J. S. UNIVERSITY SHIKOHABAD

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. THIRD YEAR

ELECTRONICS & COMMUNICATION ENGINEERING

[Effective from the Session: 2021-22]

B.Tech. V Semester
Electronics and Communication Engineering

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semester		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1	BTEC501	Integrated Circuits	3	1	0	30	20	50		100		150	4
2	BTEC502	Microprocessor & Microcontroller	3	1	0	30	20	50		100		150	4
3	BTEC503	Digital Signal Processing	3	1	0	30	20	50		100		150	4
4	BTEC504-507	Department Elective-I	3	0	0	30	20	50		100		150	3
5	BTEC508-511	Department Elective-II	3	0	0	30	20	50		100		150	3
6	BTEC551	Integrated Circuits Lab	0	0	2				25		25	50	1
7	BTEC552	Microprocessor & Microcontroller Lab	0	0	2				25		25	50	1
8	BTEC553	Digital Signal Processing Lab	0	0	2				25		25	50	1
9	BTEC554	Mini Project/Internship **	0	0	2				50			50	1
10	BTNC501	Constitution of India, Law and Engineering / Indian Tradition, Culture and Society	2	0	0	15	10	25		50			NC
		Total										**950**	**22**

**The Mini Project or Internship (4weeks) conducted during summer break after IV Semester and will be assessed during Vth Semester.

Course Code	Course Title
	Department Elective-I
BTEC504	Computer Architecture and Organization
BTEC505	Industrial Electronics
BTEC506	VLSI Technology
BTEC507	Advance Digital Design using Verilog
	Department Elective-II
BTEC508	Electronics Switching
BTEC509	Advance Semiconductor Device
BTEC510	Electronics Measurement & Instrumentation
BTEC511	Optical Communication

B.Tech. VI Semester
Electronics and Communication Engineering

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semester		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1	BTEC601	Digital Communication	3	1	0	30	20	50		100		150	4
2	BTEC602	Control System	3	1	0	30	20	50		100		150	4
3	BTEC603	Antenna and Wave Propagation	3	1	0	30	20	50		100		150	4
4	BTEC604-8	Department Elective–III	3	0	0	30	20	50		100		150	3
5		Open Elective-I	3	0	0	30	20	50		100		150	3
6	BTEC651	Digital Communication Lab	0	0	2				25		25	50	1
7	BTEC652	Control System Lab	0	0	2				25		25	50	1
8	BTOE 601-3	Elective Lab	0	0	2				25		25	50	1
9	BTNC651	Constitution of India, Law and Engineering / Indian Tradition, Culture and Society	2	0	0	15	10	25		50			NC
		Total										**900**	**21**

Course Code	Course Title
	Department Elective-III
BTEC604	Microcontroller & Embedded System Design
BTEC605	Satellite Communication
BTEC606	Data Communication Networks
BTEC607	Analog Signal Processing
BTEC608	Random Variables & Stochastic Process

Open Elective-I

Open Elective-I	BTOE-061	Real time Systems	Elective lab
	BTOE-062	Computer based Numerical Techniques	Lab
	BTOE-063	GIS & Remote sensing	Lab
	BTOE-064	Basics of data base management system	Lab
	BTOE-065	Software project Management	Lab

B.Tech 3rd Year
V Semester
Syllabus

BTEC501	INTEGRATED CIRCUITS	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**The 741 IC Op-Amp**: General operational amplifier stages (bias circuit, the input stage, the second stage, the output stage, short circuit protection circuitry), device parameters, DC and AC analysis of input stage, second stage and output stage, gain, frequency response of 741, a simplified model, slew rate, relationship between ft and slew rate.	8
II	**Linear Applications of IC Op-Amps:** Op-Amp based V-I and I-V converters, instrumentation amplifier, generalized impedance converter, simulation of inductors. **Active Analog filters:** Sallen Key second order filter, Designing of second order low pass and high pass Butterworth filter, Introduction to band pass and band stop filter, all pass active filters, KHN Filters. Introduction to design of higher order filters.	8
III	**Frequency Compensation & Nonlinearity:** Frequency Compensation, Compensation of two stage Op-Amps, Slewing in two stage Op-Amp. Nonlinearity of Differential Circuits, Effect of Negative feedback on Nonlinearity. **Non-Linear Applications of IC Op-Amps:** Basic Log–Anti Log amplifiers using diode and BJT, temperature compensated Log-Anti Log amplifiers using diode, peak detectors, sample and hold circuits. Op-amp as a comparator and zero crossing detector, astable multivibrator & monostable multivibrator. Generation of triangular waveforms, analog multipliers and their applications.	4 8
IV	**Digital Integrated Circuit Design:** An overview, CMOS logic gate circuits basic structure, CMOS realization of inverters, AND, OR, NAND and NOR gates. **Latches and Flip flops**: the latch, CMOS implementation of SR flip-flops, a simpler CMOS implementation of the clocked SR flip-flop, CMOS implementation of J-K flip-flops, D flip- flop circuits.	6
V	**Integrated Circuit Timer:** Timer IC 555 pin and functional block diagram, Monostable and Astable multivibrator using the 555 IC. Voltage Controlled Oscillator: VCO IC 566 pin and functional block diagram and applications. **Phase Locked Loop (PLL)**: Basic principle of PLL, block diagram, working, Ex-OR gates and multipliers as phase detectors, applications of PLL.	6

Text Book:

1. Microelectronic Circuits, Sedra and Smith, 7th Edition, Oxford, 2017.
2. Behzad Razavi: Design of Analog CMOS Integrated Circuits, TMH

Reference Books:

1. Gayakwad: Op-Amps and Linear Integrated Circuits, 4th Edition Prentice Hall of India, 2002.
2. Franco, Analog Circuit Design: Discrete & Integrated, TMH, 1st Edition.
3. Salivahnan, Electronics Devices and Circuits, TMH, 3rd Edition, 2015
4. Millman and Halkias: Integrated Electronics, TMH, 2nd Edition, 2010

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

1. Explain complete internal analysis of Op-Amp 741-IC.
2. Examine and design Op-Amp based circuits and basic components of ICs such as various types of filter.
3. Implement the concept of Op-Amp to design Op-Amp based non-linear applications and wave-shaping circuits.
4. Analyse and design basic digital IC circuits using CMOS technology.
5. Describe the functioning of application specific ICs such as 555 timer ,VCO IC 566 and PLL.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	1	-	-	-	-	-	1	2
CO2	3	2	2	2	1	-	-	-	-	-	1	2
CO3	3	2	2	3	1	-	-	-	-	-	2	2
CO4	3	2	2	2	1	-	-	-	-	-	1	2
CO5	3	2	2	2	1	-	-	-	-	-	2	2
Avg	**3.00**	**2.00**	**2.00**	**2.20**	**1.00**	-	-	-	-	-	**1.40**	**2.00**

BTEC502	MICROPROCESSOR & MICROCONTROLLER	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**Introduction to Microprocessor:** Microprocessor architecture and its operations, Memory, Input & output devices, The 8085 MPU- architecture, Pins and signals, Timing Diagrams, Logic devices for interfacing, Memory interfacing, Interfacing output displays, Interfacing input devices, Memory mapped I/O.	8
II	**Basic Programming concepts**:, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs, Programming techniques: looping, counting and indexing. Additional data transfer and 16 bit arithmetic instruction, Logic operation: rotate, compare, counter and time delays, 8085 Interrupts.	8
III	**16-bit Microprocessors (8086):** Architecture, Pin Description, Physical address, segmentation, memory organization, Addressing modes. **Peripheral Devices:** 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.	8
IV	**8051 Microcontroller Basics**: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes.	8
V	**Assembly programming and instruction of 8051:** Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. Programming 8051 Timers. Serial Port Programming, Interrupts Programming, **Interfacing:** LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation.	8

Text Books:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 6th Edition, Penram International Publication (India) Pvt. Ltd.,2013
2. D. V. Hall : Microprocessors Interfacing, TMH 3rd Edition,
3. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and McKinlay Rolin D., "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson, 2nd Edition,2006

Reference Books:

1. Kenneth L. Short, "Microprocessors and programmed Logic", 2nd Ed, Pearson Education Inc.,2003
2. Barry B. Brey, "The Intel Microprocessors, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, PentiumPro Processor, PentiumII, PentiumIII, Pentium IV, Architecture, Programming & Interfacing", Eighth Edition, Pearson Prentice Hall, 2009.
3. Shah Satish, "8051 Microcontrollers MCS 51 Family and its variants", Oxford,2010

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

1. Demonstrate the basic architecture of 8085.
2. Illustrate the programming model of microprocessors & write program using 8085 microprocessor.
3. Demonstrate the basics of 8086 Microprocessor and interface different external Peripheral Devices like timer, USART etc. with Microprocessor (8085/8086).
4. Compare Microprocessors & Microcontrollers, and comprehend the architecture of 8051 microcontroller
5. Illustrate the programming model of 8051 and implement them to design projects on real time problems.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	2	1	1	-	1	2	1	3
CO2	3	2	1	1	3	1	1	-	1	2	2	3
CO3	3	2	2	2	3	1	1	-	1	2	2	3
CO4	2	1	1	1	3	2	1	-	1	2	2	3
CO5	3	1	2	2	3	2	1	-	1	2	2	3
Avg	**2.8**	**1.6**	**1.4**	**1.4**	**1.4**	**1.4**	**1**	**-**	**1**	**2**	**1.8**	**3**

BTEC503	DIGITAL SIGNAL PROCESSING	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**Introduction to Digital Signal Processing**: Basic elements of digital signal processing, advantages and disadvantages of digital signal processing, Technology used for DSP. **Realization of Digital Systems**: Introduction- basic building blocks to represent a digital system, recursive and non-recursive systems, basic structures of a digital system: Canonic and Non-Canonic structures. **IIR Filter Realization**: Direct form, cascade realization, parallel form realization, Ladder structures- continued fraction expansion of H (z), example of continued fraction, realization of a ladder structure, design examples. **FIR Filter Realization**: Direct, Cascade, FIR Linear Phase Realization and design examples.	8
II	**Infinite Impulse Response Digital (IIR) Filter Design:** Introduction to Filters, Impulse Invariant Transformation, Bi-Linear Transformation, All- Pole Analog Filters: Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters, Frequency Transformations.	8
III	**Finite Impulse Response Filter (FIR) Design**: Windowing and the Rectangular Window, Gibb's phenomenon, Other Commonly Used Windows (Hamming, Hanning, Bartlett, Blackmann, Kaiser), Examples of Filter Designs Using Windows. **Finite Word length effects in digital filters**: Coefficient quantization error, Quantization noise – truncation and rounding, Limit cycle oscillations-dead band effects.	8
IV	**DFT & FFT**: Definitions, Properties of the DFT, Circular Convolution, Linear Convolution using Circular Convolution, Decimation in Time (DIT) Algorithm, Decimation in Frequency (DIF) Algorithm.	8
V	**Multirate Digital Signal Processing (MDSP)**: Introduction, Decimation, Interpolation, Sampling rate conversion: Single and Multistage, applications of MDSP- Subband Coding of Speech signals, Quadrature mirror filters, Advantages of MDSP.	8

Text Books:

1. John G Prokias, Dimitris G Manolakis, Digital Signal Processing. Pearson , 4th Edition, 2007
2. Johnny R. Johnson, Digital Signal Processing, PHI Learning Pvt Ltd., 2009.
3. S. Salivahanan, A. Vallavaraj, Digital Signal Processing, TMH, 4th Edition 2017.
4. Oppenheim & Schafer, Digital Signal Processing. Pearson Education 2015
5. S.K. Mitra, 'Digital Signal Processing–A Computer Based Approach, TMH, 4th Edition.

