1. To understand and analyze various radar parameters.
2. To analyze and design transmitter, receiver circuits and antennas for various radars.
3. To understand and contrast the need for modern radars for different applications.

Course Outcomes

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

1. Analyze the radar range equation and radar cross section.
2. Analyze radar parameters to design and conduct radar experiments.
3. Evaluate the performance of transmitter and receiver circuits.
4. Realize various signal and data processing steps involved in the recovery of a signal.
5. Analyze and design antennas for different radars.
6. Distinguish modern radars for diverse applications.

Module:1	Principles of Radar	6 hours
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Introduction to Radars, Radar principle, Doppler Effect, Radar frequency bands, Radar Block Diagram, Radar Range Equation, Radar Cross section of targets, Radar Clutter, types of scattering, Applications of Radars

Module:2	Radar Parameters	6 hours
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Transmit pulse width, Pulse Repetition Frequency, baud length, range resolution, unambiguous range, coherent integration, FFT points, incoherent integration, detectability, SNR, receiver bandwidth, Transmit power, Pulse compression techniques.

Module:3	Transmit and Receive modules(TRM)	8 hours
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Block schematic, Timing and signal generation for TRM operation, Gain and phase control, Design of power amplifiers, Transmit-receive switch, circulator, blanking switch, types of amplifiers (linear amplifiers, low noise amplifiers and solid-state amplifiers), and band pass filter.

Module:4	Signal & Data Processing	6 hours
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Digital receiver and signal processing steps, DC and clutter removing, spectrum cleaning, computation of spectral moments, computation of velocity, range time intensity (SNR) computation, cross correlation and autocorrelation, capon imaging, maximum entropy method for imaging.

Module:5	Radar Antennas	8 hours
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Antenna parameters for Radars, Parabolic Reflector antenna, Yagi-Uda antenna, Microstrip patch antenna, Phased array system: Planar Arrays, Electronic beam steering, Beam forming, Phase Shifters, Active Phased array and Semi active phased array system, Radomes.

Module:6	Types of Radars	6 hours
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Principle of operation, Block diagram, Advantages, limitations and Application of CW Radar, Pulsed Radar, MTI Radar, Synthetic Aperture Radar, and Meteorological Radars(MST and Doppler weather radar).

Module:7	Stealth Technology	3 hours
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Principles, Radar cross section reduction, RF absorbers and Radar stealth countermeasures and limits.		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1.	Merrill Skolnik, Introduction to Radar Systems, 3 rd Edition, McGraw-Hill, USA, 2017.	
Reference Books		
1.	Habibur Rahman, Fundamental Principles of Radar, CRC Press, Taylor & Francis Group, USA, 2019.	
2.	Merrill Skolnik, Radar Handbook, 3 rd Edition, McGraw-Hill, USA, 2008	
3.	Mark A. Richards, James A. Scheer, William A. Holm (Editors), Principles of Modern Radar Vol. I: Basic Principles, SciTech Publishing, Inc, USA, 2016.	
4.	G.S.N. Raju, Radar engineering and fundamentals of navigational aids, DreamTech Press (Wiley distribution), New Delhi, India, 2019.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE312L	Robotics and Automation	3	0	0	3
Pre-requisite	NIL	Syllabus version		1.0	

Course Objectives

1. To provide basic understanding of robotics and automation.
2. To demonstrate the need of various sensors and drives in robotic system.
3. To make students understand about the robotic kinematics, path planning and different trajectories.
4. To deliver the programming languages to design robots in practice and research for contemporary use.

Course Outcomes

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

1. Classify robots and summaries their role in diverse applications
2. Infer the working of basic electric, electronic, and other types of drives required in robots.
3. Distinguish and interpret the sensors for various applications in robotics and automation.
4. Determine the mathematical model of robotic systems and analyze their kinematic behavior.
5. Design robots for varied working environments encompassing all types of motions across different paths and diverse trajectories.
6. Apply the ideas in performing various robotic tasks for contemporary industry standards using suitable programming skills.

Module:1	Robotics and Automation	5 hours
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Robots: Basics, Types-Application, Mobility, DoF, Terrain, components classification, performance characteristics, Industrial Robots, HRI, Automatic assembly system.

Module:2	Drives for Robotics	5 hours
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Drives: Electric, hydraulic and pneumatic drives.

Module:3	Sensors for Robots	7 hours
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Tactile sensors - Proximity and range sensors – Optical Sensor- limit switch sensor- surface array sensor- Acoustic sensors - Vision sensor systems – Vision feedback system -Image processing and analysis - Image data reduction – Segmentation – Feature extraction -Object recognition.

Module:4	Robot Kinematics and Dynamics	10 hours
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Kinematics of manipulators, rotational, translation and transformation Homogeneous, Transformations, Denavit – Hartenberg Representation, Inverse Kinematics. Linearization of Robot Dynamics – State variable continuous and discrete models.

Module:5	Path Planning	5 hours
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Types of trajectories, trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion and straight line motion.

Module:6	Programming of Robots	5 hours
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Robot programming: ROS1 and ROS2, languages and software packages- MATLAB/Simulink, OpenRDK, Adams.

Module:7	Application of Robots	6 hours
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Industrial robots used for welding, painting and assembly, remote controlled robots, robots for nuclear, thermal and chemical plants, industrial automation, typical examples of automated Industries, Humanoid robots, medical robots, under water robots, drones.		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1. Kevin M. Lynch, Frank C. Park, "Modern Robotics- Mechanics, Planning, and Control", 2017, Cambridge University Press.		
Reference Books		
1. R. K. Mittal, I. J. Nagrath, "Robotics and Control", 2017, McGraw Hill Education, India, 2. Ramkumar Gandhinathan, Lentin Joseph, "ROS Robotics Projects-Build and Control Robots Powered by the Robot Operating System, Machine Learning, and Virtual Reality", 2019, Packt Publishing. 3. Hutchinson, S., Spong, M. W., Vidyasagar, M. "Robot Modeling and Control", 2020, Wiley publications, United Kingdom. 4. Pawlak, A. M. Sensors and Actuators in Mechatronics: Design and Applications, 2017, CRC Press, United Kingdom. 5. Lentin Joseph, "Robot Operating System (ROS) for Absolute Beginners - Robotics Programming Made Easy, 2018, Apress.		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE313L	Information Theory and Coding	3	0	0	3
Pre-requisite	BECE306L, BECE306P		Syllabus version		
			1.0		

Course Objectives

1. This course provides an understanding of fundamental information theoretic techniques including applications to compression and error control coding.
2. It also aims at quantitative measure of information may be used in order to build efficient solutions to multitudinous engineering problems.

Course Outcomes

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

1. Analyze probability theory and evaluate the average and mutual information.
2. Examine different types of channels and determine their capacity.
3. Implement various types of source coding algorithms and analyze their performance.
4. Apply various types of coding techniques and standards on audio and video.
5. Design linear block codes and cyclic codes (encoding and decoding).
6. Design and build the channel coder for 5G standard.

Module:1	Information Measures	7 hours
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Review of Probability Theory, Introduction to information theory, Uncertainty, self-information, average information, Marginal Entropy, Joint Entropy and Conditional Entropy, Mutual Information, Relationship between entropy and mutual information and their properties, Markov statistical model for information source, Entropy and information rate of markov source , Information measures of continuous random variables.

Module:2	Channel Models and Capacity	6 hours
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Importance and types of various channel models - Channel capacity calculation – Binary symmetric channel, binary erasure channel - Shannon's channel capacity and channel coding theorem - Shannon's limit.

Module:3	Probability based Source Coding	6 hours
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Source coding theorem - Huffman coding - Non binary Huffman codes - Adaptive Huffman coding - Shannon Fano Elias coding - Non binary Shannon Fano codes, Arithmetic coding

Module:4	Non Probability based Source Coding	5 hours
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Lempel-Ziv coding, Run-length encoding and rate distortion function - Transform coding - JPEG and JPEG 2000.

Module:5	Audio and Video Coding	5 hours
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Audio Coding: types – Linear Predictive Coding (LPC) – Code Excited LPC – Perceptual Coding - MPEG Audio Coding. Video Coding: Motion Estimation and Compensation – Types of Frames – Encoding and Decoding of Frames – Video Coding Standard: MPEG 4.

Module:6	Channel Coding	9 hours
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Introduction to Error control codes - Block codes, linear block codes, cyclic codes and their properties, Encoder and Decoder design- serial and parallel concatenated block code, Convolution Codes- Properties, Encoder-Tree diagram, Trellis

diagram, state diagram, transfer function of convolutional codes, Viterbi Decoding, Trellis coding, Reed Solomon codes, Turbo coder, Iterative Turbo decoder		
Module:7	Channel Coding for 5G standard	5 hours
Low Density Parity Check code - LDPC code construction, construction in 5G standard, encoding of LDPC codes, Message passing decoding on Tanner graph. Polar code – Representation, generator matrix, Successive cancellation decoder for polar codes.		
Module:8	Contemporary Issues	2 hours
		Total Lecture hours:
		45 hours
Text Book(s)		
1	Simon Haykin, "Communication Systems", 2017, 5 th Edition, Wiley India Pvt Ltd, India.	
2	Khalid Sayood, "Introduction to Data Compression, 5 th Edition, The Moragan Kaufmann Series in Multimedia Information and Systems, Elsevier, 2017.	
Reference Books		
1.	Ranjan Bose, "Information Theory, Coding and Cryptography", 2015, 1 st Edition, McGraw Hill Education (India) Pvt. Ltd., India.	
2	Murlidhar Kulkarni, K.S. Shivaprakasha, "Information Theory and Coding As per AICTE", 2019, 2 nd Edition, Wiley India Pvt Ltd, India.	
3	Orhan Gazi, "Polar Codes: A Non-Trivial Approach to Channel Coding", 2019, 1st Edition, Springer Topics in Signal Processing Book 15.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C			
BECE314L	Electromagnetic Interference and Compatibility	2	1	0	3			
Prerequisite	BECE205L	Syllabus Version						
		1.0						
Course Objectives								
<ol style="list-style-type: none"> 1. To understand importance of EMC and EMC compliance for the products. 2. To understand guidelines for reduced EMI in PCB design 3. To learn the EMI sources, mitigation, and measurement techniques/standards to guarantee the correct working modalities. 								
Course Outcomes								
At the end of the course, students will be able to								
<ol style="list-style-type: none"> 1. Understand the concepts related to EMI and EMC 2. Analyze the various coupling methods 3. Apply a proper EMI control technique for a specific identified EMI issue. 4. Apply the guidelines for PCB Design 5. Familiarize with EMC Measurement Techniques 6. Identify various emission and susceptibility testing standards which a product should comply with 								
Module 1	EMI/EMC Concepts	4 Hours						
EMI/EMC definitions – Units - Sources of EMI: Classification, Lightning, ESD, NEMP - Conducted and radiated emission - Conducted and radiated susceptibility – Intra and inter system EMI - In band interference - Spectrum conservation - Radiation hazard - Specific Absorption Rate (SAR).								
Module 2	EMI Coupling Principles	4 Hours						
Conductive coupling: Common-mode, Differential-mode - Inductive coupling - Capacitive coupling - Radiative coupling								
Module 3	EMI Control Techniques -I	8 Hours						
Grounding: Earthing principle, Types of Grounding- system grounding - Shielding: Shielding theory and shielding effectiveness, Shielding integrity at discontinuities, Conductive coatings, Cable shielding, Bonding: Shape and material for bond strap - general guidelines for good bonds.								
Module 4	EMI Control Techniques -II	8 Hours						
EMI Filters: Characteristics of filters, Impedance mismatch effects, Lumped element filters, Power line filter design, Common mode filter, Differential mode filter - EMI suppression devices and components: EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, Transient and surge suppression devices.								
Module 5	EMC Design of PCBs	8 Hours						
RF Sources in PCB - SMD / through hole components, Pins, Basic loops, Differential vs Common mode - Board layout: Ground plane and Power plane, ground bounce, Power distribution for two-layer boards, Power supply decoupling, Board zoning, Signal traces, Cross talk, Trace routing - Cables and connectors.								
Module 6	EMI Measurements	5 Hours						
Radiated interference measurements: Open area test site measurement, anechoic chamber, TEM cell; Reverberating chamber - Conducted interference measurements: Characterization of conduction currents voltages, Conducted EM noise on power supply lines, Conducted EMI from equipment - Pulsed interference immunity: ESD/EFT, Electrical surge - Time domain EMI measurement								

Module 7	EMC Standards	4 Hours
Military standards, IEEE/ ANSI Standards, CISPR/IEC, FCC standards, European Standards, VDE Standards, Other EMC Standards, Company Standards, EMC compliance for wireless devices, Radio Equipment Directive (RED).		
Module 8	Contemporary Issues	2 Hours
	Total Lecture Hours	45 Hours
Text Books:		
1.	Clayton R.Paul, "Introduction to Electromagnetic Compatibility", Wiley-Interscience, 2022	
Reference Books:		
1.	Henry W.Ott., "Electromagnetic Compatibility Engineering", Wiley, 2009.	
2.	V.P.Kodali, "Engineering Electromagnetic Compatibility: Principles, Measurements, Technologies, and Computer Models", Wiley-IEEE Press, 2001	
3.	Christos Christopoulos, "Principles and Techniques of Electromagnetic Compatibility", CRC Press, 2007.	
4.	Mark I. Montrose, "EMC Made Simple Printed Circuit Board and System Design", Montrose Compliance Services, 2014.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C				
BECE315L	Optical Networks	3	0	0	3				
Pre-requisite	BECE308L, BECE308P/ BECE318L, BECE318P	Syllabus version							
				1.0					
Course Objectives									
<p>1. To introduce Optical Components, Transmission system Engineering and Optical Digital Networks.</p> <p>2. To design Optical WDM Networks and to understand the routing techniques.</p> <p>3. To elucidate about Optical packet switching, OTN and access networks.</p> <p>4. To analyze the various optical network performances and to understand traffic management, fault management and security.</p>									
Course Outcomes									
<p>At the end of the course, students will be able to</p> <p>1. Identify the optical components and analyze the transmission system.</p> <p>2. Analyze the various Optical Digital Networks</p> <p>3. Design Optical WDM Networks and to understand the routing techniques.</p> <p>4. Understand Optical packet switching, OTN and access networks.</p> <p>5. Analyze the various optical network performance and to understand traffic management.</p> <p>6. Identify the faults in optical networks and select the suitable protection techniques.</p>									
Module:1	Optical system components	6 hours							
Optical System Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters; Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, Overall design considerations.									
Module:2	Optical digital networks	6 hours							
Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies, Media-Access Control Protocols and Testbeds; Wavelength Routing Architecture.									
Module:3	Wavelength routing networks	6 hours							
WDM Network Design - Cost tradeoffs, Virtual Topology Design, Routing and wavelength assignment, Statistical Dimensioning Models.									
Module:4	Packet switching and access networks	6 hours							
Photonic Packet Switching – OTDM, Multiplexing and De-multiplexing, Synchronization, Header Processing, Buffering, Burst Switching, Testbeds; Access Networks.									
Module:5	Optical transport network and network synchronization	6 hours							
Introduction- OTN Network Layers - FEC in OTN- OTN Frame Structure- OTN and DWDM- OTN Management- Synchronization - The Timing Signal- Signal Quality- Transmission Factor- Jitter and Wander- Photodetector Responsivity and Noise Contributors.									
Module:6	Network performance	8 hours							

Introduction-Channel Performance- Power-Bandwidth Ratio- Shannon's Limit - Optical Signal to Noise Ratio - Factors That Affect Channel Performance - Analysis of BER and SNR Related to Channel Performance - BER and SNR. Traffic Management and Control -Client Bandwidth Management -Wavelength Management – Paths with --Congestion Management - Routing Discovery of Optical Network -Node and Network - Wavelength Management Strategies.		
Module:7	Network protection, fault management and security	5 hours
Introduction- Fault Detection and Isolation - Fault and Service Protection - Point-to-Point Networks- Mesh Network Protection -Ring-Network - Ring-to-Ring Protection - Multi-ring Shared Protection - Network Security Issues - Definitions -Security - Security Layers in Communication Networks.		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1.	Debasish Datta, "Optical Networks", OUP Oxford (2021), 1 st Edition.	
Reference Books		
1.	Biswanath Mukherjee, "Optical WDM Networks", Springer, 2006. 1 st Edition.	
2.	Stamatis V. Kartalopoulos "Next Generation Intelligent Optical Networks" Springer Science Business Media. LLC, 2008, 1 st Edition.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No.69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE316E	Digital Image Processing	3	0	2	4
Pre-requisite	BECE301L,BECE301P	Syllabus version		1.0	

Course Objectives

1. To learn the fundamentals of Digital image processing in spatial and frequency domain.
2. To apply various filtering methods for image enhancement.
3. To understand the concepts of color image processing and different image compression techniques.
4. To apprehend various image segmentation algorithms and the concept of descriptors.

Course Outcomes

At the end of the course, Students will have the ability to,

1. Apply the key concepts of Digital image processing in spatial and frequency domain.
2. Compute the transform of an image by 2D-FFT, DCT, DWT and KL transform
3. Analyze the frequency domain enhancement techniques
4. Formulate the color models and to propose the desired color image processing
5. Investigate various standard image compression techniques and discriminate their effects in terms of data reduction
6. Summarize various image segmentation algorithms and to represent the same using boundary and region descriptors
7. Apply appropriate tool to implement various algorithms using the image processing concepts

Module:1	Image sampling and transformations	7 hours
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Introduction, Fundamental steps in DIP – Elements of visual perception -Image sensing and Acquisition – Image Sampling and Quantization – Imaging geometry, discrete image mathematical characterization- Basic relationship between pixels. Basic Gray level Transformations – Histogram Processing – Smoothing spatial filters- Sharpening spatial filters.

Module:2	Image Transforms	7 hours
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Two-dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT- Discrete cosine transform and KL transform-Discrete Short time Fourier Transform. Introduction to Multiresolution analysis - Discrete Wavelet Transform- the Haar wavelet family

Module:3	Image Enhancement in Frequency domain	6 hours
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Smoothing frequency domain filters- Sharpening frequency domain filters- Homomorphic filtering - Restoration filters: Bandpass – Band reject - Notch filter

Module:4	Color Image Processing	5 hours
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Color models: RGB- HSI- CMYK -Pseudo color image processing- Color transformations – Smoothening and Sharpening

Module:5	Image Compression	6 hours
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Overview of Image Compression Techniques- Entropy Encoding- Huffman – Arithmetic- LZW - JPEG and MPEG standards

Module:6	Image Segmentation	7 hours
Detection of discontinuities – Edge linking and boundary detection- Thresholding - Edge based segmentation - Region based segmentation- Matching- Morphological segmentation- Watershed algorithm		
Module:7	Representation and Description	5 hours
Boundary descriptors - Region descriptors - Texture descriptors - Use of Principal Components for Description.		
Module:8	Contemporary Issues	2 hours
Total Lecture hours:		45 hours
Text Book(s)		
1.	Rafael C.Gonzalez & Richard E.Woods, "Digital Image Processing", 2017, 4 th edition, Pearson Education, USA	
Reference Books		
1.	Anil K.Jain, "Fundamentals of Digital Image Processing", 2015, 1 st edition, Pearson India, India	
2.	Mark Nixon & Alberto Aguado, "Feature Extraction, and Image Processing", 2012, 3 rd edition, Elsevier's Science & Technology Publications, Woborn MA, Great Britain.	
3.	Scott E Umbaugh, "Digital Image Processing and Analysis: Human and Computer Vision Applications with CVIP tools", 2011, 2 nd edition, CRC press, Boca Raton, FL, USA.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Indicative Experiments		
1	(a) Perform point to point operation on the given image and compute the following and interpret changes in image i. Image Negative ii. Power law transformation iii. Log transformation (b) Perform contrast stretching for the given poor contrast image. (c) Perform histogram equalization for the given image and analyze the enhanced quality of the image.	3 hours
2	a) Read the input Image and perform Interpolation and Decimation. Show the effect of image shrinking and zooming. b) Read the input image and show the effect of gray level slicing for different levels. c) Perform Bitplane slicing for given image and comment on the number of visually significant bit planes in each image.	3 hours
3	Implement the following spatial domain filtering techniques for an image a) Low Pass Filtering b) High Pass Filtering c) Order Statistics (Median) Filtering	3 hours

4	Perform DFT for the given image and obtain its Fourier spectrum. Compute IDFT. Verify the symmetric property of DFT and compare the result with Discrete Cosine Transform (DCT).	3 hours
5	Removal of fine details in an image by frequency domain filtering and analysis of information loss.	3 hours
6	Perform image enhancement, feature extraction studies and compression using DCT.	3 hours
7	a) Perform image enhancement, feature extraction studies and compression using DWT. b) Perform DWT of an image, analyze and further reconstruct the image using IDWT	3 hours
8	Segment the region of interest from a given image using region-based segmentation and watershed algorithm.	3 hours
9	Identifying objects in an image based on their boundaries.	3 hours
10	To detect moving objects in given image frames using background subtraction algorithm.	3 hours
Total Laboratory Hours		30 hours
Mode of assessment: Continuous assessment and FAT		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE403E	Embedded Systems Design	3	0	2	4
Pre-requisite	BECE204L, BECE204P			Syllabus version	
				1.0	

Course Objectives

1. To acquaint students with definition, characteristics, challenges and design lifecycle of Embedded Systems by imparting the fundamental knowledge of I/O interfacing, serial communication protocols, wireless technologies, design using UML models
2. To familiarize the concepts and features of Real-time operating systems, task scheduling, and inter-task communication.
3. To impart various programming tools, modeling and simulation packages to program, design, simulate and build Embedded Systems

Course Outcomes

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

1. Design any application, based on the given specifications by keeping in mind different design metrics.
2. Apply the skills attained to differentiate Microprocessor/Microcontroller and interface various peripherals for a particular application.
3. Demonstrate proficiency in using device drivers, firmware and debugging tools.
4. Analyze the specific perspective of the embedded application using different modelling languages
5. Compare and contrast various wired and wireless protocols
6. Explore the concepts of RTOS and apply the knowledge for developing real-time systems

Module:1 Embedded System Product Development 4 hours

Characteristics of embedded systems, Classification of embedded systems, Embedded product development cycle, Embedded System Design Challenges, Performance and Benchmarking Tools.

Module:2 Embedded Hardware Design 5 hours

Processor classification - general purpose, customized, application specific processors, Microcontroller architectures (RISC, CISC), Embedded Memory, Strategic selection of processor and memory, Power Supply Design Considerations for Embedded Systems.

Module:3 Embedded Software Development Environment 6 hours

Cross assemblers/compilers, Linker, Runtime Library, Pre-processor Workflow, make files, Compiler Tool chains – gcc & ARM, Device Driver, Firmware, Middleware - Debugging tools: Emulators, Simulators, In-Circuit Debuggers, Logic Analyzer, Integrated Development Environment (IDE).

Module:4 Modeling Embedded Systems 6 hours

Control data flow graph, Finite state machine model, Petrinet Model, Unified model language

Module:5 Programming the Peripherals of Microcontrollers 6 hours

Programming GPIO pins, Timers / Counters, Watchdog Timer, PWM generation, ADC, DAC, LED, switches, keypad, LCD.