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

1. Design and describe different types of realizations of digital systems (IIR and FIR) and their utilities.
2. Select design parameters of analog IIR digital filters (Butterworth and Chebyshev filters) and implement various methods such as impulse invariant transformation and bilinear transformation of conversion of analog to digital filters.
3. Design FIR filter using various types of window functions.
4. Define the principle of discrete Fourier transform & its various properties and concept of circular and linear convolution. Also, students will be able to define and implement FFT i.e. a fast computation method of DFT.
5. Define the concept of decimation and interpolation. Also, they will be able to implement it in various practical applications.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3
Avg	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

BTEC504	Computer Architecture and Organization	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction to Design Methodology**: System Design – System representation, Design Process, the gate level (revision), the register level components and PLD (revision), register level design The Processor Level: Processor level components, Processor level design.	8
II	**Processor basics:** CPU organization- Fundamentals, Additional features Data Representation - Basic formats, Fixed point numbers, Floating point numbers. Instruction sets - Formats, Types, Programming considerations.	8
III	**Data path Design:** Fixed point arithmetic - Addition and subtraction, Multiplication and Division, Floating point arithmetic, pipelining.	8
IV	**Control Design:** basic concepts - introduction, hardwired control, Micro programmed control -introduction, multiplier control unit, CPU control unit, Pipeline control- instruction pipelines, pipeline performance.	8
V	**Memory organization:** Multi level memories, Address translation, Memory allocation, Caches - Main features, Address mapping, structure vs performance, System Organization: Communication methods- basic concepts, bus control. Introduction to VHDL.	8

Text Book:

1. John P Hayes "Computer Architecture and Organization", 3rd Edition McGraw Hill Publication. (2017)
2. M Morris Mano, "Computer System Architecture", 3rd Edition ,Pearson,. (2017)

Reference Books:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization and Embedded Systems", McGraw Hill Publication. (2009)
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Elsevier Publication. (2007)

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

1. Discuss about the basic concepts of system design methodology and processor level design.
2. Explain the basics of processor and basic formats of data representation.
3. Perform fixed and floating point arithmetic operations.
4. Describe the basic concepts of control design and pipeline performance.
5. Explain the architecture and functionality of central processing unit.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3
Avg	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

BTEC505	INDUSTRIAL ELECTRONICS	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction to Power Switching Devices:** Description of working & constructional features, Switching Characteristics, ratings and Applications of Power Transistor, Power MOSFET, SCR, DIAC, TRIAC, IGBT and MCT.	8
II	**SCR Performance and Applications:** Protection of SCR, SCR Triggering and Commutation Circuits/Methods, Series and Parallel operation of SCR, two transistor model of SCR, , Describe Construction & Working of Opto- Isolators, Opto-TRIAC, Opto-SCR.	8
III	**Power Converter Performance & Applications:** Introduction to Basic Power Converters Architecture - Single Phase, there performance under different types of Loads, Average/RMS output Voltage & Current, Freewheeling Diode, Feedback Diode, State Relay using Opto SCR, SMPS and UPS functioning through Block Diagrams.	8
IV	**Timers & Delay Elements, High Frequency Power Heating, Sensor and Actuators:** RC Base Constant Timers, Timer Circuits using SCR, IC-555, Programmable Timer and their Industrial Applications, Induction Heating and Dielectric Heating System and Their Applications, Sensors, Transducers, and Transmitters for Measurement, Control & Monitoring : Thermoresistive Transducer, Photoconductive Transducers, Pressure Transducers, Flow Transducers, Level Sensors, Speed Sensing, Vibration Transducers, Variable-Frequency Drives, Stepper Motors and Servomotor Drives.	8
V	**Automation and Control:** Data Communications for Industrial Electronics, Telemetry, SCADA & Automation, AC & DC Drives, Voltage & Power Factor Control through Solid State Devices, Soft Switching, Industrial Robots.	8

Text Books:

1. M.H. Rashid, "Power Electronics: Circuits, Devices & Applications", Pearson, 4rd Edition, 2013.
2. P.C.Sen, "Power Electronics", McGraw Hill Education (India) Pvt. Ltd 2nd Ed, 2017
3. V.R. Moorthy, "Power Electronics: Devices, Circuits and Industrial Applications" Oxford University Press, 2007.
4. B. Paul, Industrial Electronic and Control, Prentice Hall of India Private Limited (2004).
5. Ned Mohan, T.M. Undeland and W.P. Robbins, "Power Electronics: Converters, Applications and Design", Wiley India Ltd, 2008.
6. P.S. Bhimbra, "Power Electronics", Khanna Publishers

Reference Books:

1. Thomas E. Kissell, Industrial Electronics: Applications for Programmable Controllers, Instrumentation and Process Control, and Electrical Machines and Motor Controls, 3rd edition, 2003, Prentice Hall.
2. Chakrabarti & Rai, "Fundamentals of Power Electronics & Drives" Dhanpat Rai & Sons.

3. S.N.Singh, “A Text Book of Power Electronics” Dhanpat Rai &Sons.
4. G.K. Dubey, Power Semiconductor Controlled Drives, Prentice Hall inc. (1989).

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

1. Describe the characteristics, operation of power switching devices and identify their ratings and applications.
2. Recognize the requirement of SCR Protection and describe the Functioning of SCR.
3. Analyze and design Power Converter based on SCR for various Industrial Applications.
4. Explain High Frequency Heating Systems, Timers, Relevant Sensors & Actuator and their application in industrial setting.
5. Explain and apply Data Communication, Telemetry & SCADA System in industrial applications.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3
Avg	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

BTEC506	VLSI TECHNOLOGY	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction To IC Technology:** SSI, MSI, LSI, VLSI Integrated Circuits. Crystal Growth and Wafer Preparation: Electronic Grade Silicon, Czochralski Crystal Growth, Silicon Shaping, Processing Considerations. Wafer Cleaning Technology - Basic Concepts, Wet cleaning, Dry cleaning	8
II	**Epitaxy:** Vapor-Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation. **Oxidation:** Growth Kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxides Properties.	8
III	**Lithography:** Optical Lithography, Electron beam lithography, Photo masks, Wet Chemical Etching. **Dielectric and Polysilicon Film Deposition:** Deposition Processes of Polysilicon, Silicon Dioxide, Silicon Nitride.	8
IV	**Diffusion:** Models of diffusion in solids, Fick's 1-Dimensional diffusion equation, Diffusion of Impurities in Silicon and Silicon Dioxide, Diffusion Equations, Diffusion Profiles, Diffusion Furnace, Solid, Liquid and Gaseous Sources, **Ion-Implantation:** Ion-Implantation Technique, Range Theory, Implantation Equipment.	8
V	**Metallization:** Metallization Application, Metallization Choices, Physical Vapor Deposition, Vacuum Deposition, Sputtering Apparatus. **Packaging of VLSI devices**: Package Types, Packaging Design Consideration, VLSI Assembly Technologies, Package Fabrication Technologies, CMOS fabrication steps.	8

Text Books:

1. S. M. Sze, "VLSI Technology", McGraw Hill Publication, 2nd Edition 2017
2. S.K. Ghandhi, "VLSI Fabrication Principles", Willy-India Pvt. Ltd, 2008

Reference Books:

1. J. D. Plummer, M. D. Deal and Peter B. Griffin, "Silicon VLSI Technology: Fundamentals, Practice and Modeling", Pearson Education Publication, 2009
2. Stephen A. Campbell, "Fabrication Engineering at the Micro and Nano scale", Oxford University Press, 2013

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

1. Interpret the basics of crystal growth, wafer preparation and wafer cleaning.
2. Evaluate the process of Epitaxy and oxidation.
3. Differentiate the lithography, etching and deposition process.
4. Analyze the process of diffusion and ion implantation
5. Express the basic process involved in metallization and packaging.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	3	3	-	1	-	2	-	1	2
CO2	3	3	3	3	3	-	2	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	2	2	1	3
CO4	3	3	3	3	3	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	3	2	2	3
Avg	**3**	**3**	**2.8**	**3**	**3**	**-**	**1.5**	**-**	**2.6**	**2.5**	**2**	**2.8**

BTEC507	ADVANCED DIGITAL DESIGN USING VERILOG	3L:0T:0P	3 Credits

Unit	Topic	Lectures
I	Introduction to Mixed Logic, Logic Representation and Minimization with cost, Multiple output minimization, Entered Variable K- Map including don't care handling, XOR Pattern Handling.	8
II	Combinational Circuit Design, Multiplexers, Decoders, Encoders, Code Comparators, Adders, Subtractors, Multipliers, Introduction to Verilog, Behavioral and Structural specification of logic circuits, Boolean function implementation using Verilog, Timing Analysis, Hazard Detection and Elimination	8
III	Synchronous Sequential Circuits Design, Mapping Algorithm, Synchronous State Machines, ASM Charts, Asynchronous Sequential Circuit Design, Races, Multi-level minimization and optimization.	8
IV	Factoring, Decomposition, BDD, Ordered BDD, LPDD, Fault Detection and Analysis incombinational and sequential systems, Path Sensitization method, Boolean Difference Method, Initial State Method.	8
V	Study of programmable logic families, PLD, CPLD, FPGA, ASIC, PLA, Architectures,Design of Combinational and sequential circuits using CPLD and FPGA, Design Examples.	8

Text Books:

1. Richard F. Tinder, "Engineering Digital Design", Academic Press.
2. Parag K. Lala, "Digital system Design Using PLDs", PHI India Ltd.
3. Stephen Brown and ZvonkoVranesiv, "Fundamental of Digital Logic with Verilog Design", Tata McGraw Hill.

Reference Books:

1. John Williams, "Digital VLSI Design with Verilog", Springer Publication..
2. Samuel C. Lee, "Digital Circuit and Logic Design", PHI India Ltd.
3. Alexander Miczo, "Digital Logic Testing and Simulation",Wiley Interscience.

COURSE OUTCOME: After completion of the course student will be able to

1. Describe mixed logic circuits and their implementation.
2. Implement combinational circuits using mixed logic and Verilog.
3. Design sequential circuits using mixed logic and Verilog with mapping of Algorithm.
4. Understand faults and its elimination in sequential and combinational circuits.
5. Understand the working of programmable logic families.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	3	3	3	1	1	1	1	2	2	1
CO3	3	3	3	3	3	1	1	1	2	2	2	1
CO4	3	3	3	3	3	2	1	1	1	1	1	1
CO5	3	1	1	1	1	1	1	1	1	1	-	1
Avg	**3.00**	**2.60**	**2.40**	**2.40**	**2.20**	**1.25**	**1.00**	**1.00**	**1.25**	**1.50**	**1.66**	**1.00**

BTEC508	ELECTRONIC SWITCHING	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Evolution of switching systems:** Introduction, Message switching, Circuits switching, Functions of a switching system, Register translator-senders, Distribution frames, Crossbar switch, A general trucking, Electronic switching, Reed- electronic system, Digital switching systems.	8
II	**Digital Switching:** Switching functions, Space Division Switching, Time Division Switching, Two-Dimensional Switching, Digital Cross-Connect Systems, Digital Switching in an Analog Environment.	8
III	**Telecom Engineering**: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking models and Loss Estimates, Delay Systems	8
IV	**Control of switching systems:** Introduction, Call-processing functions, Common control, Reliability, availability and security; Stored-program control. **Signaling:** Introduction, Customer line signaling, Audio-frequency junctions and trunk circuits, FDM carrier systems, PCM signaling, Inter-register signalling, Common-channel signaling principles, CCITT signaling system no. 6 and 7, Digital customer line signaling.	8
V	**Packet Switching:** Packet Switching, Statistical Multiplexing, Routing Control (dynamic routing, virtual circuit routing and fixed-path routing), Flow Control, X.25, Frame Relay, TCP/IP ATM Cells, ATM Service Categories, ATM Switching (ATM Memory Switch, Space-Memory Switch, Memory-Space Switch, Memory-Space Memory switch, Banyan Network Switch, Clos Networks).	8

Text Book:

1. Thiagarajan Viswanathan & Manav Bhatnagar, “Telecommunication Switching Systems and Networks”, PHI, 2018
2. J.E. Flood, “Telecommunication Switching, Traffic and Networks”, Pearson Education 2016.
3. John C. Bellamy, “Digital Telephony”, John Wiley, 3rd Ed, 2006

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

1. Describe the fundamentals of circuit switching and distinguish complex telephone systems.
2. Differentiate the fundamentals of Space division switching and time division switching.
3. Design, develop and evaluate the telecom traffic to meet defined specifications and needs.
4. Identify the control of switching networks and signalling concepts.
5. Classify the engineering concepts of packet switching and routing which will help to design various switch architectures for future research work.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	1	-	-	-	-	-	-	3
CO2	3	3	3	2	2	-	-	-	-	-	-	3
CO3	3	3	3	3	2	-	-	-	-	-	-	3
CO4	3	3	3	2	2	-	-	-	-	-	-	3
Avg	**3.00**	**3.00**	**2.75**	**2.00**	**1.75**	**-**	**-**	**-**	**-**	**-**	**-**	**3.00**

BTEC509	ADVANCE SEMICONDUCTOR DEVICES	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Physics and Properties of Semiconductors:** Introduction, Crystal Structure, Energy Bands and Energy Gap, Carrier Concentration at Thermal Equilibrium, Carrier-Transport Phenomena. Phonon, Optical, and Thermal Properties, Heterojunctions and Nanostructures, Basic Equations and Examples. *p-n* Junctions, Introduction, Depletion Region, Current-Voltage Characteristics, Junction Breakdown, Transient Behavior and Noise, Terminal Functions, Heterojunctions. Metal-Semiconductor Contacts, Metal-Insulator - Semiconductor Capacitors.	8
II	**Bipolar Transistors:** Static Characteristics, Microwave Characteristics, Related Device Structures, Heterojunction Bipolar Transistor. **MOSFETs:** Basic Device Characteristics, Nonuniform Doping and Buried-Channel Device, Device Scaling and Short-Channel Effects, MOSFET Structures, Circuit Applications, Nonvolatile Memory Devices, Single-Electron Transistor. JFETs, MESFETs, and MODFETs	8
III	**Tunnel Devices:** Tunnel Diode, Related Tunnel Devices, Resonant-Tunneling Diode. **IMPATT Diodes:** Static Characteristics, Dynamic Characteristics, Power and Efficiency, Noise Behavior, Device Design and Performance, BARITT Diode, TUNNETT Diode.	8
IV	Transferred-Electron and Real-Space-Transfer Devices Thyristors and Power Devices **Photonic Devices and Sensors:** Radioative Transitions, Light-Emitting Diode (LED), Laser Physics, Laser Operating Characteristics, Specialty Lasers.	8
V	**Photodetectors and Solar Cells:** Photoconductor, Photodiodes, Avalanche Photodiode, Phototransistor, Charge-Coupled Device (CCD), Metal-emiconductor-Metal Photodetector, Quantum-Well Infrared Photodetector, Solar Cell. Sensors: Thermal Sensors, Mechanical Sensors, Magnetic Sensors, Chemical Sensors.	8

Text Book:

1. S. M. Sze, Kwok K. NG, "Physics of Semiconductor Devices", 3rd edition, Wiley Publication, 2015
2. Jacob Millman, Christos C. Halkias, Satyabrata Jit, Electronic Devices and Circuits. Publisher: TMH, 4th edition 2015.
3. Ben G. Streetman & S K Banerjee, Solid State Electronic Devices, Pearson 7th Edition, 2015
4. Pierret, Robert F., Semiconductor device fundamentals. 2nd Edition, Pearson Education India, 2015.

Course Outcomes: At the end of this course students will able to

1. Explain the behavior of BJT and MOSFET in DC biasing and as CE amplifier circuit.
2. Describe the Tunnel diode and IMPATT diode.
3. Explain the basics of Light-Emitting Diode (LED) and evaluate the performance of Photoconductor and photodiode.
4. Distinguish the performance of Photoconductor, photodiode, Phototransistor, Charge-Coupled Device
5. Analyze the functioning of Metal-Semiconductor-Metal Photodetector.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	1	-	-	-	-	-	-	3
CO2	3	3	3	2	2	-	-	-	-	-	-	3
CO3	3	3	3	3	2	-	-	-	-	-	-	3
CO4	3	3	3	2	2	-	-	-	-	-	-	3
Avg	**3.00**	**3.00**	**2.75**	**2.00**	**1.75**	**-**	**-**	**-**	**-**	**-**	**-**	**3.00**

BTEC510	ELECTRONIC MEASUREMENTS & INSTRUMENTATION	3L:0T:0P	3 CREDITS

Unit	Topics	Lectures
I	**Electrical Measurements**: Measurement system, Characteristics of instruments, Methods of measurement, Errors in Measurement & Measurement standards, Measurement error combination. **Review of indicating and integrating instruments:** PMMC instrument, Galvanometer, DC ammeter, DC voltmeter, Series ohm meter.	8
II	**Electronic Instruments:** Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, probes. **Digital voltmeter systems**: Digital multimeter, digital frequency meter **Instrument calibration:** Comparison method, digital multimeter as standard instrument, Calibration instrument.	8
III	**Measuring Methods:** Voltmeter and Ammeter methods, Wheatstone bridge, Measurement of low, medium and high resistances, Insulation resistance measurement, **AC bridges** for measurement of inductance and capacitance.	8
IV	**Electronic Measurements:** Electronic instruments: Wattmeter & Energy meter. Time, Frequency and phase angle measurements using CRO; Storage oscilloscope, Spectrum & Wave analyzer, Digital counter & Frequency meter, Q meter	8
V	**Instrumentation**: Transducers, classification & selection of transducers, strain gauges, Thermistors, Thermocouples, LVDT, Inductive & capacitive transducers, Piezoelectric and Hall-effect transducers, Measurement of motion, force, pressure, temperature, flow and liquid level.	8

Text Book:

1. A K Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons, India (2015).
2. BC Nakra & K. Chaudhary, "Instrumentation, Measurement and Analysis," TMH, 2nd Edition (2009).
3. WD Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International (2001).
4. E. O. Doebelin, "Measurements systems: Applications and Design", 6th Edition, Tata McGraw Hil 2017.

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

1. Classify the Instrumentation and Measurement system and various measurement errors.
2. Analyze and design voltmeter circuits, AC electronic voltmeter, digital frequency meter and current measurement with electronic instruments.
3. Evaluate various resistance and impedance measuring methods using Bridges and Q-meter.
4. Analyze fundamental operation of CRO and some special type of oscilloscopes like DSO, Sampling oscilloscope.
5. Demonstrate calibration method to calibrate various instruments and classify transducers like for force, pressure, motion, temperature measurement etc

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	1	1	-	2	1	1	3
CO2	3	3	3	3	3	2	1	-	2	1	2	3
CO3	3	3	3	3	3	2	1	-	2	1	2	3
CO4	3	3	3	3	3	1	1	-	2	1	1	3
CO5	3	3	3	3	3	2	1	-	2	1	2	3
Avg	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**1.60**	**1.00**	**-**	**2.00**	**1.00**	**1.60**	**3.00**

BTEC511	OPTICAL COMMUNICATION	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction to Optical Communication:** Optical Spectral Band with Operating Windows, General Communication System, Optical Communication System with its advantages. **Optical Fiber Waveguides:** Ray Theory of Transmission with TIR, Acceptance Angle, Numerical Aperture and Skew Rays, Electromagnetic Mode Theory for Optical Propagation, Modes in a Planar Guide, Phase and Group Velocity, Phase Shift with Total Internal Reflection, Evanescent Field, Goos-Haenchen Shift, Cylindrical Fiber Modes, Mode Coupling, Step Index fibers Vs Graded Index fibers, Single Mode Fibers- Cut off wavelength, MFD & Spot Size.	08
II	**Signal Loss in Optical Fibers:** Attenuation, Material Absorption Losses (Intrinsic and Extrinsic absorption), types of Linear and Non-Linear Scattering Losses, Fiber Bending Losses, Kerr Effect. **Dispersion:** Introduction with its types: Chromatic / Intramodal Dispersion (Material and Waveguide Dispersion), Intermodal dispersion (for MSI and MGI fibers), Overall (Total) Fiber Dispersion in Multimode and Singe Mode Fiber, Dispersion Modified Single Mode Fibers, Polarization & Fiber Birefringence.	08
III	**Optical Sources: LEDs-**Introduction to LEDs & Materials used for fabrication, LED Power and Efficiency, LED Structures, LED Characteristics, Modulation Bandwidth. **Laser Diodes-**Introduction, Optical Feedback & Laser Oscillations, Resonant Frequencies, Laser Modes, and Threshold Condition for Laser Oscillation, Laser Diode Rate Equations, Semiconductor injection Laser- Efficiency, Laser Single Mode operation, Reliability of LED & ILD.	08
IV	**Power Launching in Fiber:** Source to Fiber Power Launching and Coupling Techniques, Power Launching Vs Wavelength, Equilibrium Numerical Aperture. **Photo Detectors:** Introduction, Physical Principles of Photodiodes: The PIN Photo Detector, Avalanche Photodiodes, Temperature Effect on Avalanche Gain, Detector Response Time, Photo Detector Noise: Noise Sources, Signal to Noise Ratio, Comparison of Photo Detectors, Fundamental Receiver Operation with Digital Signal Transmission.	08
V	**Digital Receiver Performance:** Probability of Error / BER, Receiver Sensitivity & The Quantum Limit, Error Control Techniques, Eye Diagram Pattern Features, Coherent Detection: Homodyne Detection and Heterodyne Detection, Digital links: Point to Point Links, Power Penalties, Multichannel & Multiplexing Transmission Techniques, basic concept of Free Space Optics (FSO) based Communication System.	08

Text Book:

1. John M. Senior, "Optical Fiber Communications", Pearson, 3rd Edition, 2010.
2. Gerd Keiser, "Optical Fiber Communications", McGraw Hill, 5th Edition, 2013.
3. Govind P. Agrawal, "Fiber Optic Communication Systems", John Wiley, 3rd Edition, 2004.