Module:6 Emerging Communication Protocols 8 hours

UART, SPI, I2C, NFC, CAN, Bluetooth, Zigbee, Wi-Fi				
Module:7	Embedded Real –Time Operating Systems	8 hours		
Introduction to basic concepts of RTOS- Task, process & threads, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Schedulability Analysis, Inter process Communication, Performance Metrics of RTOS				
Module:8	Contemporary Issues	2 hours		
		Total Lecture hours: 45 hours		
Text Book(s)				
1.	Raj Kamal, "Embedded systems Architecture, Programming and Design", 2017, Third Edition, McGraw Hill Education, India.			
Reference Books				
1.	Marilyn Wolf, "Computers as components: Principles of Embedded Computing System Design", 2017, Fourth Edition, Morgan Kaufmann publications (Elsevier), United States.			
2.	Jiacun Wang, "Real-Time Embedded Systems", 2017, First Edition, Wiley Publishers, United States.			
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test				
Indicative Experiments				
1.	Experiments based on interfacing I/O devices			
2.	Experiments based on monitoring and control using sensors and actuators			
3.	Experiments based on wired Communications Protocols (UART, SPI, I2C, CAN)			
4.	Experiments based wireless Communications Protocols (Wi-Fi, Bluetooth)			
5.	Experiments based on RTOS			
Total Laboratory Hours		30 hours		
Mode of assessment: Continuous assessment and FAT				
Recommended by Board of Studies	28-02-2023			
Approved by Academic Council	No. 69	Date 16-03-2023		

Course Code	Course Title	L	T	P	C			
BECE404L	Detection, Estimation and Modulation Theory	3	0	0	3			
Pre-requisite	BECE207L	Syllabus version						
		1.0						
Course Objectives								
<p>1. To familiarize the students a hypothesis testing for various signal detection models.</p> <p>2. To make them understand and apply Gaussian detection scheme.</p> <p>3. To make them proficient in scalar and vector parameter estimation.</p> <p>4. To let them develop an expertise in Kalman filter based estimation.</p>								
Course Outcomes								
<p>At the end of the course, students will be able to</p> <ol style="list-style-type: none"> Postulate the hypothesis testing. Apply Gaussian detection in suitable signal processing applications. Develop a scheme to estimate scalar and vector parameters using the classical scheme of parameter estimation. Estimate the parameters of importance through Gaussian estimation method. Design and implement the estimators for continuous time random processes. Apply Kalman filter based estimation in suitable signal processing applications. 								
Module:1	Classical Detection Theory	6 hours						
<p>Introduction - Simple Binary Hypothesis Tests - Decision Criteria - Performance: Receiver Operating Characteristic - M Hypotheses - Performance Bounds and Approximations - Monte Carlo Simulation - Importance Sampling -Simulation of PF - Simulation of PM - Independent Observations - Simulation of the ROC, Examples, Iterative Importance Sampling.</p>								
Module:2	Gaussian Detection	8 hours						
<p>Real and Circular Complex Gaussian Random Vectors - General Gaussian Detection - Equal Covariance Matrices - Independent Components with Equal and Unequal Variances - Eigen decomposition - Optimum Signal Design - Interference Matrix: Estimator – Subtractor - Low-Rank Models - Equal Mean Vectors - Diagonal Covariance Matrix on H0: Equal Variance – Independent and Identically Distributed Signal Components - Independent Signal Components: Unequal Variances - Correlated Signal Components - Low-Rank Signal Model - Symmetric Hypotheses - Uncorrelated Noise - Nondiagonal Covariance Matrix on H0, H1, Signal on Both Hypotheses, M Hypotheses</p>								
Module:3	Classical Parameter Estimation	6 hours						
<p>Introduction - Scalar Parameter Estimation - Random Parameters: Bayes Estimation - Nonrandom Parameter Estimation - Bayesian Bounds - Lower Bound on the MSE - Asymptotic Behavior - Exponential Family - Nonrandom Parameters - Random Parameters - Summary of Scalar Parameter Estimation</p>								
Module:4	Multiple Parameter Estimation	5 hours						
<p>Multiple Parameter Estimation - Estimation Procedures - Random Parameters - Nonrandom Parameters - Measures of Error- Nonrandom Parameters - Random Parameters - Bounds on Estimation Error - Nonrandom Parameters - Random Parameters - Hybrid Parameters - Hybrid Parameters - Joint ML and MAP Estimation</p>								
Module:5	Gaussian Estimation	7 hours						

Introduction - Nonrandom Parameters - General Gaussian Estimation Model - Maximum Likelihood Estimation - Crammer–Rao Bound - Fisher Linear Gaussian Model - White Noise - Low-Rank Interference - Separable Models for Mean Parameters - Covariance Matrix Parameters - White Noise - Colored Noise - Rank One Signal Matrix Plus White Noise - Rank One Signal Matrix Plus Colored Noise - Linear Gaussian Mean and Covariance Matrix Parameters - White Noise -		
Module:6	Estimation of Continuous-Time Random Processes	5 hours
Optimum Linear Processors - Realizable Linear Filters: Stationary Processes, Infinite Past: Wiener Filters - Solution of Wiener–Hopf Equation - Errors in Optimum Systems - Unrealizable Filters - Closed-Form Error Expressions		
Module:7	Kalman Filter Based Estimation	6 hours
Gaussian - Markov Processes: Kalman Filter - Differential Equation Representation of Linear Systems and Random Process Generation - Kalman Filter - Realizable Whitening Filter - Generalizations - Implementation Issues - Bayesian Estimation of Non-Gaussian Models - The Extended Kalman Filter - Linear AWGN Process and Observations - Linear AWGN Process, Nonlinear AWGN Observations		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1.	Harry L. Van Trees, "Detection Estimation and Modulation Theory", John Wiley, 2013.	
Reference Books		
1.	Bernard C. Levy, "Principles of Signal Detection and Parameter Estimation", Springer New York, NY, ISBN 978-0-387-76542-6, 2008	
2.	H. Vincent Poor, "An Introduction to Signal Detection and Estimation", Springer New York, NY, 1994	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C			
BECE405L	Cognitive Radio Networks	3	0	0	3			
Pre-requisite	BECE307L, BECE307P/ BECE317L, BECE317P	Syllabus version						
		1.0						
Course Objectives								
<ol style="list-style-type: none"> 1. To understand the principles and importance of cognitive radio in the context of next-generation networks 2. To analyze various spectrum sensing, access and management protocols 3. To introduce the challenges and opportunities associated with cognitive radio networks 								
Course Outcomes								
<p>At the end of the course, the student will have the ability to</p> <ol style="list-style-type: none"> 1. Solve the fundamental challenges associated with security, medium access control and network layers. 2. Analyze the performance of various spectrum access, sensing and management schemes. 3. Create the network layer suitable for CRNs. 4. Use modern tools for the implementation of spectrum access, sensing and management protocols. 5. Make a presentation on assigned topic related to this course. 								
Module:1	Introduction to Cognitive Radio	6 hours						
Evolution of Cognitive Radio, Cognitive Radio in 4G/5G Wireless Communications, Key Applications-Interoperability, Dynamic Spectrum Access, Regulatory Issues of Cognitive Access, Cognitive radio architecture, Introduction to software defined radio (SDR)-architecture and design principles, Reconfigurable wireless communication systems								
Module:2	Spectrum Access and Sharing	6 hours						
Unlicensed Spectrum Sharing, Licensed Spectrum Sharing, Secondary Spectrum Access, Non-Real-Time Spectrum Access and Sharing, Real-Time Spectrum Access and Sharing- Negotiated Access, Opportunistic Access, Overlay Approach, Underlay Approach								
Module:3	Spectrum Sensing and Management	8 hours						
Spectrum Sensing to Detect Specific Primary System-Conventional spectrum sensing, power control, Power-scaling power control, Cooperative spectrum sensing, Spectrum sensing procedure. Spectrum Sensing for Cognitive Multi-Radio Networks-Multiple system sensing, Radio resource sensing								
Module:4	Medium Access Control	7 hours						
MAC for cognitive radios, Multi-channel MAC-Collision avoidance/resolution, Access negotiation, Slotted-ALOHA with Rate-Distance Adaptability, CSMA with AMC-CSMA with spatial reuse transmissions, Cross layer power-rate control scheme								
Module:5	Network Layer Design	6 hours						
Routing in Mobile Ad Hoc Networks-Features of routing in cognitive radio networks (CRN), Dynamic source routing in MANET, Ad-hoc on-demand distance vector (AODV), Routing in CRN-Routing of dynamic and unidirectional cognitive radio links								

in CRN, Control of CRN-Flow control and end-to-end error control, Network tomography, Self-Organized CRNs.		
Module:6 Trusted Cognitive Radio Networks	6 hours	
Framework of Trust in CRN, Trusted Association and Routing, Trust with Learning-Modified Bayesian learning, Learning experiments for CRN, Security in CRN-Dilemma of CRN security, Requirements and challenges for preserving user privacy in CRNs, Implementation of CRN security.		
Module:7 Spectrum Management	4 hours	
Spectrum Sharing, Spectrum Pricing, Mobility Management of Heterogeneous Wireless Networks, Regulatory Issues and International Standards		
Module:8 Contemporary Issues	2 hours	
		Total Lecture hours 45 hours
Text Book(s)		
1.	Ahmed Khattab, Dmitri Perkins, Magdy Bayoumi, Cognitive Radio Networks, Springer New York, NY, 2013.	
Reference Books		
1.	Setoodeh, P., & Haykin, S. (2017). Fundamentals of cognitive radio. John Wiley & Sons.	
2.	Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, Cognitive Radio Communications and Networks, Academic Press, Elsevier, 2010.	
3.	Xiao, Y., & Hu, F. (Eds.). (2019). Cognitive radio networks. CRC press.	
4.	Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, "Principles of Cognitive Radio", Cambridge, 2012	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE406E	FPGA Based System Design	2	0	2	3
Pre-requisite	BECE102L, BECE102P			Syllabus version	
				1.0	

Course Objectives

1. Understand FPGA Architecture and technologies
2. Modeling of complex digital sub-systems
3. Implementation of complex FPGA applications in real world scenario

Course Outcomes

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

1. Understand architectures of programmable logic devices
2. Understand various abstraction level in Verilog HDL
3. Construct high speed arithmetic and memory circuits
4. Analyze the synthesis and timing constraints/reports
5. Design the system using soft core processors
6. Develop the FPGA based system for various applications in signal processing
7. Develop and prototype digital systems using FPGA

Module:1 Programmable Logic Devices	4 hours
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Types of Programmable Logic Devices: PLA, PAL, CPLD - FPGA Architecture – Programming Technologies-Chip I/O- Programmable Logic Blocks- Fabric and Architecture of FPGA.

Module:2 HDL Fundamentals	3 hours
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Verilog Behavioral, Data Flow and Structural Modeling, Useful Modeling Techniques.

Module:3 Implementation of Arithmetic system	5 hours
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Arithmetic Circuits: High Speed Adders, Carry look-ahead adder, Carry save adders, Conditional Sum adders, Sequential and Parallel Multipliers

Module:4 FSM and memory modelling	5 hours
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Synchronous and Asynchronous FIFO – Single port and Dual port ROM and RAM - FSM Verilog modeling of Sequence detector - Serial adder - Vending machine.

Module:5 Synthesis and Timing Analysis	3 hours
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Synthesis, Optimization of Speed: Introduction, Strategies for Timing Improvement; Optimization of Area, Optimization of power

Module:6 SoC Design	4 hours
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Introduction to hardware – software codesign, Introduction to Qsys and Intel Quartus prime tool, Nios II Software Build Tools for Eclipse, Incorporate custom peripherals & instructions into an embedded system.

Module:7 FPGA Applications	4 hours
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Embedded system design using FPGAs, DSP using FPGAs, Dynamic architecture using FPGAs, reconfigurable systems, application case studies. Simulation / implementation exercises of combinational, sequential and DSP kernels on Xilinx / Altera boards.

Module:8 Contemporary Issues	2 hours
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Total Lecture hours: **30 hours**

Text Book(s)

1.	Michael D Ciletti, Advanced Digital Design with the Verilog HDL, Prentice Hall, Second Edition, 2017.	
Reference Books		
1.	Charles H Roth Jr, Lizy Kurian John and ByeongKil Lee Digital Systems Design using Verilog, Cengage Learning, First Edition, 2016.	
2.	Wayne Wolf, FPGA Based System Design, Prentices Hall Modern Semiconductor Design Series, 2011.	
3.	Ming-Bo Lin, Digital Systems Design and Practice: Using Verilog HDL and FPGAs, Create Space Independent Publishing Platform, Second Edition, 2015.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Indicative Experiments		
1.	Design of adders and Multipliers	6 hours
2.	Design of FSM	6 hours
3.	Design of Memory circuits	6 hours
4.	Synthesis and Timing Analysis	6 hours
5.	System design using Qsys	6 hours
Total Laboratory Hours		30 hours
Mode of assessment: Continuous assessment and FAT		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE407E	ASIC Design	2	0	2	3
Pre-requisite	BECE303L, BECE303P		Syllabus version		
			1.0		

Course Objectives

1. Explain the HDL coding guidelines, synthesizable HDL constructs and RTL synthesis Flow with respect to different cost functions.
2. Teach how to perform Static Timing Analysis for ASIC design.
3. Discuss the guidelines at each abstraction level in physical design
4. Provide detailed insight on importance of physical design verification

Course Outcomes

At the end of the course the student will be able to

1. Design a digital system by adhering to synthesizable HDL constructs.
2. Synthesize the given design by considering various constraints and to optimize the same.
3. Understand various timing parameters and perform Static Timing Analysis for ASIC design
4. Perform physical design by adhering to guidelines.
5. Apprehend the importance of physical design verification.
6. Design ASIC based systems using industry standard tools.

Module:1 ASIC Design Methodology & Design Flow **3 hours**

Implementation Strategies for Digital ICs: Custom IC Design- Cell-based Design Methodology - Array based implementation approaches - Traditional and Physical Compiler based ASIC Flow.

Module:2 Verilog HDL Coding Style for Synthesis **6 hours**

HDL Coding style – Guidelines and Recommendation - FSM Coding Guideline and Coding Style for Synthesis. Datapath and Control Logic Design.

Module:3 RTL Synthesis **3 hours**

RTL synthesis Flow – Synthesis Design Environment & Constraints – Architecture of Logic Synthesizer - Technology Library Basics– Components of Technology Library –Synthesis Optimization- Technology independent and Technology dependent synthesis- Data path Synthesis – Low Power Synthesis - Formal Verification.

Module:4 Basic Timing Analysis **4 hours**

Timing Parameter Definition – Setup Timing Check- Hold Timing Check- Multicycle Paths- Half-Cycle Paths- False Paths

Module:5 Advanced Timing Analysis **5 hours**

Clock skew optimization – On-Chip Variations- AOCV-Time Borrowing- Setup and Hold Violation Fixing.

Module:6 Physical Design **5 hours**

Detailed steps in Physical Design Flow- Guidelines for Floor plan, Placement, CTS and routing- ECO flow – Signal Integrity Issues.

Module:7 Physical Design Verification **3 hours**

Timing Sign-off, Physical Verification – Signoff DRC and LVS, ERC, IR Drop Analysis, Electro-Migration Analysis and ESD Analysis.

Module:8 Contemporary Issues **1 hours**

	Total Lecture hours:	30 hours
Text Book(s)		
1. Vaibbhav Taraate, ASIC Design and Synthesis RTL Design Using Verilog, Springer, First Edition, 2021, Singapore.		
Reference Books		
1. Khosrow Golshan, PHYSICAL DESIGN ESSENTIALS An ASIC Design Implementation Perspective, First Edition, 2010.		
2. Michael John Sebastian Smith, Application-Specific Integrated Circuits, First Edition, 2002.		
3. J. Bhasker and Rakesh Chadha, Static Timing Analysis for Nanometer Designs, Springer, First Edition, 2010, USA.		
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Indicative Experiments		
1. Design of Digital Architecture for given specification		6 hours
2. Logical Synthesis of Digital Architecture		6 hours
3. Netlist Optimization and Formal Verification		6 hours
4. Physical Synthesis of Digital Architecture		6 hours
5. Physical Verification of digital architecture		6 hours
Total Laboratory Hours		30 hours
Mode of assessment: Continuous assessment and FAT		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE408L	Microwave Integrated Circuits	3	0	0	3
Pre-requisite	BECE305L, BECE305P		Syllabus version		
			1.0		

Course Objectives

1. To have the essential knowledge of various planar microstrip circuits
2. To design and analyse various types of microwave planar circuits
3. To acquaint the fabrication techniques and tolerances for MIC circuits

Course Outcomes

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

1. Comprehend the importance of various microstrip lines and the losses due to various microstrip discontinuities
2. Design the lumped elements for microwave circuits
3. Analyze various microstrip resonators
4. Design and analyze band pass filters
5. Design the various microwave amplifiers, oscillators and mixers
6. Evaluate the performance of various fabrication techniques for planar circuits

Module:1 Planar transmission lines **6 hours**

Introduction, types of MICs and their technology; Microstrip lines, strip lines, slotted lines, co-planar waveguides, coupled lines and SIW. Losses in microstrip transmission lines.

Module:2 Passive elements for MICs and discontinuities **8 hours**

Lumped microstrip components: Design of microstrip and chip inductors, capacitors, resistors, Quasi lumped microstrip elements: Open and short circuited stubs (quarter wavelength, half wavelength). Interdigital capacitors, Approximate analysis. Discontinuities: Corners, symmetrical step, T-junction and series gaps

Module:3 Microstrip Resonators **6 hours**

Analysis and Design of Quarter & Half wave length resonators, Ring resonators, Patch resonators and Slot resonators.

Module:4 Microwave Filter Design **7 hours**

Introduction, Band pass filter: Insertion loss method, Conversion from low pass to band pass, Design of band pass filter using lumped elements, distributed elements, impedance inverters and coupled line filters.

Module:5 Microwave Amplifiers **6 hours**

Single stage amplifier design for maximum and specific gain, Noise figure, Design of low noise amplifiers, Gain compression, Intermodulation distortion, third order intercept point, dynamic range.

Module:6 Microwave Oscillators and Mixers **5 hours**

Conditions for oscillations, one port oscillator, two port oscillator (Transistor oscillators), Characteristics of mixer, Single ended diode mixer, Single ended FET mixer and Image reject mixer.

Module:7 MIC and MMIC Fabrication Technologies **5 hours**

Hybrid MICs, Configuration, Dielectric substances, thick and thin film technology, LTCC, HTCC, Printed Circuit Board (PCB) Technology, Fabrication process of MMIC

Module:8 Contemporary Issues **2 hours**

	Total Lecture hours:	45 hours
Text Book(s)		
1.	TC Edwards, MB Steer , Foundations for Microstrip circuit design, 4e, 2016, John Wiley, UK	
Reference Books		
1.	Ali A Behagi, RF and Microwave Circuit Design: A Design Approach using ADS, 2017, 1e, Techno Search, India.	
2.	D. M. Pozar, Microwave engineering, 2020, 4e, John Wiley, India.	
3.	G Gonzalez, Microwave transistor amplifiers, 1997, 2e, PHI Inc., NJ	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BECE409E	Sensors Technology	2	0	2	3
Pre-requisite	NIL			Syllabus version	
				1.0	

Course Objectives

1. To attain a broad familiarity with the principle of sensing and different sensors for real world applications
2. Study the various sensor technologies for the measurement of physical quantities and develop suitable signal conditioning circuits.
3. Identify most suitable sensors for each measurement application and get acquainted with fabrication and interfacing process

Course Outcomes

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

1. Understand the sensors, sensor materials and sensor technologies.
2. Utilize various RLC and self-generating sensors for measuring physical quantities
3. Design appropriate signal conditioning and compensating circuits for RLC sensors
4. Fabricate various sensors using different fabrication techniques
5. Explore advanced sensing mechanisms.
6. Explore smart sensors and IOT for various sensor applications
7. Integrate the various sensors, work with them and interpret the data obtained from various applications.

Module:1 Sensing Mechanism	4 hours
Principles of Sensing: Resistive, Capacitive, Magnetic, Inductive, Piezoelectric, Piezo-resistance, Pyro-electric, Hall effect, RF sensing. Sensor materials and material properties. Sensor Technologies: Micro Technology, Micro-Electro-Mechanical Systems Technology, Nanotechnology. Example of Smart Sensors in Nature (Vision, Hearing, Touch, and Smell).	

Module:2 RLC and Self Generating Sensors	4 hours
Resistive Sensors – Strain Gauges, Resistance Temperature Detectors, Thermistors, Light dependent resistors, Self and Mutual Inductive Transducers, LVDT, Capacitive Transducers, Variable Distance, Variable Area, Variable Dielectric Type Capacitive Sensors. Self-Generating Sensors – Thermoelectric Sensors, Piezoelectric Sensors, Pyroelectric sensors, Photovoltaic sensors, Electrochemical Sensors.	

Module:3 Sensor Signal Conditioning	4 hours
DC Bridges for Resistance Measurements-Wheatstone Bridge, Kelvin Bridge. AC Bridges for Capacitance and Inductance Measurements-AC Bridge, Schering Bridge. Sensor Compensation Circuits-Temperature, Non-linearity and Offset Compensation.	

Module:4 Sensor Fabrication	4 hours
Thick and Thin Film Sensor Fabrication – Screen Printing Technology, PVD, CVD, Fabrication of MEMS and NEMS Sensors – Lithography, Micromachining Techniques	

Module:5 Advanced Sensors	4 hours
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Position Encoders, Resonant Sensors, Sensors Based on Semiconductor Junctions, Fiber-Optic Sensors, Ultrasonic-Based Sensors, Biosensors, Superconducting Quantum Interference Devices (SQUIDs).		
Module:6	Smart Sensors	4 hours
Smart Transducers: Smart Sensors, Components of Smart Sensors, General Architecture of Smart Sensors, Evolution of Smart Sensors, Advantages, Application area of Smart Sensors.		
Module:7	Sensors for IoT	4 hours
Sensor-Cloud; Fog Computing, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring		
Module:8	Contemporary Issues	2 hours
		Total Lecture hours: 30 hours
Text Book(s)		
1.	Winncy Y. Du, "Resistive, Capacitive, Inductive, and Magnetic Sensor Technologies", 2019, 1 st Edition, CRC press, London.	
2.	B. C. Nakra and K. K. Chaudhary, "Instrumentation, Measurement and Analysis", 2016, 4 th Edition, McGraw Hill Education India Private Limited.	
Reference Books		
1.	A.K. Sawhney, "A Course in Electronic Measurements and Instrumentation", 2015, Dhanpat Rai & Co. (P) Limited.	
2.	Ramón Pallás-Areny and John G. Webster, "Sensors and Signal Conditioning" 2012, 2 nd Edition, John Wiley and Sons, Inc.	
3.	Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.	
4.	Nihtianov, Stoyan, and Antonio Luque, eds. Smart sensors and MEMS: Intelligent sensing devices and microsystems for industrial applications. Woodhead Publishing, 2018.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
List of Experiments		
1	Characteristics of Thermistor	2 hours
2	Characteristics of Strain Gauge	2 hours
3	Characteristics of Light Dependent Resistor	2 hours
4	Characteristics of Resistance Temperature Detector	2 hours
5	Characteristics of Angular potentiometer transducer model.	2 hours
6	Characteristics of LVDT	2 hours
7	Characteristics of Capacitive Level Sensor	2 hours
8	Characteristics of Thermocouples	2 hours
9	Characteristics of Photoelectric Tachometer	2 hours
10	Calibration of RTD and signal conditioning of RTD	2 hours
11	Calibration of Thermistor and signal conditioning of thermistor	2 hours
12	Characteristics of piezoelectric and Hall effect sensors	2 hours

13	Simulation of Biosensors/Chemical Sensors	2 hours
14	Simulation and design of sensors using MATLAB/LABVIEW/ COMSOL	2 hours
15	PC based Data acquisition system.	2 hours
Total Laboratory Hours		30 hours
Mode of assessment: Continuous assessment &Final Assessment Test (FAT)		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C				
BECE410L	Micro-Electromechanical Systems	3	0	0	3				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
<p>The course is aimed to</p> <ol style="list-style-type: none"> 1. Introduce MEMS technology and their application as Sensors and actuators. 2. Comprehending various materials used in MEMS devices and also Micro-Nano fabrication techniques involved. 									
Course Outcomes									
<p>Students will be able to</p> <ol style="list-style-type: none"> 1. Analyze the evolution of MEMS in various applications along with the scaling effects. 2. Understand the rudiments of materials like silicon, polymers, and metals used for realizing MEMS sensors. 3. Explore various fabrication techniques for MEMS devices 4. Analyze various sensing mechanisms and applications based on the same 5. Analyze various actuating mechanisms and applications based on the same 6. Acquaint the basics of Bio-MEMS and simple application models of BioMEMS 7. Understand flexible, printable types of devices and their applications 									
Module: 1	Micro-electro Mechanical Systems (MEMS)	5 hours							
<p>Historical background and evolution of Micro Electro Mechanical Systems (MEMS); Market for MEMS sensors -Real-world sensor/actuator examples; MEMS sensors in automobiles, smartphones, and Bio-medical applications.</p> <p>Scaling in MEMS - Scaling of length, surface area, and volume — Scaling and surface tension -Scaling in optics - Scaling in the electrostatic and electromagnetic domain, Thermal domain - Scaling in microfluidics.</p>									
Module: 2	MEMS Materials and Properties	6 hours							
<p>Crystal, Substrates and wafers, Silicon and Silicon compounds - Silicon oxide and nitride; Single Crystal Silicon growth (CZ and FZ methods); Thin metal films (Cr, Au, Ti, Pt) — Polymers (SU8, PMMA, PDMS); Glass and Quartz; Paper; Nanoparticles – CNTs – Graphene - MoS₂; Choice and role of these substrates and materials in realizing miniature sensors.</p> <p>Important material properties-Young modulus - Poisson's ratio - Density - Piezoresistive coefficients - Piezoelectric coefficients- TCR - Thermal conductivity - Material structure.</p>									
Module: 3	MEMS Fabrication Technology	7 hours							
<p>Silicon Wafer Cleaning - Oxidation - PVD (Thermal and E-beam evaporation, sputtering) - CVD - Lithography - Bulk- and surface-micromachining - LIGA - Bonding, and Packaging.</p> <p>Surface Modification Techniques for Polymers, Soft-Lithography; Micro molding; Replica molding, and Micro contact printing.</p> <p>Patterning Processes for flexible sensors - Printing technology, Non-Contact Type-Jet printing, Contact type - Screen printing, Gravure printing.</p>									
Module:4	Sensing Mechanisms and MEMS Sensors	7 hours							
<p>Sensing mechanisms – Capacitive, Piezoelectric, Piezoresistive, Electromagnetic, Optical, and Resonant sensing principles</p>									

MEMS Sensors: Pressure sensors, Accelerometers, Gas sensors, Flow sensors, Gyroscopes, Microcantilevers as sensors, Imaging and displays, and Fiber-optic communication devices.		
Module:5	Actuation Mechanisms and MEMS Actuators	7 hours
	Actuation Mechanisms: Electrostatic, Piezoelectric, Electrothermal, Shape memory alloy (SMA)	
	MEMS actuators: Microcantilever as actuators, Micro resonator, Microgripper, Micromirror, Micro motor, RF MEMS switch, Phase shifter, Varactor, and Micro heater.	
Module:6	BioMEMS	6 hours
	Glucose sensors, In Vitro and In Vivo diagnostics, μ -TAS - Micromixer, Micro Valve, Micro Pump, Drug delivery systems, and MEMS. Application models – Implantable Biochips – Micro needles – Microelectrodes - Neural prosthesis and catheter end sensors, Paper-based microfluidic devices as biosensors.	
Module:7	Flexible and Wearable Sensors	5 hours
	Textiles and polymers-based flexible sensors and applications – ECG, Blood Pressure, Epidermal Sensors, Tattoo based sensors, haptic gloves, strain sensors, pH sensors, and physiological sensors.	
Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1.	Tai-Ran Hsu, MEMS and Microsystems Design and Manufacture, 2017, 1st edition, Tata McGraw-Hill Publishing Company Ltd., India.	
Reference Books		
1.	Run-Wei Li, Gang Liu , Flexible and Stretchable Electronics Materials, Designs, and Devices – 2019, Taylor and Francis, Singapore	
2.	Marc J. Madou, Fundamentals of Microfabrication and Nanotechnology, 2018, CRC Press	
3	Chang Liu , Foundations of MEMS, 2016, Pearson India	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz, and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C					
BECE411L	Cryptography and Network Security	3	0	0	3					
Pre-requisite	BECE401L, BECE401P/ BCSE308L, BCSE308P			Syllabus Version						
				1.0						
Course Objectives										
<ol style="list-style-type: none"> 1. To acquaint students with the basic concepts in need for security mechanism, classical and traditional Encryption techniques. 2. To impart knowledge to students regarding the significance of message confidentiality, Integrity and availability using Cryptography. 3. To acquaint the students to the different types of network & internet security and its significance. 										
Course Outcomes										
At the end of the course, students will be able to										
<ol style="list-style-type: none"> 1. Analyze OSI Security Architecture and Classical Encryptions. 2. Realize the various mathematical techniques in cryptography, including number theory, Finite Field, modulo operator, Elliptic Curve Arithmetic and Discrete Logarithm. 3. Analyze Modern block and stream ciphers, Data Encryption Standard (DES), Advanced Encryption Standard (AES), IDEA and Key Exchange Algorithms. 4. Analyze Asymmetric ciphers: RSA, ElGamal, RABIN Cryptosystem. 5. Comprehend the various types of data integrity and authentication schemes. 6. Infer the various network and Internet security mechanisms. 										
Module:1 Cryptography: Overview	4 hours									
Introduction, OSI Security Architecture, Security Attacks, Security Services and Mechanisms, Classical Encryption Techniques.										
Module:2 Mathematical Foundations	6 hours									
Number Theory and Finite Fields (Group, Ring and Fields), Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Fast Exponentiation, Discrete Logarithms, Elliptic Curve Arithmetic, and Principles of Pseudorandom Number Generation.										
Module:3 Symmetric Ciphers	8 hours									
Modern Block Ciphers and Modern Stream Ciphers- DES, IDEA, AES, Pseudorandom Number Generation based on symmetric cipher, Key Exchange Algorithm: Diffie-Hellman Key Exchange.										
Module:4 Asymmetric Ciphers	7 hours									
RSA cryptosystem, ElGamal Cryptosystem, RABIN Cryptosystem, Elliptic Curve Cryptography simulating Elgamal, Pseudorandom Number Generation based on an asymmetric Cipher.										
Module:5 Data Integrity Algorithms	7 hours									
Cryptographic Hash Functions: MD4, SHA-512, Whirlpool, Message Authentication Codes, Digital Signatures: RSA, Elgamal, Schnorr, DSS.										
Module:6 Mutual Trust	5 hours									
Key Management and Distribution, X.509, User Authentication Protocols, Kerberos.										
Module:7 Network and Internet Security	6 hours									
Transport Layer Security, Wireless LAN Security, Electronic mail Security, Firewalls, IoT Threats.										

Module:8	Contemporary Issues	2 hours
	Total Lecture hours:	45 hours
Text Book(s)		
1. William Stallings, "Cryptography and Network security: Principles and Practice", 8th Edition, 2020, Pearson Education, India.		
Reference Books		
1.	Atul Kahate, "Cryptography And Network Security", 4th Edition, 2019, The McGraw Hill Company.	
2	Behrouz A.Forouzan, Debdeep Mukhopadhyay "Cryptography & Network Security", 3 rd edition, 2015, The McGraw Hill Company.	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	28-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C									
BECE391J	Technical Answers to Real Problems Project	0	0	0	3									
Pre-requisite	NIL	Syllabus version												
		1.0												
Course Objectives														
<ol style="list-style-type: none"> 1. To gain an understanding of real-life issues faced by society. 2. To study appropriate technologies in order to find a solution to real life issues. 3. Students will design system components intended to solve a real-life issue. 														
Course Outcomes														
<ol style="list-style-type: none"> 1. Identify real life issue(s) faced by society. 2. Apply appropriate technologies to suggest a solution to the identified issue(s). 3. Design the related system components/processes intended to provide a solution to the identified issue(s). 														
Module Content	(Project Duration: Two Semesters)													
<ol style="list-style-type: none"> 1. Students are expected to perform a survey and interact with society to find out the real life issues. 2. Logical steps with the application of appropriate technologies should be suggested to solve the identified issues. 3. Subsequently the student should design the related system components or processes which is intended to provide the solution to the identified real-life issues. 														
General Guidelines:														
<ol style="list-style-type: none"> 1. Identification of real-life problems 2. Field visits can be arranged by the faculty concerned 3. Maximum of 3 students can form a team (within the same/different discipline) 4. Minimum of eight hours on self-managed team activity 5. Appropriate scientific methodologies to be utilized to solve the identified issue 6. Solution should be in the form of fabrication/coding/modelling/product design/process design/relevant scientific methodology(ies) 7. Consolidated report to be submitted for assessment 8. Participation, involvement and contribution in group discussions during the contact hours will be used as the modalities for the continuous assessment of the theory component 9. Project outcome to be evaluated in terms of technical, economical, social, environmental, political and demographic feasibility 10. Contribution of each group member to be assessed 														
Mode of Evaluation: Evaluation involves periodic reviews by the faculty with whom the student has registered. Assessment on the project – Mark weightage of 20:30:50 – Report to be submitted, presentation and project reviews														
Recommended by Board of Studies	12-10-2022													
Approved by Academic Council	No. 68	Date	19-12-2022											

Course Code	Course Title			L	T	P	C											
BECE392J	Design Project			0	0	0	3											
Pre-requisite	NIL			Syllabus version														
Course Objectives																		
<ol style="list-style-type: none"> 1. Students will be able to upgrade a prototype to a design prototype. 2. Describe and demonstrate the techniques and skills necessary for the project. 3. Acquire knowledge and better understanding of design systems. 																		
Course Outcomes																		
<ol style="list-style-type: none"> 1. Develop new skills and demonstrate the ability to upgrade a prototype to a design prototype or working model. 2. Utilize the techniques, skills, and modern tools necessary for the project. 3. Synthesize knowledge and use insight and creativity to better understand and improve design systems. 																		
Module Content	(Project Duration: One Semester)																	
Students are expected to develop new skills and demonstrate the ability to develop prototypes to design prototype or working models related to an engineering product or a process.																		
Mode of Evaluation: Evaluation involves periodic reviews by the faculty with whom the student has registered. Assessment on the project – Mark weightage of 20:30:50 – Report to be submitted, presentation and project reviews.																		
Recommended by Board of Studies	12-10-2022																	
Approved by Academic Council	No. 68	Date	19-12-2022															

Course Code	Course Title			L	T	P	C											
BECE393J	Laboratory Project			0	0	0	3											
Pre-requisite	NIL			Syllabus version														
1.0																		
Course Objectives																		
<ol style="list-style-type: none"> 1. The student will be able to conduct experiments on the concepts already learnt. 2. Analyse experimental data. 3. Present the results with appropriate interpretation. 																		
Course Outcomes																		
<ol style="list-style-type: none"> 1. Design and conduct experiments in order to gain hands-on experience on the concepts already studied. 2. Analyse and interpret experimental data. 3. Write clear and concise technical reports and research articles 																		
Module Content	(Project Duration: One Semester)																	
<p>Students are expected to perform experiments and gain hands-on experience on the theory courses they have already studied or registered in the ongoing semester. The theory course registered is not expected to have laboratory component and the student is expected to register with the same faculty who handled the theory course. This is mostly applicable to the elective courses. The nature of the laboratory experiments is depended on the course.</p>																		
Mode of Evaluation: Evaluation involves periodic reviews by the faculty with whom the student has registered. Assessment on the project – Mark weightage of 20:30:50 – Report to be submitted, presentation and project reviews.																		
Recommended by Board of Studies	12-10-2022																	
Approved by Academic Council	No. 68	Date	19-12-2022															

Course Code	Course Title			L	T	P	C											
BECE394J	Product Development Project			0	0	0	3											
Pre-requisite	NIL			Syllabus version														
Course Objectives																		
<ol style="list-style-type: none"> 1. Students will be able to translate a prototype to a useful product. 2. Apply relevant codes and standards during product development. 3. The student will be able to present his results by means of clear technical reports. 																		
Course Outcomes																		
<ol style="list-style-type: none"> 1. Demonstrate the ability to translate the developed prototype/working model to a viable product useful to society/industry. 2. Apply the appropriate codes/regulations/standards during product development. 3. Write clear and concise technical reports and research articles 																		
Module Content	(Project Duration: Two Semesters)																	
Students are expected to translate the developed prototypes / working models into a product which has application to society or industry.																		
Mode of Evaluation: Evaluation involves periodic reviews by the faculty with whom the student has registered. Assessment on the project – Mark weightage of 20:30:50 – Report to be submitted, presentation and project reviews																		
Recommended by Board of Studies	12-10-2022																	
Approved by Academic Council	No. 68	Date	19-12-2022															

Course Code	Course Title			L	T	P	C											
BECE395J	Computer Project			0	0	0	3											
Pre-requisite	NIL			Syllabus version														
Course Objectives																		
<ol style="list-style-type: none"> 1. Students will be able to analyse complex engineering processes. 2. Describe the applications and limitations of a given engineering process. 3. Present the results in written reports and oral presentations. 																		
Course Outcomes																		
<ol style="list-style-type: none"> 1. Utilize programming skills/modelling to analyse complex engineering processes/problems. 2. Demonstrate the ability to evaluate the applicability and limitations of the given engineering process. 3. Communicate effectively through written reports, oral presentations, and discussion. 																		
Module Content	(Project Duration: One Semester)																	
Students are expected to use programming skills or modelling to analyse complex engineering processes. The student should be able to evaluate the application and limitations of the said engineering processes.																		
Mode of Evaluation: Evaluation involves periodic reviews by the faculty with whom the student has registered. Assessment on the project – Mark weightage of 20:30:50 – Report to be submitted, presentation and project reviews.																		
Recommended by Board of Studies	12-10-2022																	
Approved by Academic Council	No. 68	Date	19-12-2022															

Course Code	Course Title	L	T	P	C
BECE396J	Reading Course	0	0	0	3
Pre-requisite	NIL	Syllabus version		1.0	
Course Objectives					

1. The student will be able to analyse and interpret published literature for information pertaining to niche areas.
2. Scrutinize technical literature and arrive at conclusions.
3. Use insight and creativity for a better understanding of the domain of interest.

Course Outcomes

1. Retrieve, analyse, and interpret published literature/books providing information related to niche areas/focused domains.
2. Examine technical literature, resolve ambiguity, and develop conclusions.
3. Synthesize knowledge and use insight and creativity to better understand the domain of interest.

Module Content	(Project Duration: One Semester)
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This is oriented towards reading published literature or books related to niche areas or focussed domains under the guidance of a faculty.

Mode of Evaluation: Evaluation involves periodic reviews by the faculty with whom the student has registered. Assessment on the project – Mark weightage of 20:30:50 – Report to be submitted, presentation and project reviews.

Recommended by Board of Studies	12-10-2022
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Approved by Academic Council	No. 68	Date	19-12-2022
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Course Code	Course Title			L	T	P	C										
BECE397J	Special Project			0	0	0	3										
Pre-requisite	NIL			Syllabus version			1.0										
Course Objectives																	
<ol style="list-style-type: none"> 1. Students will be able to identify and solve problems in a time-bound manner. 2. Describe major approaches and findings in the area of interest. 3. Present the results in a clear and concise manner. 																	
Course Outcomes																	
<ol style="list-style-type: none"> 1. To identify, formulate, and solve problems using appropriate information and approaches in a time-bound manner. 2. To demonstrate an understanding of major approaches, concepts, and current research findings in the area of interest. 3. Write clear and concise research articles for publication in conference proceedings/peer-reviewed journals. 																	
Module Content	(Project Duration: Three Semesters)																
This is an open-ended course in which the student is expected to work on a time bound research project under the supervision of a faculty. The result may be a tangible output in terms of publication of research articles in a conference proceeding or in a peer-reviewed Scopus indexed journal.																	
Mode of Evaluation: Evaluation involves periodic reviews by the faculty with whom the student has registered. Assessment on the project – Mark weightage of 20:30:50 – project report to be submitted, presentation and project reviews.																	
Recommended by Board of Studies	12-10-2022																
Approved by Academic Council	No. 68	Date	19-12-2022														

Course Code	Course Title			L	T	P	C											
BECE398J	Simulation Project			0	0	0	3											
Pre-requisite	NIL			Syllabus version														
				1.0														
Course Objectives																		
<ol style="list-style-type: none"> 1. Students will be able to simulate a real system. 2. Identify the variables which affect the system. 3. Describe the performance of a real system. 																		
Course Outcomes																		
<ol style="list-style-type: none"> 1. Demonstrate the ability to simulate and critically analyse the working of a real system. 2. Identify and study the different variables which affect the system elaborately. 3. Evaluate the impact and performance of the real system. 																		
Module Content	(Project Duration: One Semester)																	
<p>The student is expected to simulate and critically analyse the working of a real system. Role of different variables which affect the system has to be studied extensively such that the impact of each step in the process is understood, thereby the performance of each step of the engineering process is evaluated.</p>																		
Mode of Evaluation: Evaluation involves periodic reviews by the faculty with whom the student has registered. Assessment on the project – Mark weightage of 20:30:50 – project report to be submitted, presentation and project reviews.																		
Recommended by Board of Studies	12-10-2022																	
Approved by Academic Council	No. 68	Date	19-12-2022															

Course Code	Course Title	L	T	P	C
BHUM201L	Mass Communication	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To understand the basics of mass communication theories and models
2. To analyze the role of different medium of mass communication
3. To develop perspectives on positive and negative aspects of mass communication on society

Course Outcomes

Upon successful completion of the course students will be able to

1. Explore the basic conceptual knowledge of mass communication.
2. Familiarise the communication models and theories associated with it.
3. Assess the tools of mass communication used for effective communication.
4. Evaluate the impact of mass communication on social institutions.
5. Explain the role of contemporary media towards society.
6. Analyse the impact of mass communication on social problems.

Module:1	Mass Communication	6 hours
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Mass Communication: Meaning & definitions, Characteristics, Functions of Mass Communication, Importance, patterns, Techniques of Communication, Formal/informal, verbal / written, downward & upward. Forms of Communication, Barriers of Communication, Communication Process. 7 C's of communication, Factors affecting process of communication.

Module:2	Communication Models	6 hours
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Linear communication model. Aristotle's communication model. Laswell's communication model. The Shannon-Weaver communication model. Berlo's S-M-C-R communication model. Interactive communication model. The Osgood-Schramm communication model. The Westleyand Maclean communication model.

Module:3	Communication Theories	7 hours
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Theories of Mass Communication: Cognitive Theory, Dissonance Theory, Agenda Setting Theory, Cultivation Theory, Authoritarian Theory, Libertarian Theory, Social Responsibility theory, Soviet communist theory, Magic Bullet theory, Two step flow theory, Uses and Gratification theory. Social Media Integration Theory.

Module:4	Tool of Mass Communication	6 hours
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Tools of Mass Communication: Newspapers, Magazines, Radio, TV, Films, Internet, mobiles. Advertising, Public Relations & Public Affairs, Traditional & Folk Media, Media and modernsociety, Media and democracy-Mass Media-Social Media.

Module:5	Mass Communication and Social Institutions	6 hours
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Impact on Society: Family, Marriage, Culture, Religion, Economy Health, Education and Polity.

Module:6	Mass Communication and Development	6 hours
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Social Development, Rural and Urban Development, Environmental Protection, Gender and Development, Mass Communication and Globalization.

Module:7	Mass Communication and Emerging Issues	6 hours
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Pornography – Crime - Juvenile Delinquency - Terrorism – Case Studies - Social media issues - Artificial Intelligence.

Module:8	Contemporary Issues	2 hours
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	Total Lecture hours:	45 hours
Text Book(s)		
1.	Abhay Chawla (2021), Introduction to Mass Communication, Pearson Publishers.	
2.	Ralph E. Hanson (2016), Mass Communication: Living in a Media World, Sage Publications.	
Reference Books		
1.	Keval J. Kumar (2020), Mass Communication in India, 5 th Edition, Jaico Publishing House.	
2.	Terhi Rantanen (2019), Globalization and the Media (4-vol. set) Routledge.	
3.	Prabakar. N (2017), Mass Media and Contemporary Social Issues, Common Wealth Publishers.	
4.	Stanley J Baran (2013), Mass Communication Theory: Foundations, Ferment, and FutureWadsworth Publishing Co Inc.	
5.	Joseph Turow (2022), Media Today: Mass Communication in a Converging World, Routledge.	
6.	D. S. Mehta (2006), Mass Communication and Journalism In India, Allied Publishers.	
Mode of Evaluation: CAT / Quiz / Assignment / FAT		
Recommended by Board of Studies	22-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM202L	Rural Development	3	0	0	3
Pre-requisite	NIL			Syllabus version	
				1.0	

Course Objectives

1. To make the students to understand the concepts and approaches to rural development
2. To sensitize students about the role of state and various institutions
3. To assess, interpret and evaluate the various policies and programmes

Course Outcomes

Upon successful completion of the course students will be able to

1. Understand the elementary concepts of rural development.
2. Outline the historical perspectives of rural development.
3. Critically analyse the issues and challenges in the rural society, business and economy.
4. Interpret the role and responsibilities of rural institutions and governance.
5. Apply rural development Planning and management.
6. Design, develop and implement rural centric policies and programmes.

Module:1	Rural Development	4 hours
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Definition, Concept, Nature, Elements - Determinants of rural development - Need for rural development in India and components of rural development. Scope of rural development – approaches. Significance of rural development in Indian context.

Module:2	Historical Perspectives of Rural Development	6 hours
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History of rural development in India. Pre-colonial and Post-Colonial rural development. Land reform - Green revolution - WTO regimes. MDGs – SDGs - Sustainable rural development.

Module:3	Rural Business	4 hours
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Rural small business management - process of Management - meaning organizing - Leading, Co-ordinating, and controlling, Training Programmes for entrepreneurship development, Entrepreneurial motivation and motives for entrepreneurship, Guidelines for entrepreneurship programme.

Module:4	Rural Development Institutions	6 hours
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Cooperative Institutions: Types and Working of Rural Cooperatives - Community Based Organizations: Watershed Committees - Village Forest Committees - Role of CBOs in Rural Development - Rural Banking and Credit: Types and sources of rural credit- Training Institutions NIRD & PR, NABARD, RRB, CAPART, FTCs, KVks.

Module:5	Rural Governance	5 hours
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Rural Governance: Panchayat raj - Meaning - Origin – Objectives – PRI's the Gram Panchayats and Power and Functions - Decentralized Governance and Women Empowerment, SHG, and Community Organization. Impact of Decentralized Governance on Rural Development.