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

1. Define and explain the basic concepts and theory of optical communication.
2. Describe the signal losses with their computation and dispersion mechanism occurring inside the optical fiber cable.
3. Differentiate the optical sources used in optical communication with their comparative study.
4. Identify different optical components on receiver side; assemble them to solve real world problems related to optical communication systems.
5. Evaluate the performance of an optical receiver to get idea about power budget and ultimately be an engineer with adequate knowledge in optical domain.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	1	-	-	-	-	-	-	1	2
CO2	3	3	3	2	2	1	1	-	-	-	1	3
CO3	3	3	3	3	2	1	1	1	2	2	1	3
CO4	3	3	3	1	1	1	1	-	-	-	-	3
CO5	3	3	3	3	2	1	1	1	1	1	1	3
Avg	**3.00**	**3.00**	**2.60**	**2.00**	**1.75**	**1.00**	**1.00**	**1.00**	**1.50**	**1.50**	**1.00**	**2.80**

BTEC551	INTEGRATED CIRCUITS LAB	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. Design the following using Op-Amp: ***(Through Virtual Lab Link 1)***
   a) A unity gain amplifier.
   b) An inverting amplifier with a gain of "A".
   c) A non-inverting amplifier with a gain of "A"
2. Study and design Log and antilog amplifiers.
3. Voltage to current and current to voltage convertors.
4. Second order filters using operational amplifier for: ***(Through Virtual Lab Link 1)***
   a) Low pass filter of cutoff frequency 1 KHz.
   b) High pass filter of frequency 12 KHz.
5. Realization of Band pass filter with unit gain of pass band from 1 KHz to 12 KHz.
6. Study and design voltage comparator and zero crossing detectors.
7. Function generator using operational amplifier (sine, triangular & square wave).
8. Design and construct astable multivibrator using IC 555 and
   a) Plot the output waveform
   b) Measure the frequency of oscillation ***(Through Virtual Lab Link 2)***
9. Design and construct a monostable multivibrator using IC 555 and
   a) Plot the output waveform
   b) Measure the time delay ***(Through Virtual Lab Link 2)***
10. Implement Schmitt Trigger Circuit using IC 555. ***(Through Virtual Lab Link 2)***
11. Implement voltage-controlled oscillator using IC566 and plot the waveform. ***(Through Virtual Lab Link 2)***
12. Study and design ramp generator using IC 566.

Virtual Lab Link:

1. http://vlabs.iitkgp.ernet.in/be/exp17/index.html
2. http://hecoep.vlabs.ac.in/Experiment8/Theory.html?domain=ElectronicsandCommunications&lab=Hybrid%20Electronics%20Lab

Available on: http://www.vlab.co.in/broad-area-electronics-and-communications

Course Outcomes:

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

1. Design different non-linear applications of operational amplifiers such as log, antilog amplifiers and voltage comparators.
2. Explain and design different linear applications of operational amplifiers such as filters.
3. Demonstrate the function of waveforms generator using op-Amp.
4. Construct multivibrator and oscillator circuits using IC555 and IC566 and perform measurements of frequency and time.
5. Design and practically demonstrate the applications based on IC555 and IC566.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	3	2	1	-	-	-	1	2	3
CO2	3	2	3	3	2	1	-	-	-	1	2	3
CO3	3	2	3	3	2	1	-	-	-	1	2	3
CO4	3	2	3	3	2	1	-	-	-	1	2	3
CO5	3	2	3	3	2	1	-	-	-	1	2	3
Avg	**3**	**2**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**2**	**3**

BTEC552	MICROPROCESSOR & MICROCONTROLLER LAB	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. ***1.*** Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers. ***(Through Virtual Lab Link)***
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers. ***(Through Virtual Lab Link)***
3. ***3.*** To perform multiplication and division of two 8 bit numbers using 8085. ***(Through Virtual Lab Link)***
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a program using 8086 to arrange an array of data in ascending and descending order. ***(Through Virtual Lab Link)***
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8086 instruction set.
7. To convert given Hexadecimal number into its equivalent BCD number and vice versa using 8086 instruction set.
8. To interface 8253 programmable interval timer and verify the operation of 8253 in six different modes.
9. To write a program to initiate 8251 and to check the transmission and reception of character.
10. Serial communication between two 8085 through RS-232 C port.
11. Write a program of Flashing LED connected to port 1 of the 8051 Micro Controller
12. Write a program to generate 10 kHz square wave using 8051.
13. Write a program to show the use of INT0 and INT1 of 8051.
14. Write a program for temperature & to display on intelligent LCD display.

Virtual Lab Link: http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php

Available on: http://www.vlab.co.in/broad-area-electronics-and-communications

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

1. Use techniques, skills, modern engineering tools, instrumentation and software/hardware appropriately to list and demonstrate arithmetic and logical operations on 8 bit data using microprocessor 8085.
2. Examine 8085 & 8086 microprocessor and its interfacing with peripheral devices.
3. State various conversion techniques using 8085 & 8086 and generate waveforms using 8085.
4. Implement programming concept of 8051 Microcontroller.
5. Design concepts to Interface peripheral devices with Microcontroller so as to design Microcontroller based projects.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	2	-	-	-	1	-	-	3
CO2	3	3	2	1	2	-	-	-	1	-	-	3
CO3	2	2	2	1	2	-	-	-	1	-	-	3
CO4	3	3	1	1	2	-	-	-	1	-	-	3
CO5	3	3	**2**	**1**	**2**	-	-	-	**1**	-	**-**	3
Avg	**2.8**	**2.8**	**1.8**	**1**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**3**

BTEC553	DIGITAL SIGNAL PROCESSING LAB	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. Introduction to MATLAB and or Open Source Software, Scilab (Using Spoken Tutorial MOOCs).
2. Write a Program for the generation of basic signals such as unit impulse, unit step, ramp, exponential, sinusoidal and cosine.
3. Implement IIR Butterworth analog Low Pass for a 4 KHz cut off frequency.
4. Verify Blackman and Hamming windowing techniques.
5. Evaluate 4-point DFT of and IDFT of $x(n) = 1, 0 \leq n \leq 3$; 0 elsewhere.
6. Verify Linear convolution of two sequences using FFT
7. Verify Circular Convolution of two sequences using FFT.
8. To verify FFT as sample interpolator.
9. To implement Tone Generation.
10. To implement floating point arithmetic.
11. To study about DSP Processors and architecture of TMS320C6713 DSP processor.
12. **VIRTUAL Lab by NME-ICT available at*: (Through Virtual Lab)***
    - 12.1 Study of Discrete Fourier Transform (DFT) and its inverse.
    - 12.2 Study of FIR filter design using window method: Lowpass and highpass filter.
    - 12.3 Study of FIR filter design using window method: Bandpass and Bandstop filter.
    - 12.4 Study of Infinite Impulse Response (IIR) filter.

Virtual Lab Link: http://vlabs.iitkgp.ernet.in/dsp/index.html#
http://vlabs.iitkgp.ernet.in/dsp/

Available on: http://www.vlab.co.in/broad-area-electronics-and-communications

Spoken Tutorial (MOOCs):

Spoken Tutorial MOOCs, ' Course on Scilab', IIT Bombay (http://spoken-tutorial.org/)

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

1. Create and visualize various discrete/digital signals using MATLAB/Scilab.
2. Implement and test the basic operations of Signal processing.
3. Examine and analyse the spectral parameters of window functions.
4. Design IIR and FIR filters for band pass, band stop, low pass and high pass filters.
5. Design the signal processing algorithms using MATLAB/Scilab.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	2	-	-	-	1	-	-	3
CO2	3	3	2	1	2	-	-	-	1	-	-	3
CO3	3	3	2	1	2	-	-	-	1	-	-	3
CO4	3	3	2	1	2	-	-	-	1	-	-	3
CO5	3	3	**2**	**1**	**2**	-	-	-	**1**	-	**-**	3
Avg	**3**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**3**

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B.Tech 3rd Year
VI Semester
Syllabus

BTEC601	DIGITAL COMMUNICATION	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**Random Variables:** Concept of Probability, Random variables, Statistical averages, Random process, Power Spectral Density & Autocorrelation Function of Random Processes, Gaussian Random Process.	8
II	**Digital Communication Basics:** Introduction to Digital communication systems, PSD of Line Coding schemes, Pulse shaping, Scrambling, Eye diagram, Gram-Schmidt orthogonalization scheme.	8
III	**Digital Modulation:** Modulation and Demodulation of Digital modulation schemes-ASK, FSK, PSK, DPSK, QPSK. Constellation diagram, Introduction to M-ary communication.	8
IV	**Digital Receiver:** Optimum threshold detection, Concept of Matched Filters, BER analysis of BASK, BFSK, BPSK, Introduction of Spread spectrum communication (DS-SS, FH-SS).	8
V	**Information Theory:** Measure of information-information, entropy, mutual information, mutual entropy, Source encoding (Shannon-Fano, Huffman), Shannon's channel capacity theorem, Introduction to error correction and detection, Linear block codes, Cyclic codes (systematic, non-systematic), Convolution coding and decoding.	8

Text Books:

1. B.P. Lathi, "Modern Digital and Analog communication Systems", 4th Edition, Oxford University Press.
2. John G. Proakis, "Digital Communications", 5th Edition, TMH.
3. H. Taub, D L Schilling, Gautam Saha, "Principles of Communication", 4th Edition, TMH.
4. Singh & Sapray, Communication Systems, 3th Edition, TMH.

Reference Books:

1. Simon Haykin, "Communication Systems", 5th Edition, Wiley India.
2. (Schaum's Outline Series) H P HSU & D Mitra, "Analog and Digital Communications", TMH, 3rd Edition.

Course Outcomes: At the end of this course students will demonstrate the ability:

1. To formulate basic statistics involved in communication theory.
2. To demonstrate the concepts involved in digital communication.
3. To explain the concepts of digital modulation schemes.
4. To analyze the performance of digital communication systems.
5. To apply the concept of information theory in digital systems.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3
Avg	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

BTEC602	Control System	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**Introduction to Control Systems:** Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs, Modeling of Physical systems: electrical networks, mechanical systems elements, free body diagram, analogous Systems, sensors and encoders in control systems, modeling of armature controlled and field controlled DC servomotor.	8
II	**State-Variable Analysis:** Introduction, vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions, Decomposition of transfer functions, Controllability and observability, Eigen Value and Eigen Vector, Diagonalization.	8
III	**Time domain Analysis of Control Systems:** Time response of continuous data systems, typical test signals for the time response of control systems, unit step response and time-domain specifications, time response of a first order system, transient response of a prototype second order system, Steady-State error, Static and dynamic error coefficients, error analysis for different types of systems.	8
IV	**Stability of Linear Control Systems:** Bounded-input bounded-output stability continuous data systems, zero-input and asymptotic stability of continuous data systems, Routh Hurwitz criterion, Root-Locus Technique: Introduction, Properties of the Root Loci, Design aspects of the Root Loci.	8
V	**Frequency Domain Analysis:** Resonant peak and Resonant frequency, Bandwidth of the prototype Second order system, effects of adding a zero to the forward path, effects of adding a pole to the forward path, polar plot, Nyquist stability criterion, stability analysis with the Bode plot, relative stability: gain margin and phase margin.	8

Text Book:

1. I. J. Nagrath & M. Gopal, "Control System Engineering", 6th Ed. New Age International Publishers, 2018
2. B.C. Kuo & Farid Golnaraghi, "Automatic Control Systems", 9th Edition, John Wiley India, 2008

Reference Books:

1. (Schaums Outlines Series) Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, "Control Systems", 3rd Edition, TMH, Special Indian Edition, 2010.
2. A. Anand Kumar, "Control Systems", Second Edition, PHI Learning private limited, 2014.
3. William A. Wolovich, "Automatic Control Systems", Oxford University Press, 2011.