Module:6	Issues and Challenges for Rural Development	8 hours
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Education and Rural Development – Formal and Non-formal education- Educational facilities in rural areas - Rural Health care - Primary health care – Development of health care services in rural India-Rural Housing: Shelter as a basic requirement - Types of rural houses – Housing as social security – Dimensions of rural housing problems - Sources of Drinking Water – National water Policy, Water Rights: Excess and underutilization of water. Access to

sanitation: Sanitation and environment sanitation. Technology and Innovation in Rural Development. Involvement of youth in Rural Development.		
Module:7	Rural Development Programs and Policies	10 hours
Rural Development during the Five-year plan period. Major RD Programs in India - CDP, IRDP, MGNREGS, PMAY (IAY), NRLM, TRYSEM - Success and Failures. Rural Development Policies: Need for Rural Development policies - Rural Development Legislations and Policies in India - National Forest Policy - National Water Policy - Land Reforms Policy - Agricultural Price Policy - Rural Credit Policy - National Agricultural Policy - National Policy in Cooperatives - National Policy for Farmers.		
Module:8	Contemporary Issues	2 hours
Total Lecture Hours 45 hours		
Text Book(s)		
1.	Tahir Hussain Mary Tahir and Riya Tahir (2020), Fundamentals of Rural Development, Dreamtec Press.	
2.	Abdul Azeez NP and S. M. Jawed Akhtar (2016), Rural Development in India: Policies and Programmes, Kalpaz Publications.	
3.	Katar Singh, Anil Shishodia (2019), Rural Development Principles, Policies and Management, 4 th Edition, SAGE Publications.	
Reference Books		
1.	Krishna Prasada Rao and Suresh Vadranam (2020), Dynamics of sustainable Rural Development: Issues and trends, Raj Publications.	
2.	Sujit Kumar Paul (2015), Rural Development: Concept and Recent Approaches, Concept Publishing Company.	
3.	Willem Van Eekelen (2020), Rural Development in Practice Evolving Challenges and Opportunities, Routledge Publisher.	
4.	Journal of Rural Development, NIRDPR, Hyderabad.	
5.	Journal of Economic and Political Weekly.	
Mode of Evaluation: CAT, Quiz, Assignment and FAT.		
Recommended by Board of Studies	22-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C				
BHUM203L	Introduction to Psychology	3	0	0	3				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
<p>1. To describe the nature of human behaviour and mental functions 2. To provide knowledge of the concepts of the psychological processes 3. To apply the psychological principles for understanding human behavior</p>									
Course Outcomes									
Upon successful completion of the course students will be able to									
<p>1. Describe the basic concepts of Psychology. 2. Understand the knowledge of the processes of sensation and perception. 3. Acquire an in-depth knowledge of learning, memory, forgetting and decision making. 4. Analyze the importance of motivation and emotions. 5. Apply the theoretical foundations to describe human personality and intelligence. 6. Develop and implement the resilience strategies to promote mental health.</p>									
Module:1	Foundations of Psychology	6 hours							
Nature of psychology - Neurobiological approach - Behavioural approach - Cognitive approach - Psychoanalytic approach - Humanistic approach - The broad province of contemporary psychology - Methods of psychology.									
Module:2	Sensation and Perception	6 hours							
General characteristics of sensation: Absolute thresholds - Difference thresholds – Object perception and perceptual constancies - Organization and perception - Movement perception- Depth perception - Visual coding and pattern recognition - Extra sensory perception.									
Module:3	Learning, Memory and Forgetting	6 hours							
Classical conditioning - Operant conditioning - Multiple response learning - Cognitive learning – Application of learning theories in organizational setting - Kinds of remembering – Retrieval processes - Nature of forgetting - Improving memory.									
Module:4	Motivation and Emotion	6 hours							
Physiological bases of motivation: Hunger – Obesity - Thirst - Theories of motivation - Physiological responses in emotion - Theories of emotion - Emotional expression.									
Module:5	Personality and Intelligence	6 hours							
Social learning approach - Rogers' approach - Self-esteem - Self-regulation - Self-presentation - Assessment of personality - Guilford's model of intelligence - Gardner's theory of multiple intelligence -Test of personality and intelligence related to placement context - Genetic basis and extremes of intelligence - Emotional intelligence.									
Module:6	Conflict and Adjustment	6 hours							
Understanding conflict - Frustration - Reaction to frustration - Defense Mechanisms - Adjustment - Coping with mal-adjustment.									
Module:7	Mental Health	7 hours							
Abnormal behaviour - Kinds of stressors - Coping with stress - Anxiety disorders – Depressive disorder – Factors affecting mental health - Enhancing mental health.									
Module:8	Contemporary Issues	2 hours							

	Total Lecture Hours	45 hours
Text Book(s)		
1.	Hilgard, E. R., Atkinson, R. C., & Atkinson, R. L., (2017), Introduction to Psychology, 16 th Edition, Oxford and IBH.	
Reference Books		
1.	Feldman, S. R., (2021), Understanding Psychology, 15 th Edition, McGraw Hill Education.	
2.	Myers, D.G., (2018), Psychology, 12 th Edition, Worth Publishers.	
3.	Plotnik, R., & Kouyoumdjian, H., (2018), Introduction to Psychology, 10th Edition, Cengage	
4.	Weiten W. Dunn D. & Hammer E. Y. (2017), Psychology Applied to Modern Life: Adjustment in the 21st Century, 12 th Edition, Cengage Learning.	
5.	Morgan, C.T., King, R.A., Weisz, J.R., & Schopler, J., (2014), Introduction to Psychology, 7 th Edition, McGraw Hill Education.	
Mode of Evaluation: CAT, Quiz, Assignment and FAT.		
Recommended by Board of Studies	22-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C						
BHUM204L	Industrial Psychology	3	0	0	3						
Pre-requisite	NIL	Syllabus version		1.0							
Course Objectives											
<p>1. To introduce the nature, scope and applications of the industrial psychology</p> <p>2. To Acquire knowledge of the employment selection and appraisal process considering workplace wellbeing</p> <p>3. To be able to take role of employees and managers</p>											
Course Outcomes											
Upon successful completion of the course students will be able to											
<p>1. Describe the utility and research methods used in the Industrial Psychology.</p> <p>2. Acquire practical knowledge of training and performance evaluation.</p> <p>3. Understand workplace assessment tools and techniques.</p> <p>4. Enhance leadership skills and team building.</p> <p>5. Appraise the issues of equity and inclusion at work place.</p> <p>6. Analyse and address stress and well-being related issues.</p>											
Module:1	Introduction to Industrial Psychology	8 hours									
Industrial Psychology-definition – Major Fields - Brief History - Employment of Industrial Psychologists - Research Methods – Importance of Research -Process - Statistics, Job Analysis & Job Evaluation.											
Module:2	Evaluating the Quality of Performance Measures	7 hours									
Total Quality Management – Importance - Identifying Criteria & Validating Tests and Measures, Screening Methods - Intensive Methods.											
Module:3	Employees Performance and Evaluation	5 hours									
Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance.											
Module:4	Organisational Fairness and Diversity Management	6 hours									
Employee Motivation, Psychological contracting - Satisfaction and Commitment, Diversity, Fairness and Inclusion -Work place Harassment and Vishakha Guidelines.											
Module:5	Leadership and Organisational Development	6 hours									
Leadership – Styles and Skills, Organizational Climate and Culture, Organizational Development – Factors contributing to organizational development, Current work paradigm.											
Module:6	Group Behaviour and Team	6 hours									
Group Behaviour: Group dynamic – work dynamic, Teams in Organizations, conflict management – Negotiation and persuasion - The Organization of Work Behaviour.											
Module:7	Stress and Well-being	5 hours									
Understanding Stress: Types, Sources of stress and demands of life and work, Managing Burnout, Building Resilience and Enhancing well-being at work.											
Module:8	Contemporary Issues	2 hours									
Total Lecture Hours											
Text Book(s)											
1.	Aamodt M. (2016), Industrial/Organizational Psychology: An Applied Approach, 8 th Edition, Wadsworth Publishing Co.										
Reference Books											

1.	Frank J. Landy & Jeffrey M. Conte (2016), Work in the 21 st Century: An Introduction to Industrial and Organizational Psychology, 5 th Edition, John Wiley & Sons Inc		
2.	Paul E. Levy (2017), Industrial/Organizational Psychology: Understanding the Workplace, 5th Edition, Worth Publishers.		
3.	Satoris S. Culbertson & Paul M. Muchinsky (2022), Psychology Applied to Work, 13 th Edition, Hypergraphic Pr		
4.	Ronald E. Riggio (2017), Introduction to Industrial and Organizational Psychology, 6 th Edition, Pearson.		
Mode of Evaluation: CAT, Quiz, Assignment and FAT.			
Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No. 69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
BHUM205L	Development Economics	3	0	0	3
Pre-requisite	NIL			Syllabus version	
Course Objectives					
1. To provide students with essential tools and concepts of development economics 2. To equip students to critically evaluate different economic development models 3. To provide students with an understanding of what helps development succeed					
Course Outcomes					
Upon successful completion of the course students will be able to 1. Describe the central themes and issues of economic development. 2. Differentiate between economic growth and development, major theories and their measurement. 3. Illustrate the significance of agriculture in developing countries, along with poverty and population related issues. 4. Assess the functions of international trade and the importance of foreign aid. 5. Analyse empirical evidence in the pattern of economic development. 6. Develop an understanding of the ongoing sustainable development agenda and its relevance.					
Module:1	Development Indicators and Issues	7 hours			
The concept of development - Indicators and Issues - Seven dimensions of development - Income, income growth and the Convergence Club - Poverty and hunger - Inequality and inequity - Vulnerability to Poverty - Basic needs: Human Development - Sustainability in the use of natural resources - Quality of life.					
Module:2	Impact of Development Policies and Programs	6 hours			
Objectives and overview of impact evaluation - methods of impact evaluation - Experimental design - Randomized Controlled Trials (RCTs) - Matching method to construct control groups: propensity score matching - Difference-in-difference method - Regression discontinuity designs - Event analysis and event - severity analysis - Instrumental variable estimation - Qualitative Methods.					
Module:3	Inequality, Inequity, Poverty and Vulnerability Analysis	6 hours			
Describing and measuring inequality - Decomposing inequality - Pro-poor growth and the growth incidence curve - The growth-inequality-poverty development triangle - Equity and development - inclusive growth - Characterize welfare: choice of an indicator of wellbeing - Poverty profile and aggregate indicators - Vulnerability - Other aspects of poverty - Correlates of poverty – poverty maps - behavioral poverty traps - Reducing poverty.					
Module:4	International Trade and Industrialisation Strategies	5 hours			
Trade openness - Gains from trade - Absolute, comparative and competitive advantage - Trade policy and indicators of protection - Tariffs and subsidies - Trade and the environment – Trade and food security - WTO and Multilateralism - Exchange trade Policies - regimes.					
Module:5	Economic Growth and Human Capital	7 hours			
Growth puzzle - Generic modelling of income growth - Harrod-Domar model - Solow model - Endogenous growth model - Education and Health - Education and Growth - Determinants of levels of Schooling - Estimating the returns to Education - Impact of Health on development.					
Module:6	Agriculture, Labour, Migration and Population	5 hours			

The state of world agriculture - Determinants of agricultural growth - food security in developing countries - Role of subsidies – European Union common agricultural policy - The economics of farm households - Farm household behaviour models - Responses to market signals - Labour and employment - Rural-urban migration - Demography - concepts - Some data for world Population - Cause of Population growth - Population Policy.

Module:7 Sustainable Development and Environment	7 hours
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Sustainable development goals - Links between development, Resource conservation, and environmental sustainability - negative externalities - Public goods - Economics of Common Property Rights (CPR) - Discounting: Private Vs Social and Exponential Vs Hyperbolic - the sustainability objective - Dilemmas in environment - development relation - Introducing new markets: payments for environmental services.

Module:8 Contemporary Issues	2 hours
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	Total Lecture Hours	45 hours
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Text Book (s)

1. Alain de Janvry and Elisabeth Sadoulet (2021), Development Economics: Theory and Practice. Second Edition, Routledge.
2. H.L. Ahuja (2016), Development Economics - A Critical Study of Economic Growth, Development and Environment, S. Chand Publishers, New Delhi.

Reference Books

1. A.P. Thirlwall and Penelope Pacheco - Lopez (2017), Development Economics: Theory and Evidence. Tenth Edition, Springer Nature Limited.
2. J. Edward Taylor and Travis J. Lybbert (2015), Essentials of Development Economics. Second Edition, University of California Press, California, USA.
3. Gerard Roland (2014), Development Economics, Routledge, USA.
4. Claudia Sunna and Davide Gualerzi (2016), Development Economics in the Twenty-First Century, Routledge.
5. Robert J. Barro, Xavier Sala i Martein (2003), Economic Growth, MIT Press, Cambridge, London.

Mode of Evaluation: CAT, Quiz, Assignment and FAT
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Recommended by Board of Studies	23-02-2023
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Approved by Academic Council	No.69	Date	16-03-2023
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Course Code	Course Title	L	T	P	C
BHUM206L	International Economics	3	0	0	3
Pre-requisite	NIL			Syllabus version	
				1.0	

Course Objectives

1. To understand trade related concepts and their applications in international trade
2. To understand the importance and role of foreign capital and foreign exchange for the economic development of the nations
3. To understand the nature of trade related issues and its solutions

Course Outcomes

Upon successful completion of the course students will be able to

1. Comprehend the concepts of international economics through the nature of trade issues and the importance of international cooperation.
2. Assess the importance of international trade and its contribution to economic development and growth.
3. Ascertain the basics of international trade theories and the role of factor movement at the global level.
4. Examine the essence of foreign capital flow, foreign exchange reserve and the method of exchange rate determination.
5. Review trade policies for trade promotion and trade restriction.
6. Analyse the importance and impact of balance of trade and balance of payment in the national economy.

Module:1	Trade and Economy	4 hours
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Introduction to International Economics – Subject matter - Internal trade and International Trade – Current International Economic problems and challenges – Categories of Economies - Global Economic Integration – New Economic Policy.

Module:2	International Trade and Economic Development	5 hours
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Introduction – Importance of trade and development – Terms of trade and economic development – trade problems and economic development – Foreign debt and economic development – Export instability and economic development.

Module:3	Theories of Trade	4 hours
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Comparative cost theory – Hicksian theory of trade - Factor endowment theory – International factor movement - gains from trade.

Module:4	Trade Policies and Regional Co-operation	6 hours
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Trade promotion: export promotion, Export subsidies, and Custom union – Export Oriented Units (EOU) – Special Economic Zones (SEZ) - Trade restriction: Tariff and Quota – Effects of Tariff and Quota - Import substitution – Dumping – World Trade Organization (WTO) - Regional economic co-operation (ASEAN, NAFTA, EU, and SAARC).

Module:5	Capital Flow	9 hours
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Foreign capital – Foreign Direct Investment (FDI) - FDI policy in India - FDI Cap-reforms – initiatives - Foreign Investment Promotion Board (FIPB) and Foreign Portfolio Investment (FPI) – FDI in retailing – world investment reports, IMF reports - International Financial Institutions – (World Bank, UNCTAD, International Monetary Fund, Asian Development Bank) – Financial crisis.

Module:6	Foreign Exchange	9 hours
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Foreign exchange market: Meaning, functions – risks - IMF classification of exchange rate – IMF AREAER Report - Rate of exchange: Determination – Effects – Fixed, Flexible and Floating exchange rate - exchange rate models – Foreign exchange reserve - exchange rate risk (case studies of Indian IT industries) - risk management – Currency Crises - Currency Wars.

Module:7	Balance of Payment	6 hours	
	Balance of trade – meaning - favorable and unfavorable - Balance of payment – meaning – favorable and unfavorable – current account and capital account – Disequilibrium in balance of payment – measures to correct disequilibrium.		
Module:8	Contemporary Issues	2 hours	
		Total Lecture Hours 45 hours	
Text Book(s)			
1.	Paul R. Krugman, Maurice Obstfeld and Marc J. Melitz (2017), International Economics. 11 th Edition, Pearson Education.		
2.	Francis Cherunilam (2020), International Economics. 6 th Edition, Tata MC Graw Hill Companies, New Delhi.		
Reference Books			
1.	Dominick Salvatore (2021), International Economics. 13 th Edition, John. Wiley and Sons, Inc.		
2.	Hendrik Van Den Berg (2016), International Economics. 3 rd Edition, Taylor & Francis.		
3.	James Rickards (2012), Currency Wars: The Making of the Next Global Crisis, Penguin Books.		
Mode of Evaluation: CAT, Quiz, Assignment and FAT.			
Recommended by Board of Studies	23-02-2023		
Approved by Academic Council	No. 69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
BHUM207L	Engineering Economics	3	0	0	3
Pre-requisite	NIL	Syllabus Version		1.0	

Course Objectives

1. To introduce the basic concepts of economics in engineering decision making, theories and tools of economics in engineering applications
2. To analyze cost and revenue data and carry out economic analysis to justify or reject alternatives and projects based on an economic perception
3. To analyze the risk and project uncertainty and to provide guidance to use the appropriate approach to handle the project uncertainty

Course Outcomes

Upon successful completion of the course students will be able to

1. Comprehend the basic principles of engineering economics.
2. Evaluate the methods of cost estimation and forecast the present and future values of cashflows.
3. Identify project appraisal techniques and evaluate the key factor of the project which defines the viability of a project proposal.
4. Determine the depreciation and understand the tax impact while calculating depreciation.
5. Identify, analyse and manage various types of risk.
6. Make decisions on investing funds in the most appropriate and efficient projects.

Module:1	Overview of Engineering Economics	4 hours
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The Principles of Engineering Economics – Engineering Economics and the Design Process – Engineering Economic Analysis.

Module:2	Cost Concepts and Cost Estimation Techniques	6 hours
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Cost Concepts - Cost terminology - The General Economic Environment - Cost-Driven Optimisation. Cost Estimation Techniques – An Integrated Approach - Selected Estimating Techniques (Models) and Parametric Cost Estimating.

Module:3	The Time Value of Money	8 hours
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Simple Interest - Compound Interest - The concept of Equivalence. Cash flows – Relating present and future equivalent values of single Cash Flows - Relating a uniform series (Annuity) to its present and future equivalent values – Deferred Annuities – Equivalence calculations involving multiple interest formulas – uniform (Arithmetic) Gradient of cash flow – Geometric sequences of cash flow – Interest rates that varies with time - Nominal and effective interest rate – compounding more often than once per year – continuous compounding and discrete cash flow.

Module:4	Project Estimation and Evaluation Techniques	8 hours
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Determining the minimum attractive rate of interest (MARR) – The present worth method – The future worth method - The annual worth method - The internal rate of return method - The external rate of return method and payback (payout) period method. Evaluation of Alternatives – comparison and selection among alternatives - Techniques of Evaluation. Cost-Benefit Analysis – Perspective and terminology for analysing public projects and evaluating independent projects.

Module:5	Depreciation and Income Taxes	6 hours
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Depreciation concepts and terminology - The classical depreciation methods – The modified accelerated cost recovery system – Income taxes – The effective corporate income rate – Gain (loss) on the disposal of an asset – General procedure for making After-tax economic analysis and Economic value added.

Module:6	Project Risk Analysis	5 hours
Breakeven analysis – Sensitivity analysis – Multiple factor sensitivity analysis. Probabilistic risk analysis – Sources of uncertainty – Distribution of random variables – Evaluation of projects – Discrete random variables and Continuous random variables - Evaluation of risk and Uncertainty by Monte Carlo Simulation.		
Module:7	The Capital Budgeting Process and Decision Making	6 hours
Debt Capital – Equity capital – The weighted average cost of capital (WACC) – Project selection – Budgeting of Capital Investments and Management Perspective – Leasing decision and Capital allocation. Multi-attributes – Choices of attributes, Selection of a measurement scale, and Dimensionality of the problem – Compensatory and Non-compensatory models.		
Module:8	Contemporary Issues	2 hours
		Total Lecture Hours
		45 hours
Text Book (s)		
1.	Sullivan G William, Elin M Wicks and C. Patrick Koelling (2018), Engineering Economy. Pearson Education, 17 th Edition.	
Reference Books		
1.	Blank, Leland and Anthony Tarquin (2017), Engineering Economy. Tata Mc Graw Hill, 8 th Edition.	
2.	Chan S.Park (2019), Fundamentals of Engineering Economics. Pearsons Education, 4 th Edition.	
Mode of Evaluation: CAT, Quiz, Assignment and FAT.		
Recommended by Board of Studies		23-02-2023
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C								
BHUM208L	Economics of Strategy	3	0	0	3								
Pre-requisite	NIL	Syllabus version											
					1.0								
Course Objectives													
1. To create awareness about the importance of strategic thinking among students 2. To understand the need for being competitive in all aspects of business 3. To familiarize the students with modern industrial organization with business strategyperspective													
Course Outcomes													
Upon successful completion of the course students will be able to													
1. Describe and apply elasticity of demand. 2. Apply the Economies of scale and scope concepts. 3. Interpret and apply the vertical integration concepts. 4. Explain and apply diversification. 5. Analyze and explain the market structures. 6. Critically evaluate entry and exit decisions.													
Module:1 Economic Concepts For Strategy	7 hours												
Demand, Elasticity and Revenue, Total Revenue and Marginal Revenue, Costs and Cost Functions - Fixed and Variable Costs, Theory of the firm, Game Theory - Normal and Extensive Games,Economic Costs and Profitability.													
Module:2 Production and Cost Behavior	6 hours												
Economies and Diseconomies of Scale and Economies of Scope – Sources, Indivisibilities, and the Spreading of Fixed Costs, The Learning Curve, Learning and Organization													
Module:3 The Economics of Transaction Costs	6 hours												
The Vertical Boundaries of Firm, Make Vs Buy Decisions, Contracts, Transactions Cost, Asset Specificity, Rents and Quasi-Rents, The Holdup Problem.													
Module:4 Diversification	6 hours												
Diversification - Reasons for Diversification, Costs of Diversification, Performance of Diversified Firms, Mergers and Acquisition- Benefits.													
Module:5 Market Structure	6 hours												
Market Structure and Competition, Measuring Market Structure, Monopoly, Monopolistic and Oligopoly Market Structures - Cournot and Bertrand Models, Market Structure and Performance													
Module:6 Industry Analysis	6 hours												
Five - Forces Analysis - Application of Five - Forces, Entry and Exit Decisions, Barriers to Entry, Entry - Deterring Strategies, Exit- Promoting Strategies.													
Module:7 Strategic Positioning	6 hours												
Competitive Advantage and Value Creation - Value Creation Vs Value Redistribution, Cost and Benefit Advantage, Broad Coverage versus Focus Strategy.													
Module:8 Contemporary Issues	2 hours												
	Total Lecture Hours												
45 hours													
Text Book(s)													
1.	David Dranove, David Besanko, Mark Shanley and Scott Schaeffer (2017), Economics of Strategy. Wiley, 7 th Edition.												

Reference Books	
1.	Paul Belleflamme and Martin Peitz (2015), Industrial Organization: Markets and Strategies.Cambridge University Press, 2 nd Edition.
2.	Don E Waldman and Elizabeth J Jensen (2019) Industrial Organization: Theory and Practice.Routledge, 5 th Edition.
Mode of Evaluation: CAT, Quiz, Assignment and FAT	
Recommended by Board of Studies	23-02-2023
Approved by Academic Council	No. 69 Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM209L	Game Theory	3	0	0	3
Pre-requisite	NIL	Syllabus version		1.0	

Course Objectives

1. To provide game theory fundamentals so as to apply the same in their professional life
2. To make the students understand the strategic interactions between players using game theory
3. To provide tools of game theory to apply in different decision making situations

Course Outcomes

Upon successful completion of the course students will be able to

1. Describe and apply knowledge of strategic games with perfect information.
2. Identify Nash equilibrium in games.
3. Describe mixed strategy games.
4. Analyze extensive games with perfect information.
5. Describe extensive games with imperfect information.
6. Apply bargaining in Game theory setting.

Module:1 Games with Perfect Information 5 hours

Strategic Games and Examples. Nash Equilibrium, Strict and Nonstrict Nash Equilibria, Best Response Functions, Dominated Actions - Strict and Weak Domination, Symmetric Games.

Module:2 Nash Equilibrium 6 hours

Cournot's Model of Oligopoly - Bertrand's Model of Oligopoly, Electoral Competition, Median Voter Theorem and Auctions.

Module:3 Mixed Strategy Equilibrium 5 hours

Randomization and Expected Payoffs, Mixed Strategy Nash Equilibrium and Properties, Dominated Actions – Strict and Weak Domination.

Module:4 Extensive Games with Perfect Information 7 hours

Strategies and Outcomes, Nash Equilibrium, Subgame Perfect Equilibrium, Backward Induction, The Ultimatum game, The Holdup game and Stackelberg's Model of duopoly, Properties of Subgame perfect equilibrium.

Module:5 Extensive Games with Imperfect Information 6 hours

Strategies and Nash Equilibrium, Beliefs and Sequential equilibrium, Sequential Rationality, Signaling Games, Separating and Pooling Equilibrium.

Module:6 Repeated Games 7 hours

Finitely and Infinitely Repeated Prisoner's dilemma, Grim Trigger and Tit-for-tat Strategies, Nash Equilibria of General Infinitely Repeated Games, Finitely Repeated Games.

Module:7 Bargaining 7 hours

Bargaining as an Extensive Game, Nash's axiomatic Model, Bargaining Solution, Pareto Efficiency and Symmetry, Nash Bargaining Solution.

Module:8 Contemporary Issues 2 hours

Total Lecture Hours 45 hours

Text Book (s)

1. Avinash Dixit, Susan Skeath and David McAdams (2020), Games of Strategy. W.W.Nortonand Co, Fifth Edition.

2.	Bernhard Von Stengel (2021), Game Theory Basics. Cambridge University Press, 1 st Edition.
Reference Books	
1. Drew Fudenberg and Jean Tirole (1991), Game Theory. MIT Press, 1 st Edition. 2. Osborne, Martin J (2012), An Introduction to Game Theory. Oxford University Press, 1 st Edition.	
Mode of Evaluation: CAT, Quiz, Assignment and FAT	
Recommended by Board of Studies	23-02-2023
Approved by Academic Council	No. 69 Date 16-03-2023

Course Code	Course Title	L	T	P	C			
BHUM210E	Econometrics	2	0	2	3			
Pre-requisite	NIL	Syllabus version			1.0			
Course Objectives								
1. To introduce the basic concepts of econometrics 2. To familiarize the students with econometrics methodology 3. To use appropriate econometrics tools based on data sets								
Course Outcomes								
Upon successful completion of the course students will be able to								
1. Analyse economic data based on a broad knowledge of the linear regression model. 2. Apply the multiple regression model and test hypothesis. 3. Examine the use of dummy variables in regression model. 4. Explain the violations of OLS assumptions, such as multicollinearity, heteroscedasticity, and auto correlation. 5. Analyse and assess empirical results and econometric findings. 6. Design, develop and execute various time series models.								
Module:1	Inferential Statistics	3 hours						
Normal distribution, chi-square, t - and F- distributions - Estimation of parameters - Testing of hypotheses - Defining statistical hypotheses - Distributions of test statistics - Testing hypotheses related to population parameters - Type-I and Type-II errors; Power of a test - Tests for comparing parameters from two samples.								
Module:2	The Nature and Scope of Econometrics	3 hours						
Introduction to Econometrics – Methodology of Econometrics – Types of Data: Parametric and Non-Parametric test and Sources of Data – Population Regression Function and Sample Regression Function – Significance of error term.								
Module:3	Simple Linear Regression Model: Two Variable Case	3 hours						
Estimation of model by method of ordinary least squares - Properties of estimators – Gauss Markov Theorem (BLUE) - Goodness of Fit - Testing of Hypothesis - Scaling and units of measurement - Confidence Intervals - Forecasting.								
Module:4	Multiple Regression Analysis	5 hours						
Estimation of parameters - Properties of OLS estimators - Goodness of fit- R ² and Adjusted R ² – Partial regression coefficients - Testing Hypotheses: Individual and Joint - Functional Forms of Regression Models.								
Module:5	Dummy Variables in Regression Models	4 hours						
Exogenous Dummy Variable - Formulating and interpreting coefficients on dummy explanatory variables, interactions involving dummy variables and the use of dummy variables in seasonal analysis, piece wise regression analysis, the dummy variable alternative to chow test.								
Module:6	Violation of Classical Assumptions	4 hours						
Multicollinearity – autocorrelation – heteroscedasticity – problems – causes – consequences remedial measures – model specification and diagnostic testing.								
Module:7	Time Series Analysis and Forecasting Models	6 hours						

Stationarity Vs. Non - Stationarity – Unit root Stochastic Process – Tests of Stationarity - The Unit Root Test - Transforming Non-stationary Time Series – Cointegration and Error Correction Mechanism (ECM) - ARIMA model – The Box Jenkins Methodology – Vector Auto regression (VAR) Estimation.		
Module:8	Contemporary Issues	2 hours
	Total Lecture Hours	30 hours
Text Book(s)		
1.	Damodar. N. Gujarati and Sangeetha (2021), Basic Econometrics. 6 th Edition, Tata McGraw-Hill.	
2.	Christopher Dougherty (2016), Introduction to Econometrics. 5 th Edition, Oxford University Press.	
Reference Books		
1.	Jeffrey M.Wooldridge (2019), Introductory Econometrics: A Modern Approach, 7 th Edition, Cengage Learning.	
2.	G.S. Maddala and Kajal Lahiri (2012), Introduction to Econometrics, 3 rd Edition, Pearson.	
3.	Greene, W. (2018), Econometric Analysis, 8th Edition, Pearson.	
4.	Chris Brooks (2014), Introductory Econometrics for Finance. 3 rd Edition, Cambridge University Press.	
Indicative Experiments		
1.	Statistical Inferences	2 hours
2.	The Classical Linear Regression Model	4 hours
3.	Multiple Regression Analysis	4 hours
4.	Functional Forms of Regression Models	4 hours
5.	Dummy (Binary) Variables	4 hours
6.	Testing for Violation of Classical Assumptions	4 hours
7.	Tests of specification errors (Ramsay Test)	2 hours
8.	Time Series Modelling	6 hours
Total Laboratory Hours		
30 hours		
Mode of Evaluation: CAT, Quiz, Assignment and FAT.		
Recommended by Board of Studies	23-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM211L	Behavioral Economics	3	0	0	3
Pre-requisite	NIL			Syllabus version	
Course Objectives					
<ol style="list-style-type: none"> 1. To impart knowledge on current ideas and concepts regarding decision making in Economics, Particularly from a behavioral science perspective. 2. The course will explore key departures and the consequences of behavior of firms, households and other economics entities 3. To provide an overview of how behavioral principles have been applied to economic problems. 					
Course Outcomes					
Upon successful completion of the course students will be able to					
<ol style="list-style-type: none"> 1. Identify and evaluate evidence for systematic departures of economic behavior from the traditional economic models. 2. Predictions of the neoclassical model, and psychological explanations for these anomalies. 3. Incorporate psychologically motivated assumptions into economic models, and interpret the implications of these assumptions. 4. Explain how these models change the predictions for equilibrium behavior and welfare analysis, and assess the implications for optimal policy. 5. Compare the predictions of neoclassical and behavioral models, and evaluate the best method for approaching a given topic. 6. Apply Behavioral principles in economic problems. 					
Module:1	Introduction	6 hours			
The neoclassical/standard model and behavioral economics in contrast; historical background; behavioral economics and other social sciences; theory and evidence in the social sciences and in behavioral economics; applications gains and losses, money illusion, charitable donation.					
Module:2	Basics of Choice Theory	6 hours			
Revisiting the neoclassical model; utility in economics and psychology; models of rationality; connections with evolutionary biology and cognitive neuroscience; policy analysis consumption and addiction, environmental protection, retail therapy; applications pricing, valuation, public goods, choice anomalies.					
Module:3	Beliefs, Heuristics and Biases	6 hours			
Revisiting rationality; causal aspects of irrationality; different kinds of biases and beliefs; self-evaluation and self-projection; inconsistent and biased beliefs; probability estimation; trading applications trade in counterfeit goods, financial trading behavior, trade in memorabilia.					
Module:4	Choice under Uncertainty	6 hours			
Background and expected utility theory; prospect theory and other theories; reference points; loss aversion; marginal utility; decision and probability weighting; applications ownership and trade, income and consumption, performance in sports.					

Module:5	Intertemporal Choice	6 hours
Geometric discounting; preferences over time; anomalies of inter-temporal decisions; hyperbolic discounting; instantaneous utility; alternative concepts future projection, mental accounts, heterogeneous selves, procedural choice; policy analysis mobile calls, credit cards, organization of government; applications consumption and savings, clubs and membership, consumption planning.		
Module:6	Game and Strategy Behavior	6 hours
Review of game theory and Nash equilibrium strategies, information, equilibrium in pure and mixed strategies, iterated games, bargaining, signaling, learning; applications competitive sports, bargaining and negotiation, monopoly and market entry.		
Module:7	Social Preference	7 hours
Individual preferences; choice anomalies and inconsistencies; social preferences; altruism; fairness; reciprocity; trust; learning; communication; intention; demographic and cultural aspects; social norms; compliance and punishment; inequity aversion; policy analysis norms and markets, labor markets, market clearing, public goods; applications logic and knowledge, voluntary contribution, compensation design.		
Module:8	Contemporary Issues	2 hours
Total Lecture hours:		45 hours
Text Book(s)		
1.	N.Wilkinson and M.Klaes (2017), An Introduction to Behavioral Economics", 3 rd Edition, Red Globe Press.	
Reference Books		
1.	Bazerman, Max and Don Moore (2012), Judgment in Managerial Decision Making, 8 th Edition, John Wiley & Sons.	
2.	Kahneman, Daniel (2011), Thinking, Fast and Slow, New York: Farrar, Straus and Giroux.	
Mode of Evaluation: CAT /Quiz / Assignment / FAT.		
Recommended by Board of Studies	22-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM212L	Mathematics for Economic Analysis	3	0	0	3
Pre-requisite	NIL	Syllabus version		1.0	
Course Objectives					

1. To provide basic mathematical tools and techniques to solve the problems that arise from Economics
2. To develop skills in Mathematical Modelling
3. To demonstrate the use of Mathematics in understanding theoretical Economics

Course Outcomes

Upon successful completion of the course students will be able to

1. Demonstrate the use of tools of differentiation in solving the economic problems.
2. Apply mathematical techniques to economic theory.
3. Describe economic problems in mathematical terms.
4. Implement methods from calculus to find the optimal location and value (maximum/minimum) of a mathematical function.
5. Explain the constrained optimization techniques in economic models and apply them to economic problems.
6. Apply the optimization techniques to economic problems.

Module:1	Economic Models and Functions	6 hours
Equations and Identities, The Real Number System, The Concept of Sets, Functions – Types. Graphs of Functions, Types of Functions; Linear, Quadratic, Polynomial, Power, Exponential and Logarithmic functions – Limits and continuity. Economic Applications - Demand, Cost and Revenue functions.		
Module:2	Unconstrained Optimization	5 hours
Slopes of Curves, Simple Rules of Differentiation, Second and Higher order derivatives, Maxima and Minima, Convex and Concave functions. Economic Applications – Marginal Revenue, Marginal Propensity to Consume.		
Module:3	Derivatives and Optimization	5 hours
The Chain Rule, Partial Elasticities, Homogeneous and Homothetic functions and Systems of Equations. Economic Applications – Macroeconomic Models.		
Module:4	Multi Variable Optimization	7 hours
Functions of Several Variables, Geometric representation of functions of several variables, Partial derivatives, Higher order partial derivatives. Economic Applications - Marginal Product of Labour and Capital.		
Module:5	Constrained Optimization	6 hours
The Lagrange Multiplier method, Economic Interpretations of Lagrange Multipliers, Linear Programming Problems - Kuhn-Tucker Method, Kuhn- Tucker Sufficiency Theorem, Arrow - Enthoven Sufficiency Theorem. Economic Applications – Utility Maximization with Constraints.		
Module:6	Integration, Differential and Difference Equations	6 hours
Definite and Indefinite Integrals and Economic Applications, First order and Second order Difference equations, First order and second order differential equations. Economic Applications- Income Distribution.		
Module:7	Matrix and Vector Algebra	8 hours
Systems of Linear Equations – Matrices and Matrix Operations – Matrix		

Multiplication – The Transpose – Vectors – Determinants and Inverse of a Matrix – The Leontief Model. Linear Programming – Graphical Approach – The Duality Theorem – Matrix Formulation.

Module:8	Contemporary Issues	2 hours
		Total Lecture Hours
		45 hours
Text Books		
1. Knut Sydsaeter, Peter Hammond, Arne Strom and Andres Carvajal (2021), Essential Mathematics for Economic Analysis. Pearson, Sixth Edition.		
Reference Books		
1. Chiang, Alpha C and Kevin Wainwright (2017), Fundamental Methods of Mathematical Economics. McGraw Hill Education, 4 th Edition.		
2. Simon C P and Lawrence Blume (2018), Mathematics for Economists, Viva Norton Student Edition.		
3. Dowling, Edward T (2011), Schaum's Outline Series on Introduction to Mathematical Economics. McGraw Hill, 3 rd Edition.		
Mode of Evaluation : CAT, Quiz, Assignment and FAT		
Recommended by Board of Studies	23-02-2023	
Approved by Academic Council	No. 69	Date
		16-03-2023

Course Code	Course Title	L	T	P	C				
BHUM213L	Corporate Social Responsibility	3	0	0	3				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
<ol style="list-style-type: none"> 1. To understand the need and importance of Corporate Social Responsibility and Ethics 2. To familiarise with CSR Legislations and Responsibilities 3. To identify the role of NGOs in CSR 									
Course Outcomes									
Upon successful completion of the course students will be able to									
<ol style="list-style-type: none"> 1. Describe the concepts of Corporate Social Responsibility. 2. Explain and Clarify the Legal provisions of Corporate Social Responsibility. 3. Identify the role of different stakeholders of CSR and effective implementation. 4. Analyse CSR Strategy and its implementation. 5. Carry out CSR need and impact study. 6. Design, develop and implement CSR strategy and policies. 									
Module:1	Corporate Social Responsibility	6 hours							
Definition, evolution, essentials of CSR, and arguments for CSR. The driving forces of CSR: inequality within countries and inequality among countries, sustainability, globalization, and communication- mobile and social media. Brands with attitude.									
Module:2	Stakeholder Theory	5 hours							
Definition. Stakeholder categorization: organizational and economic and societal stakeholders. Evolving issues. Model of stakeholder management, stakeholder engagement. Case Study – Capitalism; The rise of Socialism.									
Module:3	CSR Behavioural Perspective	5 hours							
Markets: Shareholders as market makers. Profit: economic value and social value. Profit optimization, production value and consumption value, social progress, the next billion, case study – Unilever.									
Module:4	CSR Strategy & Implementation	7 hours							
Vision, mission, strategy and tactics. Strategic analysis - Resource perspective and industry perspective. Integrating CSR, strategy formulation and CSR implementation. Strategic CSR is not an option – Not philanthropy, not caring capitalism and not sharing value. Strategic CSR is business. Case study - Starbucks.									
Module:5	CSR Legal Provisions	6 hours							
Clause 135 of Companies Act 2013. Schedule VII in Section 135 of Companies Act (2013), Companies (Corporate Social Responsibility) Rules 2014. CSR Policy Amendment Rules 2021 and 2022. CSR Committee, CSR Policy, Roles and Responsibilities of Board of Directors.									
Module:6	Compliance and Accountability	7 hours							
Voluntary Vs mandatory, Self-interest; behavioural economics; nudges. Accountability – defining CSR- measuring CSR. CSR reporting - standardizing CSR, certifying CSR and labelling CSR. Pricing CSR, Life cycle pricing. Case study – Socially responsible investing. Impact investing.									
Module:7	Sustainable Development and Business	7 hours							

UN Sustainable Development Goals, Sustainability in practice – climate change, resilience and natural capital. Waste: E-waste and plastic. Beyond sustainability. Sustainable value creation – values, morals and business ethics. Conscious capitalism and Value based business.

Module:8	Contemporary Issues	2 hours	
		Total Lecture Hours	
		45 hours	
Text Book(s)			
1.	Chandler. D. (2022), Strategic Corporate Responsibility: Sustainable Value Creation, 6 th Edition, North America: Sage Publication Inc.		
2.	Kadakia, R.S. (2022), Corporate Social Responsibility: Law and Practice. Delhi: Taxman.		
Reference Books			
1.	Mitra. N. and Schmidpeter, R. (2017), Corporate Social Responsibility in India: Cases and Development After the Legal Mandate. Springer Link.		
2.	Confederation of Indian Industry (2013), Handbook on Corporate Social Responsibility in India. Delhi: PricewaterhouseCoopers Private Limited (PwCPL).		
3.	Kotler.P. & Lee, N. R. (2005), Corporate Social Responsibility: Doing the Most Good for Your Company and Cause. New Jersey: John Wiley & Sons.		
4.	Hohnen. P (2007), Corporate Social Responsibility: An implementation guide for business, Potts. J (Ed). Winnipeg, Manitoba, Canada: International Institute for Sustainable Development(IISD's).		
Mode of Evaluation: CAT, Quiz, Assignment and FAT.			
Recommended by Board of Studies	23-02-2023		
Approved by Academic Council	No. 69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
BHUM214L	Political Science	3	0	0	3
Pre-requisite	NIL				Syllabus version
					1.0

Course Objectives

1. To describe the salient features of Indian politics
2. To understand political phenomena, and to explore their ethical and normative dimensions
3. To identify and reflect on the major issues confronting politics

Course Outcomes

Upon successful completion of the course students will be able to

1. Develop basic understanding of the Constitution.
2. Examine the working of the political system and institutions in India.
3. Understand different political theories and ideologies.
4. Critically analyze the issues and concerns of political life surrounding them.
5. Analyse the challenges for contemporary India.
6. Provide policy level solutions for the issue in world politics.

Module:1	Indian Constitution at Work	5 hours
	Nation and State - Salient Features of the Constitution of India - Regimes - Fundamental Rights.	
Module:2	The Bases of Politics	6 hours
	Politics - Political Science - Political Theory - Political ideologies - Liberalism - Conservatism - Marxism - Nationalism - Totalitarianism.	
Module:3	Political Attitudes	5 hours
	Political culture - Subculture - Political Socialization - Public Opinion - Opinion Polls.	
Module:4	Political Interactions	6 hours
	Political Communication - the Mass Media and Politics - Social Media - Media and Government - Interest Groups.	
Module:5	Parties – Elections	7 hours
	Parties - Parties in Democracies - Classification – Party systems - Elections – People Vote - Electoral System - Electoral Realignment - Democracy - Changing Positions.	
Module:6	Political Institutions	8 hours
	Legislature - the origin of Parliament system - modern day politics. Executive and Bureaucracies - Presidents and Prime ministers - Executive Leadership - Cabinets - issues and challenges. Judiciaries - Types of Law - the Court - the Bench and the Bar - Common Law vs Code Law – role of Courts - Indian Judicial System.	
Module:7	Political System Rule	6 hours
	Political Economy - Welfare of the state - the costs of Welfare - Poverty - the role of big governments - Violence and Revolution - International Relations - Power and National Interest - War and Peace - Foreign Policy.	
Module:8	Contemporary Issues	2 hours
	Total Lecture Hours	45 hours
Text Book(s)		

1.	Michael G. Roskin, Robert L. Cord, James A. Medeiros and Walter S. Jones (2019), Political Science: An Introduction, 14 th Edition, Pearson Education.		
Reference Books			
1.	Basu, Durga Das (2022), Introduction to the Constitution of India, 26 th Edition, Nagpur: Lexis Nexis Butterworths Wadhwa.		
2.	M Laxmikanth (2021), Indian Polity, 6th Edition, McGraw Hill Education (India) Private Limited, Noida.		
3.	O.P. Gauba (2019), An Introduction to Political Theory, 7th Edition, Mayur Paperbacks.		
4.	Robert Garner, Peter Ferdinand and Stephanie Lawson (2023), Introduction to Politics, 5 th Edition, OUP Oxford.		
5.	Peter Ferdinand, Robert Garner and Stephanie Lawson (2018), Politics, Oxford University Press.		
Mode of Evaluation: CAT, Quiz, Assignment and FAT.			
Recommended by Board of Studies	22-02-2023		
Approved by Academic Council	No. 69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
BHUM215L	International Relations	3	0	0	3
Pre-requisite	NIL				Syllabus version
					1.0

Course Objectives

1. To understand India's bilateral relationships and its role in global economic, security and political regimes
2. To analyse the issues and developments pertaining to India's foreign policy
3. To update the knowledge on contemporary issues and challenges at the global level

Course Outcomes

Upon successful completion of the course students will be able to

1. Trace the historical development of India's foreign policy.
2. Describe social, economic and political institutions (regional and global).
3. Critically evaluate the role of India as emerging super power.
4. Examine Sustainable Developmental goals of contemporary Indian society and the world.
5. Identify the opportunities and challenges between India and rest of the world.
6. Provide policy level solutions for the major challenges faced by India in the 21st century.

Module:1 India's International Relations: A Historical Perspective 7 hours

A Historical Perspective of diplomatic relations - Genesis of India's Foreign Policy – Objectives and Principles - Determinants - Internal and External Dimension - Non-Alignment: Concepts, Policy and Relevance - Evolution of India's Foreign Policy - Neo-Colonialism.

Module:2 India and the Global Economic and Political Scenario 5 hours

India and the United Nations: Security Council Reforms - India and World Trade Organization (WTO) -World Bank - IMF - G7 - G20.

Module:3 Emerging India 5 hours

Globalization- SWOT-Asian Century- India's Role in the World Today-Strategic Challenges.

Module:4 India's Foreign Policy towards Neighboring Countries 5 hours

Pakistan - Afghanistan - Sri Lanka - Bangladesh - Nepal - Bhutan - Maldives.

Module:5 India's Policy towards Major Powers 6 hours

USA - Russia - China - Japan - UK.

Module:6 India's Multilateral Engagement 9 hours

Association of South East Asian Nations (ASEAN) - South Asian Association for Regional Cooperation (SAARC) - East Asia Summit (EAS) - European Union (EU) - The African Union (AU) - BRICS - Shanghai Cooperation Organization - The Indian Ocean Rim Association (IORA) - The Asia-Pacific Economic Cooperation (APEC) - The North Atlantic Treaty Organization (NATO).

Module:7 India's Domestic and External Challenges 6 hours

Poverty – Education – Health - Terrorism - Climate Change - Energy and Food Security.

Module:8 Contemporary Issues 2 hours

	Total Lecture Hours	45 hours
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Text Book(s)	
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1.	Peu Ghosh (2020), International Relations, PHI Learning; 5 th Edition.
Reference Books	
1.	Deepanshu Singh (2021), International Relations -Interests & Challenges, Disha Publication.
2.	Aparna Pande (2020), From Chanakya to Modi: The Evolution of India's Foreign Policy New Delhi: Harper.
3.	Alyssa Ayres (2018), Our Time Has Come: How India is Making Its Place in the World, Oxford University Press.
4.	Arvind Gupta and Anil Wadhwa (2020), India's Foreign Policy: Surviving in a Turbulent World, SAGE Publications Pvt Ltd.
5.	Adluri Subramanyam Raju and R. Srinivasan (ed.) (2023), The Routledge Handbook of South Asia: Region, Security and Connectivity, Routledge India.
Mode of Evaluation: CAT, Quiz, Assignment and FAT	
Recommended by Board of Studies	22-02-2023
Approved by Academic Council	No. 69 Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM216L	Indian Culture and Heritage	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To enthuse the students to know more about India's rich traditions and culture
2. To inspire the students to appreciate and respect the History and Society through the Ages
3. To familiarize students on heritage sites and its history and importance

Course Outcomes

Upon successful completion of the course students will be able to

1. Illustrate the meaning of culture and heritage and the factors which contributed to themaking of our culture.
2. Examine the glory of Indian history.
3. Trace the evolution of Indian society over centuries.
4. Identify the development of our heritage and its features.
5. Explain the significance, conditions and development of ancient Indian science andtechnology.
6. Critically analyse the modernization of Indian culture from the past to the present and thefuture.

Module:1	Indian Culture	5 hours
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Concept and meaning of Culture - Culture and Civilization - Culture and Heritage - Importance of Culture in Human life - Indian Culture - Characteristics of Indian Culture - Unity and Diversity - Aspects of Indian Culture - Cultural Identities - Significance of Geography on Indian Culture - Cultural influences.

Module:2	History, Society and Culture through the Ages	9 hours
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Indus Valley Civilisation - Invasions and its impact on Indian culture - Ashoka the great - Legacy of Mauryans - Socio cultural development of Deccan and South India - Classical age of Gupta - Life of people under Delhi sultanate - Cultural development during Mughals - India in the 18th Century: Economy, Society and Culture - Origin and Evolution of Nationalist Movement.

Module:3	Indian Languages and Literature	4 hours
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Evolution of script and languages in India: Harappan Script and Brahmi Script - Role of Sanskrit: Vedas, Upanishads, Epics and Puranas - Buddhist and Jain literature in Pali and Prakrit – Evolution of regional Languages and literature: Sangam literature, Urdu and Hindi - Role of Christian missionaries in the Indian languages and literature.

Module:4	Religion and Philosophy	6 hours
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Vedic religion - Hinduism and branches - Jainism – Buddhism - Islam and Sufism - Sikhism - Bhakti movement - religious and social reform movements.

Module:5	Arts and Architecture	9 hours
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Origin and Evolution of Paintings in India - Concept of Performing Arts - Indian classical music: Ancient and Modern Indian Music and Folk Music - Dances of India: Various Dance forms - Indian Sculpture - Art schools in ancient India - Architecture: Meaning, Form and Context, The Temple, Medieval Architecture of India and Colonial Architecture – World Heritage Sites.