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

1. Describe the basics of control systems along with different types of feedback and its effect. Additionally they will also be able to explain the techniques such as block diagrams reduction, signal flow graph and modelling of various physical systems along with modelling of DC servomotor.
2. Explain the concept of state variables for the representation of LTI system.
3. Interpret the time domain response analysis for various types of inputs along with the time domain specifications.
4. Distinguish the concepts of absolute and relative stability for continuous data systems along with different methods.
5. Interpret the concept of frequency domain response analysis and their specifications.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	2	-	-	-	-	-	-	2
CO2	3	3	2	3	3	-	-	-	-	-	1	3
CO3	3	3	3	3	3	1	-	-	-	-	1	3
CO4	3	3	3	3	3	1	-	-	-	-	1	3
CO5	3	3	3	3	3	1	-	-	-	-	1	3
Avg	**3.00**	**3.00**	**2.80**	**2.80**	**2.80**	**1.00**	**-**	**-**	**-**	**-**	**1.00**	**2.80**

BTEC603	Antenna & Wave Propagation	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**Coordinate Systems and Transformation:** Cartesian, Cylindrical, Spherical transformation. Vector calculus: Differential length, area and volume, line, surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar.	6
II	**Electrostatic fields and Magnetostatic fields**: Electric field intensity, Electric field due to charge distribution, Electric flux density, Gauss's Law- Maxwell's equation, Continuity equation and relaxation time, boundary conditions, Magneto-static fields, Ampere's circuit law, Maxwell's equation, magnetic scalar and vector potential, Magnetic boundary conditions, Maxwell's equation in final form.	10
III	**Antenna fundamental and definitions:** Introduction, Basic antenna parameters, Patterns, Beam area (or Beam solid angle) ΩA, Radiation intensity, Beam efficiency, Directivity D and Gain G, Directivity and resolution, Antenna apertures, Effective height, The radio communication link, Fields from oscillating dipole, Single-to-noise ratio (SNR), Antenna temperature, Antenna impedance.	8
IV	**Antenna Design:** Electric dipoles, The short electric dipole, The fields of a short dipole, Radiation resistance of short electric dipole, Thin linear antenna, Radiation resistance of λ/2 antenna, Array of two driven λ/2 elements: Broadside case and end-fire case, Horizontal antennas above a plane ground, Vertical antennas above a plane ground, Yagi-Uda antenna design, Longwire antennas, Folded dipole antennas.	8
V	**Wave Propagation:** Plane earth reflection, Space wave and surface wave. Space wave propagation: Introduction, Field strength relation, Effects of imperfect earth, Effects of curvature of earth. Sky wave propagation: Introduction structural, details of the ionosphere, Wave propagation mechanism, Refraction and reflection of sky waves by ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and skip distance, Relation between MUF and the skip distance, Multi-Hop propagation, Wave characteristics.	8

Text Books:

1. MNO Sadiku, "Elements of Electromagnetic', 7th Ed, Oxford University Press, 2018.
2. John D Kraus, Ronald J Marhefka and Ahmad S. Khan, "Antennas and WavePropagation", 5th Edition, Tata McGraw Hill, 2017.
3. Das, Antennas and Wave Propagation, TMH 1st Edition.
4. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley, 2016.
5. WH Hayt and JA Buck, "Engineering Electromagnetic", 7th Edition TMH, 2013.
6. (Schaums Outlines Series) Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, "Engineering Electromagnetic", 3rd Edition, TMH, Special Indian Edition,2010.

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

1. Identify different coordinate systems and their applications in electromagnetic field theory toestablish a relation between any two systems using the vector calculus.
2. Explain the concept of static electric field, current and properties of conductors.
3. Express the basic concepts of ground, space, sky wave propagation mechanism.
4. Demonstrate the knowledge of antenna fundamentals and radiation mechanism of the antenna.
5. Analyze and design different types of basic antennas.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	1	-	-	-	-	-	-	3
CO2	3	3	2	1	1	-	-	-	-	-	-	3
CO3	3	3	2	2	2	-	-	-	-	-	-	3
CO4	3	3	2	2	1	-	-	-	-	-	-	3
CO5	3	3	2	2	2	-	-	-	-	-	-	3
Avg	**3.00**	**3.00**	**2.00**	**1.60**	**1.40**	**-**	**-**	**-**	**-**	**-**	**-**	**3.00**

Unit	Topics	Lectures
I	**Advanced concepts in 8051 architecture:** Review of 8051 architecture, concept of synchronous serial communication, SPI and I2C communication protocols, study of SPI port on 89LP 51RD2, study of SAR ADC/DAC MCP3304 / MCP 33, interfacing concepts for SPI based ADC/DAC, study of watchdog timer, study of PCA timer in different modes like capture mode, PWM generation mode, High speed output toggle mode Embedded 'C' programming for the above peripherals **Introduction, AVR Family architecture**, Register File, The ALU. Memory access and Instruction execution. I/O memory. EEPROM. I/O ports. Timers. Interrupt Structure	8
II	**MSP430x5x Microcontroller:** series block diagram, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of 16-bit microcontroller; Sample embedded system on MSP430 microcontroller. Memory Mapped Peripherals, programming System registers, I/O pin multiplexing, pull up/down registers, GPIO control. Interrupts and interrupt programming.	8
III	**Introduction to Embedded Systems**: Describe what an embedded system is and its main components, Outline the different options available for building embedded systems, Explain the benefits, functions, and attributes of embedded. systems,Examine the constraints specific to embedded systems and their impact **The Arm Cortex-M4 Processor Architecture**: Outline the different Arm processor families, Differentiate between an Arm processor and an Arm architecture ,Outline the main features of Arm Cortex-M4 processors,Distinguish the different blocks and registers in an Arm Cortex-M4 processor.	8
IV	**Introduction to the Internet of Things**: Describe the concepts of IoT and understand the key elements of an IoT device,Outline the evolution of IoT,Describe the main technologies that enable IoT, Identify the key challenges facing IoT systems ,Evaluate the opportunities and risks that emerge with IoT adoption **Hardware Platforms for IoT**: Identify the concepts of hardware platform and the factors influencing its design,Differentiate between various types of memory, Explain the principles of sensors and the role of I/O ,Describe analog-to-digital and digital-to-analog conversion techniques, Identify the different techniques that can be used to save energy	8
V	**Introduction to the Mbed Platform and CMSIS**: Describe the Mbed platform and its functionalities, Explain the different components of the Mbed OS, Identify the different Mbed development tools that are available,Identify the features offered by the Mbed SDK and HDK, Outline the Cortex Microcontroller Software Interface Standard (CMSIS) tool and its benefits. **IoT Connectivity:** Identify the concept of Bluetooth technology, Identify key features of the Bluetooth and Bluetooth Low Energy protocols, Explain how a Bluetooth connection is secured, Outline the new features that are introduced in the Bluetooth 5 specification, Explain the architecture and protocol stack used in ZigBee.	8

Text Books:

1. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and Mc Kinlay Rolin D "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Publication,200
2. John H Davies, "MSP430 Microcontroller Basics" Newnes Publication,2008.
3. Embedded Systems Fundamentals on Arm Cortex-M based Microcontrollers: A Practical Approach by Alexander G. Dean https://www.arm.com/resources/education/textbooks/efficient- embedded-systems

Reference Books:

1. TI MSP430x5xx and MSP430x6xx Family User's Guide , Revised 2018.
2. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by JosephYiu
3. Cortex-A Series Programmer's Guide for ARMv7-A by Arm from http://infocenter. arm.com/ help/topic/com.arm.doc.den0013d/index.html
4. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison:https://community.arm.com/developer/ip-products/processors/b/processors-ip- blog/posts/white-paper-cortex-m-for-beginners-an-overview-of-the-arm-cortex-m-processor-family- and-comparison.

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

1. Explain the advance concept of 8051 architectures and AVR family architecture and compare them for different applications.
2. To demonstrate the basics of MSP430x5x Microcontroller
3. To execute the I/O interfacing and peripheral devices associated with MicrocontrollerSoC (system on chip).
4. Explain the advance concept Arm Cortex-M4 Processor Architecture.
5. Demonstrate the ability to do Demonstrate the basics of Embedded Systems, IoT and its application and design IoT based projects on Arm based development boards

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	2	1	1	-	1	2	1	3
CO2	3	2	1	1	3	1	1	-	1	2	2	3
CO3	3	1	1	1	3	1	1	-	1	2	2	3
CO4	3	2	2	2	3	2	1	-	1	2	2	3
CO5	2	1	2	2	3	2	1	-	1	2	2	3
Avg	**2.8**	**1.6**	**1.4**	**1.4**	**1.4**	**1.4**	**1**	**-**	**1**	**2**	**1.8**	**3**

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BTEC605	**SATELLITE COMMUNICATION**	**3L:0T:0P**	**3 Credits**

Unit	Topics	Lectures
I	**Introduction to Satellite Communication:** History, Overview of Satellite Communication, Types of Satellite, Types of Orbit, Satellite services, Advantages & Applications of Satellite communication, Satellite Life phases, Space Debris, Introduction to Geo-synchronous and Geo-stationary satellites.	8
II	**Orbital Mechanics:** Orbital Mechanics, Kepler's Three laws of Planetary Motion, Developing the Equations of the orbit, Look Angle Determination, Earth Stations, Orbital Perturbations, Orbital effects in Communication system performance.	8
III	**Satellite Sub-systems:** Seven segments of Satellite communication, Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system. **Satellite Link Design:** Basic transmission theory, System noise temperature and G/T ratio, Design of down link and uplink, Design of satellite links for specified C/N.	8
IV	**Introduction to Various Satellite Systems:** VSAT**,** Direct broadcast satellite television and radio, Satellite navigation and the Global positioning systems, GPS position location principle, GPS receivers and codes, Satellite Signal Acquisition, GPS navigation Message, GPS Signal Levels, Timing Accuracy, GPS Receiver Operation.	8
V	**Launchers & Advanced Technologies:** Mechanism of Satellite launching, Launch Vehicles, Advanced launching tech like Space X, Intelligent Testing, Control and Decision making for Space, Inter Satellite Link. **Indian Satellite Systems:** History and Overview of Indian Satellite System, Achievements, GSLV, PSLV, Advanced Technology Vehicle.	8

Text Books:

1. B.Pratt, A.Bostian, "Satellite Communications", Wiley India, 2nd Edition,2006.
2. D. Roddy, "Satellite Communications", TMH, 4th Edition, 2001.
3. Digital Satellite Communications/ Tri T. Ha./ McGraw-Hill, 2nd Edition
4. D.C. Agrawal, Satellite communication, Khanna Publishers; 7th Edition.

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

1. Define and list the benefits of satellite communication**.**
2. Demonstrate orbital mechanics principles of satellite communication systems and solve problems related to it.
3. Describe a satellite link and identify ways to improve the link performance.
4. Classify new technologies of satellite communication systems as per given specifications.
5. Examine advanced technologies of satellite launching and describe the Indian satellite system.

CO-PO Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3
Avg	**3**	**3**	**3**	**2**	**-**	**-**	**-**	-	**-**	**-**	**-**	**3**

BTEC606	DATA COMMUNICATION NETWORKS	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction to Networks & Data Communications:** Goals and Applications of Networks ,The Internet, Protocols & Standards, Layered Tasks, OSI reference Model, TCP / IP, Addressing, Line Coding Review.	8
II	**Physical Layer**: Transmission Media- Guided and unguided, Network Topology Design, **Data Link Layer**: Error detection and Correction, Framing, Flow and Error Control Protocols, Noiseless Channel and Noisy Channel Protocol, HDLC, Point-to-Point Protocol	8
III	**Multiple Access:** RANDOH, CDMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization Wired LANs: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11, Bluetooth IEEE 802.16.	8
IV	**Network Layer:** Design Issues. Routing Algorithms. Congestion control Algorithms. Internetworking –TCP/IP, IP Packet, IPv4 and IPv6 Protocols, IPV4 Addresses, Connecting Devices, Virtual LAN IPV6 Addresses.	8
V	**Transport Layer Protocol:** UDP and TCP, ATM, Cryptography, Network Security**,** Session Layer-Design issues. **Application Layer:** File Transfer, Electronic mail, HTTP, WWW, SMTP, Cryptography, Network Security.	8

Text Books:

1. B. A. Forouzan, "Data Communications and Networking", 5th Edition, TMH, 2017.

Reference Books:

1. S. Tanenbaum, "Computer Networks", 4th Edition, Pearson, 2013.
2. W. Stallings, "Data and Computer Communication", 8th Edition, Pearson, 2007.

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

1. Identify the issues and challenges in the architecture of a network.
2. Analyze the services and features of various protocol layers in data layer.
3. Demonstrate the knowledge of multiple access to design a access technique for a particular application.
4. Realize protocols at different layers of a network hierarchy.
5. Recognize security issues in a network and various application of application layer.

CO-PO Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	-	-	-	-	-	1	2
CO2	3	3	3	2	2	1	1	-	-	-	1	3
CO3	3	3	3	3	2	1	1	1	2	2	1	3
CO4	3	3	3	1	1	1	1	-	-	-	-	3
CO5	3	3	3	3	2	1	1	1	1	1	1	3
Avg	**3.00**	**3.00**	**2.60**	**2.00**	**1.75**	**1.00**	**1.00**	**1.00**	**1.50**	**1.50**	**1.00**	**2.80**

BTEC607	ANALOG SIGNAL PROCESSING	3L : 0T : 0P	3 Credits

Unit	Topics	Lectures
I	Introduction to domains and the analogue/digital trade off, Introduction to current conveyor, current feedback amplifier. Analog signal filtering: introduction to bilinear transfer functions and active realizations. Second-order filter realization, filter design parameters (Q and ω_0), frequency response, Three op-amp biquad, effect of finite gain of op-amp over filters, Sallen-Key biquad.	8
II	Ideal low-pass filter, Buttreworth and Chebyshev magnitude response, pole locations, low-pass filter specifications, comparison of Maximally flat and Equal ripple responses.	8
III	Delay equalization: equalization procedures, equalization with first-order and second order modules, strategies for equalization design. Definition of Bode sensitivity.	8
IV	The General Impedance Convertor (GIC), optimal design of the GIC, realization of simple ladders, Gorski-Popiel's Embedding Technique, Bruton's FDNR technique, Creating negative components.	8
V	Elementary transconductor building blocks, resistors, integrators, amplifiers, summers, Gyrator, First and second order filters, Higher order filters	**8**

Text Book:

1. R. Schaumann and M.E. Valkenberg, "Design of Analog Circuits", Oxford University Press

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

1. Describe and apply fundamentals of signal processing in analog domain and its associatedconcepts like OTA and current conveyor.
2. Introduction of filter and its designing parameters
3. Solve problems and design higher order filters like Butterworth and Chebyshev.
4. Understand and explain the reasons for delay in filter designing and its procedure to equalize.
5. Understand the principles of the inductor simulation like general impedance convertor (GIC), optimal design of the GIC, Gorski-Popiel's Embedding Technique, Bruton's FDNR techniquewhich are used for placing equivalent inductor on integrated circuits.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	1	-	-	-	-	-	-	-	3
CO2	3	3	1	1	-	-	-	-	-	-	-	3
CO3	3	3	1	1	-	-	-	-	-	-	-	3
CO4	3	3	1	1	-	-	-	-	-	-	-	3
Avg	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

BTEC608	RANDOM VARIABLES & STOCHASTIC PROCESS	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Probability**: Introduction to set theory, experiments and sample spaces, joint probability, conditional probability, concept of total Probability, Bayes' Theorem, and independent events, Bernoulli's trials, combined experiments.	8
II	**Random Variables:** Introduction, types of random variables, cumulative distribution function and probability density functions, Standard distributions: Gaussian, exponential, Rayleigh, uniform, Bernoulli, binominal, Poisson, discrete uniform and conditional distributions. Functions of one random variable: distribution, mean, variance, moments and characteristics functions.	8
III	**Multiple Random Variables:** Joint distributions, joint density function and properties, marginal distribution and density functions, conditional distribution and density Functions, statistical independence, functions of two random variables, joint moments, Multiple random variables: multiple functions of multiple random variables, jointly Gaussian random variables, sums of random variable, Central limit theorem.	8
IV	**Stochastic Processes:** Definitions, Random process concept, Statistics of stochastic processes: Mean, Autocorrelation, Covariance Functions and its properties, Strict and Wide sense stationary, random processes, Time Averages and Ergodicity, Mean-Ergodic Processes.	8
V	**Stochastic Processes in Frequency Domain:** Power spectrum of stochastic processes, Properties of power spectral density, Relationship between Power Spectrum and Autocorrelation Function, the Cross-Power Density Spectrum and Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function, Transmission over LTI systems, Gaussian and White processes.	8

Text Books:

1. Probability, Random Variables And Stochastic Processes, Papoulis, TMH (2002)
2. Stochastic Processes, 2ed, Ross, Wiley.(1996)

Reference Books:

1. Devore – Probability and statistics for engineering and sciences, Cengage learning 2011
2. Mendenhall – Introduction to probability and statistics, Cengage learning 2012
3. Probability, Random Variables And Random Signal Principles, Peebles, TMH 2002
4. Probability Theory and Stochastic Processes for Engineers, Bhat, Pearson 2011
5. Probability and Random Processes with Application to Signal Processing, 3/e, Stark, Pearson2002
6. Random Variables & Stochastic Processes, Gaur and Srivastava, Genius publications 2003
7. Random Processes: Filtering, Estimation and Detection, Ludeman, Wiley 2002
8. An Introduction to Probability Theory & Its App., Feller, Wiley 1969

Course Outcomes:

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

1. Students will be able to explain the basic learning of Probability.
2. Students will be able to demonstrate the concept of Random Variables.
3. Students will be able to analyze Multiple Random Variables.
4. Students will be able to interpret the basics of Stochastic Processes.
5. Students will be able to express Stochastic Processes in Frequency domain.

CO-PO Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3
Avg	**3**	**3**	**3**	**2**	**-**	**-**	**-**	-	**-**	**-**	**-**	**3**

BTEC651	DIGITAL COMMUNICATION LAB	0L:0T:2P	1 Credit

Part A

SUGGESTIVE LIST OF EXPERIMENTS:

1. To study Eye diagram patterns of various digital pulses.
2. To study the inter symbol interference.
3. To study generation of Unipolar RZ & NRZ Line Coding.
4. To study generation of Polar RZ & NRZ Line Coding.
5. To study generation of Bipolar RZ & NRZ Line Coding.
6. Implementation and analysis of BASK modulation and demodulation
7. Implementation and analysis of BFSK modulation and demodulation
8. Implementation and analysis of BPSK modulation and demodulation. *(Through Virtual Lab)*
9. Implementation and analysis of QPSK modulation and demodulation. *(Through Virtual Lab)*
10. To simulate M-ary Phase shift keying technique using MATLAB.
11. To study generation and detection of DPSK using MATLAB.
12. Implementation and analysis of Delta modulation and demodulation.
13. Implementation and analysis of DSSS Modulation, Demodulation & BER measurement.
14. Implementation and analysis of FHSS Modulation, Demodulation & BER measurement.
15. To study encoding and decoding of Linear Block Codes
16. To study the working of Convolution encoder.

Part **B**

1. To study simple dipole □ 2 antenna and to calculate beam-width, front / back ratio, andgain of the antenna. 10.
2. To study folded dipole antenna and to calculate beam-width, front / back ratio, andgain of the antenna.
3. To study □ 2 phase array end-fire antenna and to calculate beam-width, front / backratio, and gain of the antenna.
4. To study broadside array antenna and to calculate beam-width, front / back ratio, andgain of the antenna.

Virtual Lab Link: https://vlab.amrita.edu/?sub=1&brch=201

Course Outcomes: At the end of this course students will demonstrate the ability:

1. To formulate basic concepts of pulse shaping in digital communication.
2. To identify different line coding techniques and demonstrate the concepts.
3. To design equipments related to digital modulation and demodulation schemes.
4. To analyze the performance of various digital communication systems and evaluate thekey parameters.
5. To conceptualize error detection & correction using different coding schemes in digitalcommunication.

CO-PO Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	-	1	-	2	-	1	2
CO2	3	3	3	3	3	-	2	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	2	2	1	3
CO4	3	3	3	3	3	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	3	2	2	3
Avg	**3**	**3**	**2.8**	**3**	**3**	**-**	**1.5**	**-**	**2.6**	**2.5**	**2**	**2.8**

BTEC652	**CONTROL SYSTEM LAB**	**0L:0T:2P**	**1 Credit**

SUGGESTIVE LIST OF EXPERIMENTS:

1. Introduction to MATLAB Control System Toolbox.
2. Determine transpose, inverse values of given matrix.
3. Plot the pole-zero configuration in s-plane for the given transfer function.
4. Determine the transfer function for given closed loop system in block diagram representation.
5. Create the state space model of a linear continuous system.
6. Determine the State Space representations of the given transfer function.
7. Determine the time response of the given system subjected to any arbitrary input.
8. Plot unit step response of given transfer function and find delay time, rise time, peaktime, peak overshoot and settling time.
9. Determine the steady state errors of a given transfer function.
10. Plot root locus of given transfer function, locate closed loop poles for different values ofk.
11. Plot bode plot of given transfer function. Also determine gain and phase margins.
12. Plot Nyquist plot for given transfer function. Also determine the relative stability by measuring gain and phase margin.