Module:6	Science and Technology	6 hours
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Development of Science in ancient India - Science and Technological developments in medieval India - Science and Technology in Modern India - Scientists of Ancient India - Medical Science in Ancient India.		
Module:7	Education in India	4 hours
Education in Ancient Period - Education in Modern Period - Recent development in Education - New Education Policy.		
Module:8	Contemporary Issues	2 hours
Total Lecture Hours 45 hours		
Text Books		
1.	S.B. Singh (2019), Culture and Heritage in India, Sivani Book.	
2.	Nitin Singhania (2021), Indian Art and Culture, McGraw Hill, 4 th Edition.	
3.	Poonam Dalal Dahiya (2017), Ancient and Medieval India, McGraw Hill Education.	
Reference Books		
1.	Dr. S. Srikanta Sastri, Translated by S. Naganath (2021), Indian Culture, Notion Press.	
2.	Binod Bihari Satpathy (2018) Indian culture and heritage, Catholic University of Santa Maria.	
3.	Romila Thapar (2019), Cultural Pasts: Essays in Early Indian History, Oxford University Press.	
4.	Indra Deva and Shrirama (2018), Society and Culture in India: Their Dynamics through the Ages, Rawat Publications.	
5.	Devdutt Pattanaik (2021), Indian Culture, Art and Heritage, Pearson India.	
Mode of Evaluation: CAT, Quiz, Assignment and FAT.		
Recommended by Board of Studies	23-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM217L	Contemporary India	3	0	0	3
Pre-requisite	NIL	Syllabus version			1.0

Course Objectives

1. To understand the process of making the Constitution and the Integration and Reorganization of Indian States
2. To acquaint the students with the political developments in India after Independence
3. To comprehend the socio-economic changes and progress in India

Course Outcomes

Upon successful completion of the course students will be able to

1. Understand the reconstructive events of post-independence India.
2. Examine the socio-economic transformation and political realignments in India.
3. Describe the Political developments since 1991.
4. Analyse the factors responsible for Socio – Economic issues.
5. Critically assess the opportunities and challenges in the globalized environment.
6. Review the progress of recent developments in India towards policy development.

Module:1 Making of the Republic - The Constituent Assembly 6 hours

The Legacy of Colonialism and National Movement - Framing of Indian Constitution - Constituent Assembly - Draft Committee Report - declaration of Indian Constitution - Features of Indian Constitution.

Module:2 Challenges of Nation Building (1947 – 1964) 6 hours

India on the eve of Independence - Partition of India - Integration of Princely States - Internal and External policies of Nehru - Integration and Reorganization of Indian States - Socio- Economic Reforms - Planning Commission – Five year planning.

Module:3 Political, Social and Economic Developments (1964 – 1991) 5 hours

Political Developments after Nehru Era - Green Revolution - White Revolution – Blue Revolution - Abolition of Privy Purses and Titles - Nationalization of Banks - The Emergency - Janata Government; Return of Congress to power.

Module:4 Political, Social and Economic Reforms since 1991 8 hours

Political Developments - relations with neighboring countries - Liberalization, Privatization and Globalization - important economic achievements of Vajpayee - Economic growth under Manmohan Singh - Mahatma Gandhi National Rural Employment Guarantee Act - Economic Reforms and Policy Implementation under Modi - Make in India - Digital India - Atmanirbhar Bharat – Citizenship Amendment Act (CAA) - Confidence-building Measures in Kashmir – Post COVID-19 reality.

Module:5 Emerging Trends 6 hours

An Emerging Global Power - ISRO and Its Achievements - India and Its Digitalization - Indian Smart Cities - Science, Technology and Education - Healthcare - IT - Service Industry – Governance -Concept of Society 5.0.

Module:6 Socio-Cultural and Economic Issues 6 hours

Communalism and Separatist Movements - Unemployment and Income inequalities – Inflation - Child Labour - Poverty - Gender issues - Women safety.

Module:7	Empowerment Programs	6 hours
Entrepreneurship Programs - A brief mention of ongoing welfare schemes of the Central and State Governments for women, aged, youth - Women Empowerment and Policy of Reservation.		
Module:8	Contemporary Issues	2 hours
	Total Lecture Hours	45 hours
Text Book(s)		
1.	Bipan Chandra (2017), India Since Independence, Imprint: India Penguin.	
2.	Deepak Singh (2022), India at 75 - History of Post-Independence India, Disha Publication.	
Reference Books		
1.	Chinmaya Saxena, Smiti Saxena (2021), India Post Independence, Notion Press.	
2.	Basu, Durga Das (2021), Introduction to the Constitution of India, 5 th Edition, Nagpur: Lexis Nexis Butterworths Wadhwa.	
3.	Ramachandra Guha (2017), India After Gandhi: The History of the World's Largest Democracy. New York: Ecco (Harper Collins).	
4.	Neera Chandhoke and Praveen Priyadarshi (2009), Contemporary India: Economy, Society, Politics, Pearson Education India; First edition	
5.	Sanjaya Baru (2022), Journey of a Nation: 75 years of Indian Economy, Rupa Publications India.	
6.	L,O-Paul Dana and Naman Sharma and Satya Ranjan Acharya (eds.) (2021),Organising Entrepreneurship and MSMEs across India, World Scientific India.	
7.	https://www.ibef.org/	
Mode of Evaluation: CAT, Quiz, Assignment and FAT.		
Recommended by Board of Studies	22-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C				
BHUM218L	Financial Management	3	0	0	3				
Pre-requisite	NIL	Syllabus version							
					1.0				
Course Objectives									
<ol style="list-style-type: none"> 1. To develop through understanding of the role of the financial manager 2. To learn financial decision making relates to Working Capital, Investment, Capital structure and Dividend. 3. To attain application level knowledge in financial decision making. 									
Course Outcomes									
Upon successful completion of the Course the students will be able to									
<ol style="list-style-type: none"> 1. Understand role and functions of a Financial Manager 2. Assess the linkages between the economic environment and corporate. 3. Apply Working Capital Management techniques 4. Use various capital budgeting tools and techniques 5. Critically evaluate and implement different financial decisions. 6. Demonstrate professional level financial managerial skills. 									
Module:1	Financial Management – An Overview								
4 hours									
Finance and Related Disciplines; Scope of Financial Management; Objectives of Financial Management; Primary Objective of Corporate Management; Agency Problem; Organization of Finance Function; and Emerging Role of Finance Managers in India - Economic Environment and Businesses.									
Module:2	Risk and Return of Portfolio								
5 hours									
Time Value of Money, Conceptual Framework of Risk and Return: Type of Risks; Risk and Return of a Single Asset; Risk and Return of Portfolio; Portfolio Selection; and Capital Asset Pricing Model (CAPM)									
Module:3	Capital Budgeting Decision								
7 hours									
Capital budgeting process - Estimation of relevant cash flows – Payback Period method - Accounting Rate of Return - Net Present Value - Net Terminal Value - Internal Rate of Return - Profitability Index - Capital Budgeting Under Risk –Certainty Equivalent Approach and Risk Adjusted Discount Rate.									
Module:4	Financing Decision								
7 hours									
Cost of Capital and Financing Decision - Estimation of Components of Cost of Capital: Equity Capital - Retained Earnings - Debt and Preference Capital –Weighted Average Cost of Capital and Marginal Cost of Capital - Sources of Long-Term Financing – Capital Structure - Operating and Financial Leverage - Determinants of Capital Structure.									
Module:5	Working Capital Management								
7 hours									
Meaning and Nature of Working Capital - Determination of Working Capital Requirement - A Brief Overview of Cash Management, Inventory Management and Receivables Management.									
Module:6	Dividend Decision								
4 hours									
Meaning – Types – Dividend Decision Policy – Factors Affecting Dividend Decisions - Dividend Decisions Theories.									
Module:7	Business Valuations								
9 hours									
Nature and Purpose of the Valuation of Business and Financial Assets - Models for									

the Valuation of Shares - Valuation of Debt and Other Financial Assets - Efficient Market Hypothesis (EMH) and Practical Considerations in the Valuation of Shares.		
Module:8	Contemporary Issues	2 hours
Total Lecture hours		45 hours
Text Book(s)		
1.	I.M. Pandey, (2021) Financial Management. Pearson New Delhi.	
2.	Eugene. Brigham, Joel. Houston (2021),Fundamentals of Financial management, South & Western Cengage Learning India (PVT) Ltd.	
Reference Books		
1.	Prasanna Chandra, (2022), Financial Management, Theory and Practice, Tata McGraw Hill Publishing Company, New Delhi.	
2.	M Y Khan and P K Jain, (2018), Financial Management: Text, Problems and Cases 8th Edition Tata McGraw Hill Publishing Company, New Delhi.	
3.	James.C. Van Horne, (2015), Fundamentals of Financial Management, Pearson ,UK	
Mode of Evaluation: CAT / Assignment / Quiz / Seminar / FAT		
Recommended by Board of Studies	06-03-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM219L	Principles of Accounting	3	0	0	3
Pre-requisite	NIL			Syllabus version	
				1.0	

Course Objectives

1. To understand the Accounting fundamental concepts and principles.
2. To know the accounting Process and preparation of Financial Statements.
3. To analyse the financial statements for business decision making.

Course Outcomes

Upon successful completion of the Course the students will be able to

1. Acquire knowledge on double entry system of book keeping.
2. Prepare the Financial Statements
3. Develop understanding on Global and Indian Accounting Standards.
4. Apply different depreciation methods for capital assets.
5. Analyse, interpret and use accounting data in managerial decision making.
6. Acquire knowledge on Accounting Information System

Module:1	Fundamentals of Accounting	6 Hours
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Fundamentals of Accounting – Meaning – Scope, Objects and limitations; Financial Accounting – Role of Financial Accounting – Differences – Financial Accounting - Management Accounting – Accounting concepts & convention - Bank Reconciliation Statement

Module:2	Accounting Framework	5 Hours
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Capital and Revenue items - Double Entry System - Introduction to Journal - Ledger and Procedure for Recording and Posting - Introduction to Trial Balance

Module:3	Accounting Standards	5 Hours
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IFRS - GAAP – Ind AS - Specific Standards - AS 1 : Disclosure of Accounting Policies - AS 2 : Valuation of Inventories - AS 3 : Cash Flow Statements - AS 10 : Property, Plant and Equipment - AS 11 : The Effects of Changes in Foreign Exchange Rates - AS 12 : Accounting for Government Grants - AS 13 : Accounting for Investments - AS 16 : Borrowing Costs

Module:4	Financial Statements and Analysis	9 Hours
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Financial Statements - Meaning and Components of Financial Statements - Preparation of Final Accounts - Profit and Loss Account - Balance Sheet – Problems with Simple Adjustments. Comparative Financial Statement – Common Size Financial Statements and Trend Analysis – Key Ratios

Module:5	Depreciation	6 Hours
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Depreciation – Concepts – Causes – Methods of Depreciation – Problems on Straight Line Method and Written Down Value Method.

Module:6	Accounts from Incomplete Records	6 Hours
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Single Entry System – Features - Advantages – Disadvantages - Single Entry Versus Double Entry- Statement of Affairs – Meaning – Profit Calculation.

Module:7	Accounting Information System	6Hours
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Application of Computers in Accounting- Data analytics in Accounting – Frauds and Errors – Controls. Revenue Cycle – Expenditure Cycle – Production Cycle- Payroll Accounting- Introduction to ERP, Accounting Softwares and Core Banking

Module: 8	Contemporary Issues	2 Hours
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Total Lecture hours:	45 hours
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Text Book(s)	
1.	R.L. Gupta and V. K Gupta, (2019) Principles and Practice of Accountancy, Sultan Chand and Sons
2.	S.P. Jain, K.L. Narang, Simmi Agrawal and Monika Sehgal (2018), Financial Accounting, Volume 1, 21st Edition, Kalyani Publishers, New Delhi
Reference Books	
1.	M.C. Shukla, T.S. Grewal and S.C. Gupta, (2022), Advanced Accounts Volume 1, 19th Edition, S. Chand Publishing, New Delhi
2.	S.N. Maheshwari, CA S.K. Maheshwari and S.K. Maheshwari, (2018), Advanced Accountancy, Volume 1, 11th Edition, Vikas Publishing House Ltd., New Delhi
3.	T. Horngren Charles, L. Sundern Gary, A. Elliott John, R. Philbrick Danna, (2017), Introduction to Financial Accounting, Pearson Education, India
Mode of Evaluation: CAT / Assignment / Quiz/ Final Assessment Test	
Recommended by Board of Studies	06-03-2023
Approved by Academic Council	No. 69 Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM220L	Financial Markets and Institutions	3	0	0	3
Pre-requisite	NIL	Syllabus Version		1.0	
Course Objectives					

1. To understand the structure, operations and different instruments of capital markets
2. To explain the role and challenges of financial intermediation
3. To acquire knowledge on the regulatory framework of the financial system

Course Outcomes

Upon successful completion of the course students will be able to

1. Explain the regulator's role in a country's Financial System.
2. Articulate the structure of Indian capital market operations.
3. Appreciate the operation of the capital market.
4. Comprehend the Money market operations.
5. Assimilate the role of depositories and stock broking services.
6. Explain various financial services offered by financial institutions.

Module:1	An Overview of Financial Environment	7 hours
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The nature and role of financial system- Financial structure – Different financial functions - Role of financial Markets and Institutions - Recent developments. Indian financial system – History and developments. Globalization and financial sector changes. Reforms in the financial system.

Module:2	Financial Institutions	6 hours
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Overview of Financial Institutions - Regulatory and non - regulatory institutions - Banking and nonbanking institutions – Role and functions.

Module:3	Regulatory Framework	6 hours
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Financial system regulators: Reserve Bank of India (RBI) – Securities and Exchange Board of India (SEBI) – Pension Fund Regulatory and Development Authority (PFRDA) - Insurance Regulatory and Development Authority (IRDA). Role and functions – Acts and regulations.

Module:4	Primary Market	5 hours
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New issues - Primary market operation - Intermediaries – lead managers - underwriting- bankers to Issue - listing mechanism – listing regulations. Registrar and share transfer agents.

Module:5	Secondary Market	7 hours
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Stock exchanges - intermediaries and stock broking services – custodial services – depository System - clearing and settlement systems. Role of technology in financial markets operations.

Module:6	Money Market	5 hours
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Instruments - Intermediaries – importance and applications.

Module:7	Financial Services	7 hours
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Fee based Financial services: Merchant banking - Mergers and Acquisitions – Credit Syndication - Credit Rating. Fund based Financial services: Leasing – Hire Purchasing- Mutual Funds - Bills Discounting – Factoring and Forfaiting – Housing finance – Venture Capital – Insurance.

Module:8	Contemporary Issues	2 hours
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	Total Lecture Hours	45 hours
Text Book (s)		
1. Bharti V. Pathak (2018), Indian Financial System, Pearson India, 5 th Edition.		
2. Anthony Saunders, Marcia Millon Cornett and Anshul Jain (2021), Financial Markets and Institutions, McGraw Hill, 7 th Edition.		
Reference Books		
1. L.M.Bhole and Jitendra Mahakud (2017), Financial Institutions and Markets. Structure, Growth and Innovations, McGraw Hill Education, 6 th Edition.		
2. Mishkin, Frederic S, Stanley G Eakins, Tulsi Jayakumar and R.K.Pattnaik (2017), Financial Markets and Institutions, Pearson Education, 8 th Edition.		
Mode of Evaluation: CAT, Quiz, Assignment and FAT.		
Recommended by Board of Studies	23-02-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C			
BHUM221L	Economics of Money, Banking and Financial Markets	3	0	0	3			
Pre-requisite	NIL	Syllabus version						
		1.0						
Course Objectives								
1. To create awareness about Financial Markets 2. To make students understand the nuances of Financial Economics 3. To create awareness about the working of Banks and Financial Institutions								
Course Outcomes								
Upon successful completion of the course students will be able to 1. Describe financial markets and institutions. 2. Explain the functions of money 3. Define and apply interest rate dynamics 4. Critically evaluate monetary policy and its tools 5. Interpret exchange rate changes and its impact 6. Articulate the interconnected dynamics of the financial system.								
Module:1	Financial System and Economic Indicators	7 hours						
Financial System – Financial Markets - Banking and Financial Institutions - Regulatory Framework. Global and National Macroeconomic Indicators – Economic Growth, Money Supply, Inflation and Interest Rates. Business Cycles. Role of Commodity Markets. Monetary Policy and its uses.								
Module:2	Money Supply, Liquidity and Credit	6 hours						
Money – Meaning and Functions - Money Supply - Types – Liquidity Theory – RBI's Monetary and Liquidity Aggregates - Factors influencing Supply and Demand for Money. Credit Multiplier – Determinants of Credit.								
Module:3	Interest Rates	6 hours						
Understanding Interest Rates and Return. Real and Nominal Interest Rates. Changes in interest rates. Term Structure of Interest Rates. Behavior of Interest Rates - Asset Demand – Demand in Bond and Money Markets – Equilibrium Interest Rates – Shifts in Equilibrium Rates.								
Module:4	Central Banking and Monetary Policy	5 hours						
Central Bank – Role and Functions. Central Bank's Balance Sheet and the Control of Monetary Base. Monetary Policy – Goals and Tools. Monetary Transmission Mechanism – Channels. Reserve Bank of India – Objectives, Organization, Functions and Role. Financial Stability - Regulation and Enforcement – Debt Management - Currency Management.								
Module:5	The Foreign Exchange Market	7 hours						
Foreign Exchange Market – Foreign Exchange Rates – Determination – Changes in the Exchange Rates. Law of One Price – Purchasing Power Parity Theory. Exchange Rates in the Short run and Long run. Big Mac Index. Currency War.								
Module:6	The Keynesian IS-LM Model	5 hours						
Aggregate Demand – Keynesian View, Shifts in Aggregate Demand and Aggregate Supply - Determination of Aggregate Output, Investment and the Role of the Government. The ISLM Model – Equilibrium in the Goods Market and Money Market. Monetary and Fiscal Policy in ISLM Model.								
Module:7	Financial Crises and Learning	7 hours						

Great Depression in the US 1929 - South Asian Financial Crises - 1997-98. Financial Crisis in Mexico 1994-95 and Argentina - 2001-02. Subprime Financial Crisis - 2007-08. Banking Crises. Factors causing financial Crises – Agency Problem – Housing Price Bubbles – Financial Innovations.

Module:8	Contemporary Issues	2 hours
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Total Lecture Hours	45 hours
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Text Book(s)

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| 1. | Frederic S Mishkin (2021), The Economics of Money, Banking and Financial Markets, Pearson Education Limited, 13 th Edition. |
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Reference Books

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| 1. | N. Gregory Mankiw (2022), Principles of Macroeconomics, Cengage India, 9 th Edition. |
| 2. | O. Blanchard (2020), Macroeconomics, Pearson Education, 7 th Edition. |

Mode of Evaluation: CAT, Quiz, Assignment and FAT

Recommended by Board of Studies	23-02-2023
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Approved by Academic Council	No. 69	Date	16-03-2023
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Course Code	Course Title	L	T	P	C				
BHUM222L	Security Analysis and Portfolio Management	3	0	0	3				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
1. To create awareness about functions and structure of financial markets and institutions 2. To make students understand the nuances of investment decision making 3. To achieve investment advisory skills									
Course Outcomes									
Upon successful completion of the course students will be able to 1. Describe the linkages between Macroeconomic environment and financial markets. 2. Explain theoretical foundations of financial markets. 3. Demonstrate skills in financial statement analysis. 4. Apply financial security analysis. 5. Execute portfolio construction and evaluation techniques. 6. Demonstrate professional investment advisory skills.									
Module:1	Macroeconomics and Financial Market	6 hours							
Financial Markets and the Economy- Economic Growth, Business Cycles, Inflation, Interest Rates, Commodity Prices. Monetary and Fiscal Policy. Global Economic Indicators. Financial Market - Instruments – Institutions - Regulatory Framework. Trading: Trading mechanics – Types of Orders – Margins.									
Module:2	Investment Theories	7 hours							
Risk and Return – Mean, Variance, Covariance and Standard Deviation. Efficient Market Hypotheses- Random Walk – Modern Portfolio Theory – Dow Theory. Mean – Variance Portfolio Theory - Beta – Capital Asset Pricing Model (CAPM). Security Market Line (SML) Efficient Frontier. Portfolio Models. Index Models – Single and Multi -Index Models. Fama- French Model.									
Module:3	Financial Statement Analysis	6 hours							
Financial Statements – Standalone Vs Consolidated – Analysis of Balance Sheet, Profit and Loss and Cash flow Statement. Ratio Analysis – Investment Related Ratios (Return, Operating and Profitability Ratios). Common size and Comparative size Statement Analysis.									
Module:4	Fundamental and Technical Analysis	5 hours							
Economy – Industry - Company Analysis - Top down approach-Value investing principles - Short term vs Long term investing - Qualitative and Quantitative factors. Valuation models. Technical Analysis - Chart Types – Candle Chart, Bar Chart, Line Chart – Chart Patterns – Candle Patterns. Technical Indicators – Oscillators – Rule Based Trading Strategies.									
Module:5	Equity Valuation	7 hours							
Cost of capital – Weighted Average Cost of Capital (WACC) - Growth estimation - cash flow estimation – Discounted Cash Flow (DCF) models. Stock Valuation: Stock Valuation models - Dividend Discount Models, Price-Earnings Ratio, Free Cash flow - Valuation Approaches.									
Module:6	Fixed Income Securities	5 hours							
Bonds - Corporate and Government securities - Treasury Securities - Types. Bond - Yield,									

Maturity and Bond valuation - duration and modified duration - Bond Portfolio Strategies.			
Module:7 Portfolio Management	7 hours		
Diversification and Portfolio Risk, Combination of risky assets – Portfolio possibilities curve. Portfolio Management Process - tools and techniques, Sharpe Ratio, Jensen Alpha and Treynor Index. Coffee Can Investing. Mutual Funds and Alternate Investments - Mutual Funds – Classification – Mutual Fund Investments – Systematic Investment Plan (SIP) - Hedge Funds - Real Estate Investment Trusts (REITs).			
Module:8 Contemporary Issues	2 hours		
Total Lecture Hours 45 hours			
Text Book(s)			
1. Zvi Bodie, Alex Kane, Alan J. Marcus and Pitabas Mohanty (2019), Investments, McGrawHill, 11 th Edition.			
2. Prasanna Chandra (2021), Investment Analysis and Portfolio Management, McGraw Hill, 6 th Edition.			
Reference Books			
1. Frank Reilly and Keith C Brown (2019), Investment Analysis and Portfolio Management, Cengage, 11 th Edition.			
2. Charles P Jones (2016), Investments: Principles and Concepts. Wiley Finance, 12 th Edition. Edwin J Elton, Martin J Gruber, Stephen J Brown and William N.Goetzmann (2015), Modern Portfolio Theory and Investment Analysis. John Wiley, 9 th Edition.			
Mode of Evaluation: CAT, Quiz, Assignment and FAT			
Recommended by Board of Studies	23-02-2023		
Approved by Academic Council	No. 69	Date	16-03-2023

Course Code	Course Title	L	T	P	C				
BHUM223L	Options, Futures and other Derivatives	3	0	0	3				
Pre-requisite	NIL	Syllabus version							
Course Objectives	1.0								
1. To identify the basic principles of Derivatives Market 2. To define the nature of risk and identify hedging strategies 3. To describe the principles of risk management and the role of the risk manager									
Course Outcomes									
Upon successful completion of the course students will be able to 1. Examine the role of Risk Manager in the Financial Planning Process. 2. Analyze and evaluate various risk exposures. 3. Compare and contrast the different types of derivatives. 4. Identify the different types of options. 5. Critically evaluate Option Pricing Mechanism. 6. Explain the concept of commodity derivatives.									
Module:1	Financial Risks – An Overview	7 hours							
Financial Risk - Types - Market Risk - Credit Risk - Liquidity Risks - Operational Risk - Commodity Price Risk - Trading Risk - Portfolio Risk. Global Financial Crises and RiskManagement – Hedging - Tools and Techniques.									
Module:2	Derivatives	6 hours							
Derivatives – definition - classification. Risk - risk management. Futures Vs. forwards, Over the Counter (OTC) Vs. exchange traded contracts. Futures and options on stocks, indices, commodities, exchange rates etc., understanding quotes.									
Module:3	Futures and Forwards	6 hours							
Futures: Specification-spot, forward and future relationship convergence – delivery and settlement. Margi-margin call. Hedging strategies using futures. Determination of forward and future prices.									
Module:4	Options	7 hours							
Options: Mechanics of option market - option properties – Put, Call, American and European options. Put - Call parity - underlying asset. Option pricing model: Black-Scholes option pricing model assumptions - theoretical Vs market price – volatility - historical and implied volatility- volatility estimation - volatility smile. Option Greeks: Delta - delta hedging – theta – Gamma - Vega-Rho - relationship between them.									
Module:5	Option Trading Strategies	5 hours							
Single option strategies - Multiple option strategies – Neutral and Volatility based strategies.									
Module:6	Credit Derivatives	5 hours							
Credit derivatives: Credit risk - credit default swap – Asset backed Securities – collateralized securities. Swaps: LIBOR – interest rate swaps - currency swaps- total return swaps – other types.									
Module:7	Commodity Derivatives	7 hours							
Commodity derivatives: Commodity market – commodity price risk – futures and options on commodities – hedging using commodity derivatives.									
Module:8	Contemporary Issues	2 hours							
Total Lecture Hours									
Text Book(s)									

1. Hull, John.C and Shankarshan Basu (2022), Options, Futures and other Derivatives, Pearson, 11 th Edition			
2. Don M Chance, Robert Brooks and Sanjay Dhamija (2019), An Introduction to Derivatives and Risk Management, Cengage India, 10 th Edition.			
Reference Books			
1. John Hull (2012), Risk Management and Financial Institutions, Wiley.			
2. Robert A. Strong (2016), Derivatives An Introduction Second Edition, South-Western.			
Mode of Evaluation: CAT, Quiz, Assignment and FAT			
Recommended by Board of Studies	23-02-2023		
Approved by Academic Council	No. 69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
BHUM224L	Fixed Income Securities	3	0	0	3
Pre-requisite	NIL	Syllabus version		1.0	

Course Objectives

1. To make the students comprehend the specific features of the Indian and Global Fixed Income securities markets
2. To make the students learn and use the term structure theories to form fixed income portfolio techniques and to use the appropriate immunization strategies to manage the fixed income portfolio
3. To make the students understand Government securities market

Course Outcomes

Upon successful completion of the course students will be able to

1. Comprehend the bond market and players in the bond market.
2. Value the bonds under changing interest rate market scenario.
3. Apply the term structure theory in forecasting the future interest rates.
4. Grasp the price sensitivity of bonds to changing interest rate and apply quantitative immunization strategy to mitigate the risk.
5. Construct the bond portfolio to accommodate the changing interest rates.
6. Explain corporate debt markets.