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

1. Classify different tools in MATLAB along with the basic matrix operations used in MATLAB.
2. Evaluate the poles and zeros on s-plane along with transfer function of a given system.
3. Construct state space model of a linear continuous system.
4. Evaluate the various specifications of time domain response of a given system.
5. Appraise the steady state error of a given transfer function.
6. Examine the relative stability of a given transfer function using various methods such asroot locus, Bode plot and Nyquist plot.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	3	1	-	-	-	-	-	3
CO2	3	3	2	2	3	1	-	-	-	-	-	2
CO3	3	3	1	1	3	1	-	-	-	-	-	2
CO4	3	3	2	2	3	1	-	-	-	-	-	2
CO5	3	3	2	2	3	1	-	-	-	-	-	2
CO6	3	3	2	2	3	1	-	-	-	-	-	2
Avg	**3.00**	**2.83**	**1.83**	**1.83**	**3.00**	**1.00**	-	-	-	-	-	**2.16**

BTOE601	**MEASUREMENT & INSTRUMENTATION LAB**	**0L:0T:2P**	**1 Credit**

SUGGESTIVE LIST OF EXPERIMENTS:

1. Measurement ofphase difference and frequency using CRO (Lissajous Figure)
2. Study ofL.C.R. Bridge and determination ofthe value ofthe given components.
3. Characteristics ofThermocouples and RTD.
4. Study of the following transducer (i) PT-100 Transducer (ii) J-Type Transducer (iii) K-Type Transducer (iv) Pressure Transducer
5. Characteristics ofLDR, Photo Diode, and Phototransistor:

(i) Variable Illumination.
(ii) Linear Displacement

6. Characteristics ofLVDT.
7. Study ofthe transistor tester and determination ofthe parameters ofthe given transistors
8. Experiment using PLC Trainer Kits

Through Virtual Lab:

9. Measurement oflow resistance Kelvin's double bridge.
10. To measure unknown capacitance ofsmall capacitors by using Schering's bridge.
11. To measure unknown Inductance using Hay's bridge.
12. Measurement ofcapacitance by De Sauty Bridge.

Virtual Lab Link: http://vlabs.iitkgp.ernet.in/asnm/#
Available on: http://www.vlab.eo.in/broad-area-electronics-and-communications

Course Outcomes:

At the end ofthis course students will demonstrate the ability to:

1. Measure the unknown resistance, capacitance and inductance using LCR Bridge,Kelvin double bridge, Schering bridge, Hay's bridge, De sauty bridge.
2. Practically demonstrate the different types of transducers like J-type, K-type, PT-100and RTD.
3. Interpret frequency and phase difference from Lissajous figure.
4. Interpret hybrid parameters oftransistor and demonstrate different transducer like LDRand LVDT.
5. Demonstrate Experiment using PLC Trainer Kits

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	1	1	-	2	1	1	3
CO2	3	3	3	3	3	2	1	-	2	1	2	3
CO3	3	3	3	3	3	2	1	-	2	1	2	3
CO4	3	3	3	3	3	1	1	-	2	1	1	3
CO5	3	3	3	3	3	2	1	-	2	1	2	3
Avg	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**1.60**	**1.00**	**-**	**2.00**	**1.00**	**1.60**	**3.00**

BTOE602	**CAD FOR ELECTRONICS LAB**	**0L:0T:2P**	**1 Credit**

SUGGESTIVE LIST OF EXPERIMENTS:
PSPICE Experiments:

1. (a) Transient Analysis of BJT inverter using step input.(b)DC Analysis (VTC) of BJT inverter
2. (a) Transient Analysis of NMOS inverter using step input.
   (b) Transient Analysis of NMOS inverter using pulse input.
   (c) DC Analysis (VTC) of NMOS inverter.
3. (a) Analysis of CMOS inverter using step input.
   (b) Transient Analysis of CMOS inverter using step input with parameters.
   (c) Transient Analysis of CMOS inverter using pulse input.
   (d) Transient Analysis of CMOS inverter using pulse input with parameters.
   (e) DC Analysis (VTC) of CMOS inverter with and without parameters.
4. Transient & DC Analysis of NAND Gate using CMOS inverter.
5. Transient Analysis of NOR Gate inverter and implementation of XOR gate using NOR gate
6. To design and perform transient analysis of D latch using CMOS inverter.
7. To design and perform the transient analysis of SR latch circuit using CMOS inverter.
8. To design and perform the transient analysis of CMOS transmission gate.
9. Analysis of frequency response of Common Source amplifiers.
10. Analysis of frequency response of Source Follower amplifiers

Part B :

HDL (using VHDL **program module & verilog Module)**

VHDL PROGRAMS

1. Design and Simulation of Full Adder using VHDL program module
2. Design and Simulation of 4x1 MUX using VHDL **program module**
3. Design and Simulation of BCD to Excess-3 code using VHDL **program module**
4. Design and Simulation of 3 to 8 decoder using VHDL **program module**
5. Design and Simulation of JK Flip-flop using VHDL **program module**
6. Design and Simulation of CMOS Inverter using **verilog Module**

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

1. Design and analyze the performance of different type of inverters.
2. Design and analyze the performance of the basic logic gates using CMOS inverter circuit.
3. Design and analyze the performance of the memory based digital circuits using CMOS invertercircuit.
4. Analyze the performance of the different configuration of MOS amplifier circuits.

CO-PO Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	1	-	-	-	1	2	3
CO2	3	2	3	3	2	1	-	-	-	1	2	3
CO3	3	2	3	3	2	1	-	-	-	1	2	3
CO4	3	2	3	3	2	1	-	-	-	1	2	3
CO5	3	2	3	3	2	1	-	-	-	1	2	3
Avg	**3**	**2**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**2**	**3**

BTEC603	**MICROCONTROLLERS FOR EMBEDDED SYSTEM LAB**	**0L:0T:2P**	**1 Credit**

Part A

SUGGESTIVE LIST OF EXPERIMENTS:

1. Write a program of flashing LED connected to port 1 of the 8051 Micro Controller.
2. Write a program to generate 10 kHz squire wave using 8051.
3. Write a program to show the use of INT0 and INT1 of 8051.

Part B: Based on MSP 430

1. Write a program for temperature & to display on intelligent LCD display.
2. Write a program to generate a Ram waveform using DAC with micro controller.
3. Write a program to Interface GPIO port in C using MSP430 (blinking LEDs, push buttons)
4. Write a program Interface potentiometer with GPIO.
5. Write a program of PWM based Speed Controller of Motor controlled by potentiometerconnected to GPIO.
6. Write a program of PWM generation using Timer on MSP430 GPIO.
7. Write a program to Interface an accelerometer.
8. Write a program using USB (Sending data back and forth across a bulk transfer-mode USBconnection.)
9. Write a program for Master Slave Communication between 2MSP430s using SPI
10. Write a program of basic Wi-Fi application-Communication between two MSP430 based sensornodes.
11. Setting up the CC3100 as a HTTP server.
12. Review of User APIs for TI CC3100 & Initialization and Setting of IP addresses.

Part B: Based on ARM Process:

1. To develop and verify the interfacing ADC and DAC with LPC 2148 Arm Micro Controller.
2. Interfacing of LED and PWM with Micro Controller. (ARM-) using embedded C program.
3. Interfacing of serial port with Am processor using embedded C-program.
4. Interfacing of key board and LCD with Arm processor using embedded C-Program.
5. To develop and verify Embedded C program mailbox using ARM.
6. To implement zigbee protocol with ARM program.
7. Implement the lighting and winking LEDs of the ARM I/O port via programming.
8. ARM programming in C language using KEIL IDE.
9. Demonstrate the TIMING concept of real time application using RTOS on ARM microcontrollerkit.
10. Demonstrate the Multi-Tasking concept of real time application using RTOs on ARMmicrocontroller.
11. Demonstrate the RS 232 serial communication using RTOS on ARM microcontroller kit.
12. ISR (Interrupt Service Routine) programming in ARM based system with I/O port.

Part C: Virtual Lab Platform

http://vlabs.iitb.ac.in/vlabs-dev/labs/8051-Microcontroller-Lab/labs/index.php
https://www.soe.uoguelph.ca/webfiles/engg4420/EmbeddedSystemsAndLabsForARM-V1.1.pdf https://profile.iiita.ac.in/bibhas.ghoshal/IEMB_2018/Lectures/ES_basics.pdf
https://nptel.ac.in/courses/108/102/108102045/

Practical Outcome The Student able to:

1. To understand the basis work of microcontroller and learn the working.

2. To understand the building blocks of embedded system.
3. To learn the concept of interfacing with different devices.
4. To relate the concept of memory map and memory interface.
5. To discover the characteristics of real time system.

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CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	2	-	-	-	1	-	-	3
CO2	3	3	2	1	2	-	-	-	1	-	-	3
CO3	2	2	2	1	2	-	-	-	1	-	-	3
CO4	3	3	1	1	2	-	-	-	1	-	-	3
CO5	3	3	**2**	**1**	**2**	-	-	-	**1**	-	-	3
Avg	**2.8**	**2.8**	**1.8**	**1**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**3**

OPEN ELECTIVE-I

[BTOE-061] REAL TIME SYSTEMS

Objectives:

- Understand the fundamental concepts of real-time systems, including timing requirements and constraints.
- Learn about different types of real-time tasks, such as periodic, sporadic, and aperiodic tasks.
- Gain knowledge of real-time operating systems (RTOS) and their features, including task management and synchronization.

Subject Code: BTOE-061	**REAL TIME SYSTEMS**	**L TP:3 0 0**	**Credits:3**

Course Outcome: The student will be able to

CO-1	Enhance creative knowledge of students regarding selection of a business idea and it's implementation process.
CO-2	Acquire knowledge on entrepreneurship development, its Pro's and con's.
CO-3	Acquire basic knowledge on how to become an Entrepreneur.
CO-4	Develop knowledge on Production systems and it's sustainability through production, planning and control (PPC)
CO-5	Develop appropriate business model and apply in a better way.

SYLLABUS

Unit-I

Introduction

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and TimingConstraints,HardRealTimeSystemsandSoftRealTimeSystems,ReferenceModelsforRealTimeSystems: Processors and Resources,

Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Unit-II

Real Time Scheduling

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First(LST)Algorithms, Rate Monotonic Algorithm,

Offline Versus Online Scheduling, Scheduling A periodic ands poradic jobs in Priority Driven and Clock Driven Systems.

Unit-III

Resources Sharing

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-CeilingProtocolinDynamicPrioritySystems,PreemptionCeilingProtocol,Access

Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

Unit-IV

Real Time Communication

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for SwitchedNetworks,MediumAccessControlProtocolsforBroadcastNetworks,

Internet and Resource Reservation Protocols.

Unit-V

Real Time Operating Systems and Data bases

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues,

Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.