Module:1 Instruments and Characteristics	7 hours
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Fixed Income Securities - Bond and Money Markets – Instruments- Bond Features and Types – Risk Associated with Bonds. Pricing of Bonds - Review of Time value of Money – Fixed and Floating Rate Securities. Nominal Vs Real Interest Rates Coupon Rate and Current Yield, Zero Coupon Rate – Supply and Demand of Bonds – Changes in Equilibrium Interest Rates.

Module:2 Volatility and Term Structure of Interest Rates	6 hours
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Term Structure of Interest Rates – Classical Theory of Term Structure. Yield Curve, Zero Coupon Bond Yield Curve. Bond Price Volatility – Price Sensitivity – Immunization – Measurement of Duration, Modified Duration- Convexity Measurement, Factors influencing yield. Term Structure of Interest Rate, Spread, Corporate Debt Instruments.

Module:3 Fixed Income Portfolio Management	6 hours
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Active and Passive Bond Portfolio Construction – Management Strategies. Indexing – Bond Indices. Setting Portfolio Objectives, Interpreting Portfolio Parameters and Performance Measurement.

Module:4 Risk and Risk Management	5 hours
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Interest Rate Risk- Impact on Bonds – Risk Management – Tools and Techniques. Swaps and Futures, Credit Derivatives – Credit Default Swaps, Plain Vanilla Options and Exotic derivatives.

Module:5 Securitization	7 hours
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Mortgage backed securities – Collateral Mortgage Obligations – Asset backed securities – Collateral Debt Obligation.

Module:6 Indian Government - Securities Market	5 hours
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Government Security (G-Sec) – Participants - How they are issued – Auction-Auction Type -Open Market Operation – Repo and Reverse Repo - Liquidity Adjustment Facility. Treasury Bills. Yield Calculation.

Module:7 Corporate Debt Markets	7 hours
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Primary and Secondary Markets- Corporate Debt Instruments – Types – Bond with embedded Options- Sinking Funds – Convertible Bonds- Warrants. Commercial Papers – Preference Shares – High Yield Bonds. Credit Analysis - Credit Rating - Methodology.

Module:8	Contemporary Issues	2 hours
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	Total Lecture Hours	45 hours
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Text Book(s)

- | | |
|----|---|
| 1. | Frank J. Fabozzi (2012), Bond Markets, Analysis and Strategies, Pearson India, 9 th Edition. |
| 2. | Moorad Choudhry, Masekoldrisch (2012), Fixed Income Market: Instruments, Application, Mathematics. Wiley Finance Series, 2 nd Edition. |

Reference Books

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|----|--|
| 1. | Fabozzi, F.J (2017), The Handbook of Fixed Income Securities, McGraw Hill Education, 8 th Edition. |
| 2. | Choudhry (2010), Fixed Income Securities and Derivatives Handbook, Wiley, 2 nd Edition. |
| 3. | Suresh Sundaresan (2009), Fixed Income Markets and their Derivatives, Academic Press Inc, 3 rd Edition. |

Mode of Evaluation: CAT, Quiz, Assignment and FAT.

Recommended by Board of Studies	23-02-2023
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Approved by Academic Council	No. 69	Date	16-03-2023
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Course Code	Course Title	L	T	P	C				
BHUM225L	Personal Finance	3	0	0	3				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
<p>1. To explain the aspects of financial planning like savings, investment, taxation, insurance & retirement planning and to develop necessary skills to become a successful financial planner</p> <p>2. To impart knowledge on various investment instruments</p> <p>3. To make the students understand the personal finance planning process with its elements</p>									
Course Outcomes									
<p>Upon successful completion of the course students will be able to</p> <p>1. Describe outline the meaning and relevance of financial planning.</p> <p>2. Identify the need for career planning and financial services.</p> <p>3. Examine the concept of personal tax planning</p> <p>4. Explain the concept of investment planning and its methods.</p> <p>5. Analyze insurance planning and its relevance.</p> <p>6. Demonstrate personal financial advisory skills.</p>									
Module:1	Personal Finance Foundations	7 hours							
<p>The financial planning process – setting goals-achieving goals. Time value of money and opportunity cost concepts. Economic Way of Thinking. Career Planning and Financial Planning - Career choice – opportunities – long term career development. Money management – personal financial records – asset and liability – budgeting.</p>									
Module:2	Macroeconomic Environment	6 hours							
<p>Economic growth – Household Savings – Circular Flow of Income - Business Cycles - Inflation – Interest rates - Banking and financial markets.</p>									
Module:3	Tax Planning	6 hours							
<p>Tax Planning - Income tax – Tax Slabs - Gross Income and Taxable Income – Eligible Deductions – HRA Calculations – HRA Exemptions - Tax Deducted at Source (TDS). Tax on property, wealth and earnings. Tax filing – PAN and TAN – Tax planning strategies. Capital Gains – Short Term and Long Term Capital Gains and Taxes.</p>									
Module:4	Credit Planning	5 hours							
<p>Credit Planning - Types of Credit – Home, Auto and Personal loans. Mortgage Loans – Reverse Mortgage Loans - Consumer Credit - Credit Cards - Purchasing decisions - Credit Score (CIBIL).</p>									
Module:5	Insurance Planning	7 hours							
<p>Need for Protection Planning - Risks of Mortality - Life Insurance - Term Insurance - Whole Life Insurance – Endowment Policy - Money Back Policy - Children Policies - Annuity Plans – Unit Linked Insurance Policies (ULIP). Health insurance - Cashless Facility - Exclusions-Add – ons. Motor Insurance – Liability Only Policy – Package Policy - Coverage and Exclusions. Travel Insurance - Property and General insurance - Insurance and Tax planning.</p>									
Module:6	Investment Management	5 hours							

Investment plan - Process and Objectives - Risk and Return - Portfolio Risk and Return - Diversification. Factors influencing investment – asset allocation - source of information. Investing in stocks – short term vs long term – stock evaluation and analysis. Mutual funds and Systematic Investment Plans (SIP). Fixed income securities - real estate investments - Precious metals – alternate investments - Commodities - Various Savings Schemes.

Module:7	Retirement Planning	7 hours
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Controlling Financial Future: Retirement planning – Financial analysis - Planning for retirement income. Pension Schemes - Estate planning – Will – Trust - Estates.

Module:8	Contemporary Issues	2 hours
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Total Lecture Hours **45 hours**

Text Book(s)

1. Kapoor, J.R, Les R Dlabay, Robert J Hughes and M.M.Hart (2020), Personal Finance, McGraw Hill, Twelfth Edition.
2. Gitman, Joehnk, and Billingsley (2015), Personal Financial Planning, Cengage Learning, Thirteenth Edition.

Reference Books

1. Thomas Garman and Raymond Forgue (2014), Personal Finance, South Western College, Publishing, 12th Edition.
2. Arthur J. Keown (2019), Personal Finance, Pearson, 8th Edition.
3. Jeff Madura (2020), Personal Finance, Pearson, 7th Edition.

Mode of Evaluation: CAT, Quiz, Assignment and FAT.

Recommended by Board of Studies 23-02-2023

Approved by Academic Council No. 69 Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM226L	Corporate Finance	3	0	0	3
Pre-requisite	NIL	Syllabus version		1.0	

Course Objectives

1. To provide foundational knowledge of corporate finance.
2. To analyse and interpret major corporate issues and challenges.
3. To advance strategic financial decision-making skills

Course Outcomes

Upon successful completion of the Course the students will be able to

1. Understand the foundational theories and concepts of corporate finance
2. Analyze capital budgeting process and techniques
3. Estimate cost of capital with due consideration of risk and returns.
4. Evaluate long term financing decisions
5. Develop strategic understanding of Mergers, Acquisition and Corporate Restructuring
6. Demonstrate application orientation skills in valuation

Module:1	Corporate Finance: Introduction	6 hours
Scope and Objectives of Corporate Finance - Overview of Financial Management Process - Financial Goals and Constraints - Role of Financial Manager - Tools of Corporate Finance -Understanding of Financial Statements and Cash Flows - Corporate Financing Decision – Corporate Taxes		
Module:2	Net Present Value and Investment rules	6 hours
Time Value of Money - Present and Future Value of Single Payments - Capital Budgeting Tools and Techniques and Decisions		
Module:3	Cost of Capital, Risk and Return	7 hours
Concepts of Risk and Return – Diversifiable and Non - Diversifiable Risk – Risk Return Trade off- Cost of Capital - Cost of Debt Capital - Cost of Equity Capital - Cost of Preference Capital- Weightage Average Cost of Capital- Capital Asset Pricing Model (CAPM) - Security Market Line (SML).		
Module:4	Long Term Financing	5 hours
Early Stage Financing – Venture Capital - IPO – FPO - Rights Issue. Equity – Common and Preferred Stock; Debt – Bank Loans- Bonds – International Bonds - Capital Dilution – Leasing - Types of Leasing.		
Module:5	Mergers, Acquisition and Corporate Restructuring	6 hours
Merger and Acquisition in India, Forms of Merger, Concept of Acquisition, Difference between Merger and Acquisition, Strategic Rationales for M&A, Steps in M&A Process, Due Diligence, Regulatory Framework for M&A - Corporate Restructuring.		
Module:6	Valuation: Principles and Practice	8 hours
Concept of Valuation - Equity Valuation – Valuation Models - Dividend Discount Model - Discounted Cash Flow Model - Residual Income Model – Asset - based Model.		
Module:7	International Corporate Finance	5 hours
Foreign Exchange Markets - Exchange Rates – Exchange Rate Risk – Interest Rate – Interest Rate Risk – International Capital Budgeting – Political Risk – Risk Management Tools.		

Module:8	Contemporary Issues	2 hours
		Total hours: 45 hours
Text Book(s)		
1. Aswath Damodaran (2020) Corporate Finance: Theory and Practice John Wiley & Sons.		
2. Ross, S. A., Westerfield, R., Jordan, B. D., & Biktimirov, E. N. (2021) Fundamentals of Corporate finance. McGraw-Hill		
Reference Books		
1. Brealey Myer (2013) Principles of Corporate Finance McGraw-Hill Education.		
2 Vernimmen, P., Quiry, P., & Le Fur, Y. (2022). Corporate finance: theory and practice. John Wiley & Sons.		
3 Jonathan Berk, Peter DeMarzo, Jarrad Harford, Fundamentals of Corporate Finance (2019, 3 rd Edition), Pearson, India.		
Mode of Evaluation: CAT / Assignments / Quiz/ Final Assessment Test		
Recommended by Board of Studies	06-03-2023	
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C			
BHUM227L	Financial Statement Analysis	3	0	0	3			
Pre-requisite	NIL	Syllabus version						
		1.0						
Course Objectives								
<ol style="list-style-type: none"> 1. To Provide framework for Financial Statement Analysis 2. To develop a thorough understanding of tools and techniques of Financial Statements 3. To understand the application of tools and techniques in the Financial Statement Analysis. 								
Course Outcomes								
Upon successful completion of the Course the students will be able to								
<ol style="list-style-type: none"> 1. Understand role and purpose of Financial Statement Analysis 2. Apply various tool and techniques to analyze Financial statements 3. Carry out effective Cash Flow Analysis 4. Estimation of Enterprise value 5. Forecast Company's Financial Statements 6. Evaluate Company's Performance using Credit Analysis 								
Module:1	Framework for Financial Statement	5 hours						
Nature and Objectives of Financial Statements - Uses and Limitations of Financial Statements -Types of Financial Statements - Balance Sheet, Income Statement, Cash Flow Statement - Stakeholders of Financial Statements - Financial Reporting - Role of Auditor								
Module:2	Tools and Techniques of Financial Statement Analysis	5 hours						
Ratio Analysis - Profitability ratio, Liquidity ratio, Short - Term and Long - Term Solvency Ratios - Operating and Financial Leverages- EPS and other Ratios used in Valuation – P/E and PB ratio- Dividend Payout Ratio- Application of Ratios to Prepare the Balance Sheet								
Module:3	Cash Flow Analysis and Estimation	6 hours						
Cash Flow Statement - Financing, Investing, and Operating Activities As per AS 3 - Preparation of the Cash Flow Statement - Earnings before Interest and Taxes (EBIT), - EBITDA and Total Enterprise Value								
Module:4	Inter Corporate Transactions	6 hours						
Corporate Investment Category- Minority Passive and Minority Active Investments. Joint Ventures – Controlling Interest Investments – Pooling of Interest – Impact of Pooling – Consolidated Financial Statements – Goodwill- Goodwill Impairment- Specil Purpose of Entity -Securitization of Assets.								
Module:5	Forecasting Financial Statements	7 hours						
A Typical One -Year Projection - Sensitivity Analysis with Projected Financial Statements - Projecting Financial Flexibility - Pro Forma Financial Statements - Multiyear Projections								
Module:6	Credit Analysis	7 hours						
Meaning of Credit Risk – Importance and Limitations-7 C' of Credit Worthiness								

Analysis- Credit Rating Process - Combination Ratios - Ratios Relating to Credit Risk		
Module:7	Equity Analysis	7 hours
The Dividend Discount Model - The Price-Earnings Ratio - The Du Pont Formula - Valuation Through Restructuring Potential		
Module:8	Contemporary Issues	2 hours
	Total Lecture hours	45 hours
Text Book(s)		
1.	Martin S. Fridson (Author), Fernando Alvarez (2022), Financial Statement Analysis: A Practitioner's Guide, Wiley Finance	
2.	Gerald I. White, Ashwinpaul C. Sondhi, and Haim D. Fried.3e The Analysis and Use of Financial Statements, Wiley Publication	
3.	P. C. Tulsian, CA Bharat Tulsian, Tushar Tulsian (2022), Analysis of Financial Statements, Tcom Prints	
Reference Books		
1.	K. R. Subramanyam, (2020), Financial statement analysis, Published by McGraw-Hill Education, New York.	
2.	Sandeep Goel (2014), Financial statement analysis, Publisher: Routledge Taylor & Francis Group.	
3.	Robinson, Greuning, Henry, and Broihahn (2009) International Financial Statement Analysis. Published by John Wiley & Sons, Inc., Hoboken, New Jersey.	
Mode of Evaluation: CAT / Assignment / Quiz / Seminar / FAT		
Recommended by Board of Studies		06-03-2023
Approved by Academic Council	No. 69	Date 16-03-2023

Course Code	Course Title	L	T	P	C
BHUM228L	Cost and Management Accounting	3	0	0	3
Pre-requisite	NIL				Syllabus version
					1.0

Course Objectives

1. To familiarize the students with the basic management and cost accounting concepts
2. To develop an understanding of the decision choices in business.
3. To gain the application of budgeting techniques in management decision making.

Course Outcomes

Upon successful completion of the Course the students will be able to

1. Gain a working knowledge of the principles of cost and Management accounting
2. Express the place and role of cost sheet in Organization
3. Prepare Material, Labour, Overheads cost and activity based costing to control them effectively
4. Apply the skills of Marginal costing techniques in managerial decision making
5. Assess the performance and control cost by analyzing the variance
6. Prepare Cash flow and different functional budgets

Module:1	Overview of Cost and Management Accounting	4 hours
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Meaning - Cost & Management Accounting – Accounting Information on Managerial Decisions - Differences between Management Accounting and Cost Accounting

Module:2	Cost - Sheet	4 hours
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Meaning, Elements of Cost- Preparation of Cost sheet, Basics of Tender and Quotations

Module:3	Materials, Labour, and Overhead Cost	8 hours
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Materials, Labour, Overhead: Purchase Procedure- MRP (Materials Requirement Planning), EOQ (Economic Ordering Quantity); Methods of Labor Remuneration; Overhead Absorption- Activity Based Costing

Module:4	Marginal Costing	8 hours
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Introduction- Significance of P/V ratio, BEP (Break-even Point), MOS (Margin of safety) - Make or Buy Decisions, Accepting Order, Product Mix Decision, Shutdown

Module:5	Standard Costing	7 hours
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Meaning, Characteristics, Objectives, Differences between Estimated Costing and Standard Costing, Budgeting, and Standard Costing Differences - Variance Analysis - Material Cost Variance only

Module:6	Cash Flow	5 hours
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Preparation of Cash Flow – Investment Activities – Operating Activities – Financing Activities

Module:7	Budgeting	7 hours
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Meaning, Nature, Functions of Budgeting, Process of Budget Control- Zero Based Budgeting, Preparation of Budget- Flexible Budget, Production Budget, Purchase Budget

Module:8	Contemporary Issues	2 hours
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Total Lecture hours	45 hours
Text Book(s)	
1.	Colin Drury, 11 th Edition (2020) Management and Cost Accounting, Cengage Learning Publication.
2.	Jain, S.P. and K.L. Narang, (2019) Cost and Management Accounting, Kalyani Publishers.
Reference Books	
1.	C.A. Chhawchharia, C.A. Yash 4 th Edition, (2022), Cost & Management Accounting, Taxmann Books Publications.
2.	CA. P C Tulsian (2022) Cost & Management Accounting, S.Chand Publications
3.	M. N. Arora 11 th Edition (2021), A Textbook of Cost and Management Accounting, S. Chand Publications.
4.	Khan, M.Y. and P.K. Jain,(2013), Management Accounting, Tata McGraw Hill, Publishing, New Delhi
5.	S.N. Maheshwari, (2013), Management Accounting, S. Chand Publications, New Delhi.
Mode of Evaluation: CAT / Assignment / Quiz / Seminar / FAT	
Recommended by Board of Studies	06-03-2023
Approved by Academic Council	No. 69 Date 16-03-2023

Course Code	Course Title	L	T	P	C
BSTS301P	Advanced Competitive Coding – I	0	0	3	1.5
Pre-requisite	NIL			Syllabus version	1.0

Course Objectives

1. To develop the step by step approach in solving problems with the help of programming techniques of data structures.
2. To deploy algorithms in real time applications.

Course Outcomes

At the end of the course the student should be able to

1. Provide a basic understanding of core Java concepts
2. Identify Bitwise algorithms for solving real world problems.
3. Illustrate various techniques for searching, sorting and hashing
4. Understand and implement Greedy Algorithm.

Module:1	Algorithms	6 hours
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Java Introduction, Features, Structure, Data Types, Basic I/O Operators, Decision making and Control structure, Time & Space complexity.

Module:2	Math based problems	6 hours
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Simple Sieve, Segmented & Incremental Sieve, Euler's phi Algorithm, Strobogrammatic Number, Remainder Theorem, Toggle the switch & Alice Apple tree, Binary Palindrome.

Module:3	Bitwise algorithms	6 hours
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Booth's Algorithm, Euclid's Algorithm, Karatsuba Algorithm, Longest Sequence of 1 after flipping a bit Swap two nibbles in a byte

Module:4	Arrays and Searching	6 hours
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Block Swap Algorithm, Max product subarray, Maximum sum of hour glass in matrix, Max Equilibrium Sum, Leaders in array, Majority element.

Module:5	Sorting and String	6 hours
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Lexicographically first palindromic string, Natural Sort order , Weighted substring ,Move hyphen to beginning, Manacher's Algorithm

Module:6	Recursion and Back tracking	6 hours
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Sorted Unique Permutation, Maneuvering, Combination, Josephus trap, Maze Solving, N Queens Problem.

Module:7	Greedy Algorithm:	6 hours
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Warnsdorff's Algorithm, Hamiltonian Cycle, Kruskal's Algorithm ,Activity Selection Problem, Graph Coloring, Huffman Coding

Module:8	Interview Preparation	3 hours
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Networking , Security, Crypton Techniques

Total Lecture hours:	45 hours
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Text Book

1.	Mark Allen Weiss, "Data structures and algorithm analysis in C++", 2019, 4th Edition, Pearson Education.
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Reference Books

1.	J.P. Tremblay and P.G. Sorenson, "An Introduction to Data Structures with applications", 2017, Second Edition, Tata Mc Graw Hill.
2.	Richard M. Reese, Jennifer L. Reese, Alexey Grigorev , Java: Data Science Made Easy,2019, Pocket Publishing.

Mode of Evaluation: Written assignment, Quiz, Project & FAT.			
Recommended by Board of Studies	24-02-2023		
Approved by Academic Council	No. 69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
BSTS302P	Advanced Competitive Coding – II	0	0	3	1.5
Pre-requisite	NIL	Syllabus version		1.0	

Course Objectives

1. To deploy algorithms in real time applications.
2. To develop the step by step approach in solving problems with the help of programming techniques of data structures.

Course Outcomes

At the end of the course the student should be able to

1. Identify List, Stack based algorithms for solving real world problems.
2. Illustrate various techniques for searching, sorting and hashing.
3. Understand and implement Dynamic Programming.
4. Design new algorithms or modify existing algorithms for new application.

Module:1	Linked list	6 hours
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Loop Detection, Sort the bitonic DLL, Segregate even & odd nodes in a LL, Merge sort for DLL, Minimum Stack, The Celebrity problem.

Module:2	Stack and Queue	6 hours
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Iterative Tower of Hanoi, Stock Span problem, Priority Queue using DLL, Sort without extra Space, Max Sliding Window Stack permutations

Module:3	Trees	6 hours
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Recover the BST, Views of tree, Vertical order traversal, Boundary traversal.

Module:4	Graphs	3 hours
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BFS, DFS, Dial's Algorithm, Bellman-Ford Algorithm

Module:5	Heaps	3 hours
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Topological Sort, Heap Sort, Binomial heap, K-array heap Winner tree.

Module:6	Maps, Sets and Hashing	6 hours
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HashMap to TreeMap, Types of Sets , Distributing items when a person cannot take more than two items of same type

Module:7	Dynamic Programming	9 hours
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Longest Common Subsequence, Longest Increasing Subsequence, Longest Bitonic Subsequence, Longest Palindromic Subsequence, Subset sum problem, 0-1 Knapsack, Traveling Salesman, Coin Change, Shortest Common Super sequence, Levenshtein Distance problem , Rod Cutting problem, Wildcard pattern matching, Pots of gold game

Module:8	Product Company Specific Interview Preparation -2	6 hours
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Operating Systems, Data Base Management Systems, Relational Data Base Management Systems.

	Total Lecture hours	45 hours
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Text Book

1.	Mark Allen Weiss, "Data structures and algorithm analysis in C++", 2019, 4th Edition, Pearson Education.
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Reference Books

1.	J.P. Tremblay and P.G. Sorenson, "An Introduction to Data Structures with applications", 2017, Second Edition, Tata Mc Graw Hill.
2.	Richard M. Reese, Jennifer L. Reese, Alexey Grigorev, Java: Data Science Made Easy, 2019 Pocket Publishing.

Mode of Evaluation: Written Assignment, Quiz, Project & FAT.			
Recommended by Board of Studies	24-02-2023		
Approved by Academic Council	No.69	Date	16-03-2023

Course Code	Course Title	L	T	P	C
BECE351E	Internet of Things	1	0	2	2
Pre-requisite	NIL	Syllabus version		1.0	

Course Objectives

1. To impart knowledge on the infrastructure, communication and networking technologies of IoT.
2. To analyse, design and develop Industrial IoT solutions.
3. To develop IoT architecture for use cases under discussion.

Course Outcomes

1. To focus on the technologies that enable IoT and to interpret the different components in IoT architecture.
2. Comprehend the concepts of edge computing and edge enabled solutions for real-time industrial applications.
3. Envision the IoT architecture models and the protocol stack for the design and development of IoT applications on different platforms.
4. Interpret the security threats and to design a resilient IoT Architecture.
5. Program the controller and sensors as part of IoT
6. Assess different Internet of Things technologies and their applications
7. To apply the concepts of Internet of Things in the real world scenarios

Module:1	Essentials of Internet of Things	2 hours
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IoT Emergence, Definition and Characteristics of IoT, Impact of IoT on business and society, IoT product development life cycle, IoT enabling Technologies, Applications.

Module:2	Architecture Reference Model	2 hours
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Domain Model, Information Model, Functional Model – Communication and security model, SOA based architecture.

Module:3	Protocol Suite	2 hours
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Physical layer, Link layer -BLE, LoRAWAN, Network layer, Transport layer, Application Layer protocols - MQTT, CoAP – Communication Models.

Module:4	Edge Computing	2 hours
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Introduction to Edge/Fog computing, Front end Edge Devices, Gateway, Edge ML for Industry automation.

Module:5	Security Engineering	2 hours
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IoT Attacks and Security Challenges, Threat and Mitigating Threats to IoT Systems, Privacy concerns - Access control, Lightweight Cryptography, Privacy in IoT

Module:6	IoT Platforms for Use Case Development	2 hours
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Open source IoT platforms and services, Communication API's- REST, WebSocket, Scalability of IoT Solutions

Module:7	IoT Verticals	1 hours
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Roadmap for developing complete IoT solutions; Smart Cities, Healthcare, Agriculture and Farming

Module:8	Contemporary Issues	2 hours
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	Total Lecture hours:	15 hours
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Text Book(s)

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A hands-on Approach", University Press, 2015.
2. Ammar Rayes, Samer Salam, " Internet of Things from Hype to Reality- A road to

<p>Digitization" Second Edition, Springer, ISBN 978-3-319-99515-1.</p> <p>3. Rajkumar Buyya, Amir Vahid " Internet of Things Principles and Paradigms", Elsevier, 2016.</p>			
Reference Books			
<ol style="list-style-type: none"> 1. Brian Russell, Drew Van "Practical Internet of Things Security "Packt Publishing, ISBN 978-1-78588-963-9, 2016. 2. Adrian McEwen & Hakim Cassimally, "Designing the Internet of Things", Wiley, 2017, Second Edition. 			
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test			
List of Experiments (Indicative)			
<ol style="list-style-type: none"> 1. IoT based soil health Monitoring 2. Air Quality monitoring system 3. Smart Parking System using an appropriate IoT visualization services 4. IoT based Healthcare and fitness monitoring 5. Real-time environmental weather prediction 6. IoT enabled accident prevention and detection system 7. Smart Street light system 8. Plant health monitoring using a suitable IoT platform and services 9. Build a web based application to automate the door that unlocks itself using facial recognition. 10. Intelligent Traffic light control system for ambulance services 			
Total Laboratory Hours	30 Hours		
Mode of assessment: Continuous assessment and FAT			
Recommended by Board of Studies	28.02.2023		
Approved by Academic Council	No. 69	Date	16-03-2023

Course Code	Course Title			L	T	P	C											
BECE399J	Summer Industrial Internship			0	0	0	1											
Pre-requisite	NIL			Syllabus version														
				1.0														
Course Objectives																		
1. The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.																		
Course Outcomes																		
1. Demonstrate professional and ethical responsibility. 2. Understand the impact of engineering solutions in a global, economic, environmental and societal context. 3. Develop the ability to engage in research and to involve in life-long learning. 4. Comprehend contemporary issues.																		
Module Content	4 Weeks (28 hours)																	
Four weeks of work at industry site. Supervised by an expert at the industry.																		
Mode of Evaluation: Internship Report, Presentation and Project Review																		
Recommended by Board of Studies	12-10-2022																	
Approved by Academic Council	No. 68	Date	19-12-2022															

Course Code	Course Title	L	T	P	C									
BECE497J	Project-I	0	0	0	3									
Pre-requisite	NIL	Syllabus version		1.0										
Course Objectives														
1. To provide sufficient hands-on learning experience related to the design, development and analysis of suitable product / process so as to enhance the technical skill sets in the chosen field.														
Course Outcomes														
1. Demonstrate professional and ethical responsibility. 2. Evaluate evidence to determine and implement best practice. 3. Mentor and support peers to achieve excellence in practice of the discipline. 4. Work in multi-disciplinary teams and provide solutions to problems that arise in multi-disciplinary work.														
Module Content	(Project Duration: One Semester)													
Project may be a theoretical analysis, modeling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, software development, applied research and any other related activities. Can be individual work or a group project, with a maximum of 3 students. In case of group projects, the individual project report of each student should specify the individual's contribution to the group project. Carried out inside or outside the university, in any relevant industry or research institution. Publications in the peer reviewed journals / International Conferences will be an added advantage.														
Mode of Evaluation: Assessment on the project - project report to be submitted, presentation and project reviews.														
Recommended by Board of Studies	12-10-2022													
Approved by Academic Council	No. 68	Date	19-12-2022											

Course Code	Course Title			L	T	P	C										
BECE498J	Project-II / Internship			0	0	0	5										
Pre-requisite	NIL			Syllabus version			1.0										
Course Objectives																	
1. To provide sufficient hands-on learning experience related to the design, development and analysis of suitable product / process so as to enhance the technical skill sets in the chosen field.																	
Course Outcomes																	
<ol style="list-style-type: none"> 1. Formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints. 2. Perform literature search and / or patent search in the area of interest. 3. Conduct experiments / Design and Analysis / solution iterations and document the results. 4. Perform error analysis / benchmarking / costing. 5. Synthesize the results and arrive at scientific conclusions / products / solution. 6. Document the results in the form of technical report / presentation. 																	
Module Content	(Project Duration: One Semester)																
<ol style="list-style-type: none"> 1. Project may be a theoretical analysis, modeling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, software development, applied research and any other related activities. 2. Project can be for one or two semesters based on the completion of required number of credits as per the academic regulations. 3. Can be individual work or a group project, with a maximum of 3 students. 4. In case of group projects, the individual project report of each student should specify the individual's contribution to the group project. 5. Carried out inside or outside the university, in any relevant industry or research institution. 6. Publications in the peer reviewed Journals / International Conferences will be an added advantage. 																	
Mode of Evaluation: Assessment on the project - project report to be submitted, presentation and project reviews.																	
Recommended by Board of Studies	12-10-2022																
Approved by Academic Council	No. 68	Date	19-12-2022														

BECE101N	Introduction to Engineering	L	T	P	C				
		0	0	0	1				
Pre-requisite	Nil	Syllabus version		1.0					
Course Objective:									
<ul style="list-style-type: none"> • To make the student comfortable and get familiarized with the facilities available on campus • To make the student aware of the exciting opportunities and usefulness of engineering to society • To make the student understand the philosophy of engineering 									
Course Outcome:									
<ul style="list-style-type: none"> • To know the infrastructure facilities available on campus • To rationally utilize the facilities during their term for their professional growth • To appreciate the engineering principles, involve in life-long learning and take up engineering practice as a service to society 									
General Guidelines									
<ol style="list-style-type: none"> 1. Student should observe and involve in the activities during the induction programme. Both general activities and those which are discipline-specific should be included here. 2. Student should get familiarized with the infrastructure facilities available on campus during the general induction, school induction programme and also from the institutional website. 3. Student should attend the lecture by industries, including those on career opportunities, organized by the School and probably involve in 'Do-it-yourself' projects or projects involving reverse-engineering. 4. Activities under 'Do-it-Yourself' will be detailed by the School. 5. Student should prepare a report on the activities and observations, as per the specified format, and submit the same in institutional LMS, VTOP for further evaluation <p>General instruction on formatting: Document to be prepared with the titles given in the template; Arial type with font size of 12 to be used; photographs can be included in the document as per the requirement; 1.5 line spacing to be used.</p>									
Mode of Evaluation: Evaluation of the submitted report and interaction with the students									
Recommended by Board of Studies	02.07.2021								
Approved by Academic Council	No. 63	Date	23.09.2021						

Short Syllabus

BSSC101N Essence of Traditional Knowledge (0-0-0-2)

Traditional Knowledge - Indigenous Knowledge, Traditional knowledge Versus Western Knowledge; Culture and Civilization - Cultural practices in India; Languages and Literature; Religion and Philosophy in India - Religious Reform Movements in Modern India; Fine Arts in India - Science and Technology; Traditional Medicine; Traditional Knowledge in Different Sectors - Management of Biodiversity and Protection of Traditional Knowledge; Legal Framework and Traditional Knowledge - The Protection of Traditional Knowledge Bill (2016).

BSSC101N	Essence of Traditional Knowledge	L	T	P	C				
		0	0	0	2				
Pre-requisite	Nil	Syllabus version		1.0					
Course Objectives:									
<ol style="list-style-type: none"> 1. To impart the knowledge on Indian tradition and Culture. 2. To enable the students to acquire the traditional knowledge in different sectors. 3. To analyze and understand the Science, Management and Indian Knowledge System. 									
Course Outcomes:									
<ol style="list-style-type: none"> 1. Familiarize the concept of Traditional Indian Culture and Knowledge. 2. Explore the Indian religion, philosophy and practices. 3. Analyze and understand the Indian Languages, Culture, Literature and Arts. 4. Gives a clear understanding on the Indian perspective of modern scientific world and basic principles of Yoga and holistic health care system of India. 5. Enable knowledge on Legal framework and traditional knowledge. 									
Module:1	Introduction to Traditional Knowledge								
Traditional knowledge: Definition, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge, characteristics, Traditional knowledge vis-a-vis Indigenous knowledge, Traditional knowledge Vs Western Knowledge.									
Module:2	Culture and Civilization								
Introduction to Culture and Civilization, Culture and Heritage, Characteristics features of Indian Culture, Importance of Culture, Cultural practices in Ancient India, Medieval India and Modern India.									
Module:3	Languages and Literature								
Indian Languages and Literature: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature and literatures of South India.									
Module:4	Religion and Philosophy								
Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only).									
Module:5	Fine Arts in India								
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama. Science and Technology in India, Development of science in ancient, medieval and modern India. Traditional Medicine – Herbal Healing - Yoga and Pranayama practices.									
Module:6	Traditional Knowledge in different sectors								
Traditional knowledge and engineering, Traditional medicine system, Traditional knowledge in agriculture, Dependence of Traditional Societies on food and healthcare needs; Importance of conservation and sustainable development of environment, Management of biodiversity and Protection of Traditional knowledge.									
Module:7	Legal framework and Traditional Knowledge								
Introduction on Legal framework and Traditional Knowledge: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, The protection of traditional knowledge bill, 2016.									
Total Lecture Hours:					60 hours				
Text Books :									
1.	Shikha Jain, Parul G Munjal And Somya Joshi,(2020) Traditional Knowledge Systems And Cultural Heritage, Aryan Books International, India.								
2.	Anindya Bhukta(2020), Legal Protection for Traditional Knowledge: Towards A New								

	Law for Indigenous Intellectual Property, Emerald Publishing Limited, United Kingdom.
Reference Books :	
1.	Traditional Knowledge System in India, by Amit Jha, 2009.
2.	Basant Kumar Mohanta & Vipin Kumar Singh (2012), "Traditional Knowledge System & Technology in India", Pratibha Prakashan, India.
3.	S. Baliyan, Indian Art and Culture, Oxford University Press, India.
4	http://indiafacts.org/author/michel-danino/
5.	GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi,2016.
Mode of Evaluation: Quiz and Term End – Quiz	
Recommended by Board of Studies	16-11-2021
Approved by Academic Council	No. 64 Date 16-12-2021

Course Code	Course Title	L	T	P	C				
BSSC102N	Indian Constitution	0	0	0	2				
Pre-requisite	NIL	Syllabus version		1.0					
Course Objectives									
This Course is an introduction of Indian Constitution and basic concepts highlighted in this course for understanding the Constitution of India.									
Course Outcome									
At the end of the course, the student will acquire:									
<ol style="list-style-type: none"> 1. A basic understanding of Constitution of India. 2. The ability to understand the contemporary challenges and apply the knowledge gained from the course to current social contemporary legal issues. 3. The understanding of constitutional remedies. 									
Module:1	Introduction to Indian Constitution	5 hours							
Introduction to the constitution of India and the Preamble - Sources of Indian Constitution - Features of Indian Constitution - Citizenship - Fundamental Rights and Duties - Directive Principles of state policy									
Module:2	Union Government and its Administration Structure of the Indian Union	8 hours							
Federalism, Centre- State relationship - President: Role, Power and Position - Prime Minister and Council of ministers - Cabinet and Central Secretariat - Lok Sabha - Rajya Sabha- The Supreme Court and High Court: Powers and Functions									
Module:3	State Government and its Administration	4 hours							
Governor- Role and Position - Chief Minister and Council of Ministers - State Legislative Assembly - State secretariat: Organization, Structure and Functions									
Module:4	Local Administration	7 hours							
District's Administration Head- Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative - Panchayati Raj: Composition and Functions Evolution and 73rd and 74th Amendments - Zila Parishad and district administration: Composition and Functions Elected officials and their roles, CEO Zila Panchayat: Position and role- Panchayat Samiti: Composition and Functions - Gram Panchayat: Composition and Functions Importance of grass root democracy									
Module:5	Election Commission	6 hours							
Role of Chief Election Commissioner - State Election Commission - Functions of Commissions for the welfare of SC/ST/OBC and women.									
	Total Lecture hours:	30 hours							

Reference Books	
1.	Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)
2.	M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)
3.	J.C Johari, Indian Government and Politics, Shoban Lal & Co., 2012
4.	Noorani, A.G , Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.
5.	R. Bhargava, (2008) 'Introduction: Outline of a Political Theory of the Indian Constitution', in R. Bhargava (ed.) Politics and Ethics of the Indian Constitution, New Delhi: Oxford University Press.
6.	Bidyut Chakrabarty & Rajendra Kumar Pandey, Indian Government and Politics, SAGE, New Delhi, 2008
7.	G. Austin, The Indian Constitution: CornerStone of a Nation, Oxford, Oxford University Press, 1966
Mode of Evaluation: CAT, Written assignment, Quiz and FAT	
Recommended by Board of Studies	27-10-2021
Approved by Academic Council	No. 68 Date 19-08-2022

Short Syllabus

BCHY102N Environmental Sciences (0-0-0-2)

Environment and Ecosystem-definition-components and types-food chain, food web, energy flow-ecological succession; Biodiversity-definition-levels-species roles-hotspots-threats-conservation-genetically modified crops; Sustaining Environmental Quality-environmental hazards-conservation-solid waste management; Clean and Green Energy-renewable energy resources-Hydrogen energy-Electric and CNG vehicles; Environmental Protection Act-objectives-impact analysis; Sustainable Development-Population growth-effect-SDGs-Women and child welfare; Global Climate Change-Green house effect-Kyoto-Paris- Montreal Protocol-Carbon sequestration-role of information technology in environment.

BCHY102N	Environmental Sciences	L	T	P	C			
		0	0	0	2			
Pre-requisite	NIL	Syllabus version						
		1.0						
Course Objectives:								
The course is aimed at students to								
<ol style="list-style-type: none"> 1. Understand and appreciate the unity of life in all its forms and their implications of life style on the environment. 2. Identify the different causes for environmental degradation. 3. Analyze individual's contribution to environmental pollution. 4. Evaluate the impact of pollution at the global/local level and find solutions for remediation. 								
Course Outcomes								
At the end of the course, the students will be able to:								
<ol style="list-style-type: none"> 1. Recognize the environmental issues in a problem-oriented, interdisciplinary perspective. 2. Classify the key environmental issues, the science behind those problems and potential solutions. 3. Demonstrate the significance of biodiversity and its preservation. 4. Identify various environmental hazards. 5. Design various methods for the conservation of resources. 6. Formulate action plans for sustainable alternatives that incorporate science, humanity, and social aspects. 								
Module: 1	Environment and Ecosystem	5 hours						
Environment: definition; Earth-life support system. Ecosystem definition, components and types. Key environmental problems, their basic causes and sustainable solutions. Food chain, food web and their significance, Energy flow in ecosystem; Ecological succession-stages involved, primary and secondary succession - hydrarch, mesarch, xerarch.								
Module: 2	Biodiversity	4 hours						
Biodiversity-definition, levels and importance. Species: roles: types: extinct, endemic, endangered and rare species. Hot-spots –Significance, Mega-biodiversity. Threats to biodiversity due to natural and anthropogenic activities, Conservation methods. GM crops-advantages and disadvantages.								
Module: 3	Sustaining Environmental Quality	4 hours						
Environmental hazards: definition, types, causes and solutions: Biological (Malaria, COVID-19), Chemical (BPA, heavy metals), and Nuclear (Chernobyl); Air, water and soil quality management and conservation; Solid waste management methods.								
Module: 4	Clean and Green Energy	5 hours						
Renewable energy resources: Solar energy-thermal and photovoltaic; Hydroelectric energy. Wind energy, Ocean thermal energy; Geothermal energy; Energy from biomass; Hydrogen energy; Solar-hydrogen revolution. Electric and CNG vehicles.								
Module: 5	Environmental Protection Policies	4 hours						
Environmental Protection (EPA) objectives; Air Act, water Act, Forest conservation Act and Wild life protection Act. Environmental Impact Analysis: guidelines, core values. Impact assessment methodologies.								
Module: 6	Sustainable development	4 hours						
Effect of population-urban environmental problems; Population age structure; Sustainable human societies: tools in economics, sustainable development goals SDGs and promoting awareness. Women and child welfare, Women empowerment.								

Module: 7	Global Climate Change	4 hours
Global climate change and green-house effect. Kyoto Protocol-carbon credits, The Paris Agreement, carbon sequestration: definition, types and methodologies. Ozone layer depletion: causes and impacts. Mitigation of ozone layer depletion- Montreal Protocol. Role of Information Technology in environment.		
Total Lecture hours:		30 hours
Assessment: Seminars, Quiz, Case Studies, Final Assessment Test.		
Text Books		
1. G. Tyler Miller and Scott E. Spoolman (2016), Environmental Science, 15 th Edition, Cengagelearning. 2. Benny Joseph, (2012), Environmental Science and Engineering, 5 th Edition, Tata McGraw Hill Education Private Limited, New Delhi, India.		
Reference Book(s)		
1. David M. Hassenzahl, Mary Catherine Hager, Linda. R. Berg (2011), Visualizing Environmental Science, 4 th Edition, John Wiley & Sons, USA. 2. Raj Kumar Singh, (2012), Environmental Studies, Tata McGraw Hill Education Private Limited, New Delhi, India. 3. George Tyler Miller, Jr. and Scott Spoolman (2012), Living in the Environment – Principles, Connections and Solutions, 17 th Edition, Brooks/Cole, USA.		
Recommended by Board of Studies	14-02-2022	
Approved by Academic Council	No. 65	Date 17-03-2022

Short Syllabus

BHUM101N Ethics and Values (0-0-0-2)

Civic Responsibilities - Defining Ethics and Morals, Gandhian Philosophy; Personal Social Responsibility - Leadership Qualities of the Present and Past Leaders; Crimes against Humanity – Harassment, Violence, Terrorism; Contemporary Social Problems – Corruption, Electoral Malpractice, White Collar Crimes, Tax Evasion, Unfair Trade Practices; Addiction and Substance Abuse - Handling peer pressure, Prevention of Suicides; Sexual Health and Sensitive Issues - Professional Ethics and Personal Values, Behavioural Addiction and Technological Abuse.

BHUM101N	Ethics and Values	L	T	P	C						
		0	0	0	2						
Pre-requisite	Nil	Syllabus version		1.0							
Course Objectives:											
<ol style="list-style-type: none"> 1. To understand and appreciate the ethical issues faced by an individual in profession, society and polity. 2. To understand the negative health impacts of certain unhealthy behavior. 3. To appreciate the need and importance of physical, emotional health and social health. 											
Course Outcomes:											
<ol style="list-style-type: none"> 1. Students will be able to: 2. Follow sound morals and ethical values scrupulously to prove as good citizens. 3. Understand various social problems and learn to act ethically. 4. Understand the concept of addiction and how it will affect the physical and mental health. 5. Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects. 6. Identify the main typologies, characteristics, activities, actors and forms of cybercrime. 											
Module:1	Being Good and Responsible										
Gandhian values such as truth and non-violence – Comparative analysis on leaders of past and present – Society's interests versus self-interests - Personal Social Responsibility: Helping the needy, charity and serving the society.											
Module:2	Social Issues 1										
Harassment – Types - Prevention of harassment, Violence and Terrorism.											
Module:3	Social Issues 2										
Corruption: Ethical values, causes, impact, laws, prevention – Electoral malpractices; White collar crimes - Tax evasions – Unfair trade practices.											
Module:4	Addiction and Health										
Peer pressure - Alcoholism: Ethical values, causes, impact, laws, prevention – Ill effects of smoking - Prevention of Suicides; Sexual Health: Prevention and impact of pre-marital pregnancy and Sexually Transmitted Diseases.											
Module:5	Drug Abuse										
Abuse of different types of legal and illegal drugs: Ethical values, causes, impact, laws and prevention.											
Module:6	Personal and Professional Ethics										
Dishonesty - Stealing - Malpractices in Examinations – Plagiarism.											
Module:7	Abuse of Technologies										
Hacking and other cyber crimes, Addiction to mobile phone usage, Video games and Social networking websites.											
Total Lecture Hours:											
60 hours											
Text Books :											
1.	R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2019, 2nd Revised Edition, Excel Books, New Delhi.										
2.	Hartmann, N., "Moral Values", 2017, United Kingdom: Taylor & Francis.										
Reference Books :											
1.	Rachels, James & Stuart Rachels, "The Elements of Moral Philosophy", 9th edition, 2019, New York: McGraw-Hill Education.										

2.	Blackburn, S. "Ethics: A Very Short Introduction", 2001, Oxford University Press.		
3.	Dhaliwal, K.K , "Gandhian Philosophy of Ethics: A Study of Relationship between his Presupposition and Precepts", 2016, Writers Choice, New Delhi, India.		
4	Ministry of Social Justice and Empowerment, "Magnitude of Substance Use in India", 2019, Government of India.		
5.	Ministry of Home Affairs, "Accidental Deaths and Suicides in India", 2019, Government of India.		
6.	Ministry of Home Affairs, "A Handbook for Adolescents/ Students on Cyber Safety", 2018, Government of India.		
Mode of Evaluation: Poster making, Quiz and Term End - Quiz			
Recommended by Board of Studies	27-10-2021		
Approved by Academic Council	No. 64	Date	16-12-2021