BOOKS AND REFERENCES:

1. Real Time Systems–Jane W. S. Liu, Pearson Education Publication.
2. Real Time Systems–Mall Rajib, Pearson Education
3. Real-Time Systems: Scheduling, Analysis, and Verification–Albert M.K. Cheng, Wiley

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	2	-	-	-	1	-	-	3
CO2	3	3	2	1	2	-	-	-	1	-	-	3
CO3	2	2	2	1	2	-	-	-	1	-	-	3
CO4	3	3	1	1	2	-	-	-	1	-	-	3
CO5	3	3	**2**	**1**	**2**	-	-	-	**1**	-	-	3
Avg	**2.8**	**2.8**	**1.8**	**1**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**3**

[BTOE-062] COMPUTER BASEDNUMERICALTECHNIQUES

Objective:

The objective of this course is to familiarize the graduate engineers with techniques in errors, approximations, approximates roots, Interpolation, finite differences, numerical differentiation and integration programming, numerical solution of differential equations and boundary value problems. It aims to equip the students with standard concepts and tools from previously gained knowledge to an advanced level that will enable them to tackle more advanced level of Optimization techniques and applications that they would find useful in their discipline

Subject Code: BTOE-062	COMPUTER BASEDNUMERICALTECHNIQUES	**L TP:3 0 0**	**Credits:3**

Course Outcome: The student will be able to	
CO-1	To apply the knowledge of errors, roots and application in the field of engineering.
CO-2	Todealdealswithfinitedifferencesandinterpolationtosolveengineeringproblemsinvolvingcomplicatedreallifesituationsetc.
CO-3	To deal with numerical integration and differentiation that is required in different branches of Engineering to graduate engineers for applying more difficult problems in case of complex structures.
CO-4	To deals with numerical solution of differential Equations for engineering problems involveing real life situations etc.
CO-5	To deal with boundary value problems of real life systems and Engineers.

SYLLABUS
Unit-I **Error and roots of Algrabraic and Transcendental Equations:** Introduction of Numbers and their accuracy, Computer Arithmetic, Mathematical preliminaries, Errors and their Computation, General error formula, Error in a series approximation.SolutionofAlgebraicandTranscendentalEquation**:**BisectionMethod,Iterationmethod,Methodoffalseposition,Newton-Raphsonmethod,Methodsoffinding real and complex roots, Muller's method, Rate of convergence of Iterative methods, Polynomial Equations.
Unit-II **Interpolation:**IntroductionFiniteDifferences,DifferencetablesPolynomialInterpolation:Newton'sforwardandbackwardformulaCentralDifferenceFormulae: Gauss forwardandbackwardformula,Stirling's,Bessel's,Everett'sformula.Interpolationwithunequalintervals:Lagrange'sInterpolation,Newton Divided difference formula, Hermite's Interpolation.

Unit-III **Numerical Integration and Differentiation**: Introduction: Numerical differentiation of Newton's forward and backward formula, Stirling's, Bessel's, Everett's formula, Lagrange's Interpolation and Newton Divided difference formula. **Numerical Integration**: Newton cotes formula, Trapezoidal rule, Simpson's 1/3 and3/8rules,Boole's rule, Waddle's rule.
Unit-IV **SolutionofdifferentialEquations:**Introduction,Picard'sMethod,Euler'sMethod, Taylor'sMethod,RungeKuttaMethods,PredictorCorrectorMethods,AutomaticErrorMonitoringandStabilityof solution.
Unit-V **Boundary Value problems:** Introduction, Finite difference method, solving Eigen value problems, polynomial method and power methods. Numerical solution of Partial Differential equations. Elliptic, Parabolic and hyperbolic PDEs.DistillationinaPlateColumn,Unsteady-stateOperation,StartingaStirred-tankReactor, Rateat which a Plate Absorber Approaches Steady State.

BOOKS AND REFERENCES

1. Jain,IyengarandJain,"NumericalMethodsforScientificandEngineeringComputations",NewAgeInternational.
2. GrewalBS,"NumericalmethodsinEngineeringandScience",KhannaPublishers,Delhi**.**
3. Rajaraman V, Computer Oriented Numerical Methods, Pearson Education
4. TVeerarajan,TRamachandran,"TheoryandProblemsinNumericalMethods,McGrawHill
5. Pradip Niyogi, Numerical Analysis and Algorithms, Mc Graw Hill.
6. Francis Scheld, Numerical Analysis, Mc Graw Hill.
7. Sastry S. S, Introductory Methods of Numerical Analysis, Pearson Education.
8. Kiusalaas,J.:NumericalmethodsinengineeringwithMATLAB,CambridgeUniversityPress
9. Woodford,C andPhillips,C:Numericalmethodswithworkedexamples:MATLABEdition,Springer

CO-PO Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	-	-	-	1	-	-	3
CO2	3	3	2	1	2	-	-	-	1	-	-	3
CO3	2	2	2	1	2	-	-	-	1	-	-	3
CO4	3	3	1	1	2	-	-	-	1	-	-	3
CO5	3	3	**2**	**1**	**2**	-	-	-	**1**	-	-	3
Avg	**2.8**	**2.8**	**1.8**	**1**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**3**

[BTOE-063] GIS & REMOTE SENSING

Objective:

Understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

Subject Code: BTOE-064	GIS&REMOTESENSING	L TP:3 0 0	Credits:3

Course Outcome: The student will be able to	
CO-1	Understand about the principles of Remote Sensing and its advantages and limitations.
CO-2	Retrieve the information content of remotely sensed data.
CO-3	Apply problem specific remote sensing data for engineering applications.
CO-4	Analyze spatial and attribute data for solving spatial problems.
CO-5	Create GIS and car to graphic outputs for presentation

SYLLABUS
Unit-I Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagneticspectrum,energyinteractionsintheatmosphereandwiththeEarth'ssurface;majoratmosphericwindows;principalapplicationsofdifferentwavelengthregions;typical spectralreflectancecurveforvegetation,soilandwater,spectralsignatures.
Unit-II Different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerialphotography-endlapandsidelap;stereoscopicvision,requirementsofstereoscopic photographs; air-photo interpretation-interpretation elements;
Unit-III Photo grammetry- measurements on a single vertical aerial photograph, measurements on astereo-pair-verticalmeasurementsbytheparallaxmethod;groundcontrolforaerialphotography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; imageenhancement;informationextraction,imageclassification,unsupervisedclassification,supervisedclassification, important consideration in the identification of training areas, Vegetation indices.
Unit-IV Microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties..
Unit-IV Methods of data input into GIS, Data editing, spatial data models and structures, Attribute Data management, integrating data (mapoverlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.

BOOKS AND REFERENCES

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. B S Publications, Hyderabad.
2. Elangovan ,K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J. R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lilles and, T.,R. W. Kieferand J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
6. Sabins, F. F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Wave land Press Inc., Illinois, USA.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	2	-	-	-	1	-	-	3
CO2	3	3	2	1	2	-	-	-	1	-	-	3
CO3	2	2	2	1	2	-	-	-	1	-	-	3
CO4	3	3	1	1	2	-	-	-	1	-	-	3
CO5	3	3	**2**	**1**	**2**	-	-	-	**1**	-	-	3
Avg	**2.8**	**2.8**	**1.8**	**1**	**2**	-	-	-	**1**	-	-	**3**

[BTOE-064] BASICS OF DATA BASE MANAGEMENT SYSTEM

Objectives:

- Introduce students to the fundamental concepts of database management systems (DBMS).
- Familiarize students with various types of database models and their characteristics.
- Teach students data modeling techniques, such as ER diagrams, for designing efficient database structures.

Subject Code: BTOE-064	BASICS OF DATA BASE MANAGEMENT SYSTEM	L TP:3 0 0	Credits:3

The students will be able to

CO-1	Describe the features of a data base system and its application and compare various types of data models.
CO-2	ConstructanERModelforagivenproblemandtransformitintoarelationdatabaseschema.
CO-3	Formulate solution to a query problem using SQL Commands, relation alalgebra, tuple calculus and domain calculus.
CO-4	Explaintheneedofnormalizationandnormalizeagivenrelationtothedesirednormalform.
CO-5	Explaindifferentapproachesoftransactionprocessingandconcurrencycontrol.

SYLLABUS

UNIT-I

Introduction: An overview of database management system, database system vs file system, database system concepts and architecture, views of data – levels of abstraction, data models,schemaandinstances,dataindependence,databaselanguagesandinterfaces,datadefinitionlanguages,DML,overalldatabasestructure,transactionmanagement,storagemanagement,databaseusersandadministrator.

Data Modeling using the Entity Relationship Model: ER model concepts, notation for ERdiagram,mappingconstraints,keys,conceptsofsuperkey,candidatekey,primarykey,generalization,aggregation,reduction ofanERdiagramstotables,extendedERmodel,relationshipsofhigher degree.

UNIT-II

Relational Database Concepts: Introduction to relational database, relational database structure, relational model terminology – domains, attributes, tuples, relations & relational database schema, integrity constraints, entity integrity, referential integrity, keys constraints, domain constraints, Relational algebra - relational calculus, tuple and domain calculus, basic operations – selection and projection, set-theoretic operations, join operations.

DataBaseDesign&Normalization: Functionaldependencies,normalforms,first,second,& third normal forms, BCNF, inclusion dependence, loss less joined compositions, normalizationusingFD,MVD,andJDs,alternativeapproachestodatabasedesign

UNIT-III

Structured Query Language (SQL): Basics of SQL, DDL, DML, DCL, advantage of SQL, SQL data type and literals, types of SQL commands, SQL operators and their procedure, tables – creation&alteration,definingconstraints,viewsandindexes,queriesandsubqueries,aggregatefunctions,built-infunctions,insert,updateanddeleteoperations,joins,unions,intersection,minus,transactioncontrolcommands.

PL/SQL: Introduction,features,syntaxandconstructs,SQLwithinPl/SL,DMLinPL/SQLCursors,storedprocedures,storedfunction,databasetriggers,indices

UNIT-IV

Transaction Processing Concepts: Transaction concepts, properties of transaction, testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, recovery from transaction failures, two-phase commit protocol, log based recovery, check points, dead lock handling.

Concurrency Control Techniques: Concurrency control, locking techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity, multi-version schemes, recovery with concurrent transaction.

UNIT-V

Data base Security–Types of security, system failure, backup & recovery techniques, authorization & authentication, system policies, levels of security – physical, OS, network &DBMS, privileges – grant &revoke.

Recent Trends in Database Management Systems: Centralized and Client-Server Architectures,DistributedDatabases,Object-OrientedDatabase,Spatial&TemporalDatabases,DecisionSupportSystems, Data Analysis, Data Mining & Warehousing, Data Visualization, Mobile Data bases, OODB & XML Databases, Multimedia & Web Databases, Spatial and Geographical Data bases, Web and Mobile Data bases, Active Data bases

:

BOOKS AND REFERENCES

1. Elmasri, Navathe, “Fundamentals of Data base System”, Addision Wesley.
2. Korth, Silbertz, Sudarshan,“ Data base Concepts”, Mc Graw Hill.
3. BipinC.Desai,“AnIntroductiontoDatabaseSystem”,GalgotiaPublication.
4. Majumdar & Bhattacharya, “Data base Management System”, Mc Graw Hill.
5. DateC.J. ,“An Introduction to Data base System”, Addision Wesley.
6. Ramakrishnan, Gehrke, “Data base Management System”, Mc Graw Hill.
7. AtulKahate,“IntroductiontoDatabaseManagementSystems”,PearsonEducation.
8. Paul Beynon Davies ,“Data base System”, Palgrave Macmillan.
9. BhartiP.K. ,“An Introduction to Data base Systems”, JPNP.
10. Rajesh Narang, “Data base Management System”, PHI.
11. Singh,S.K.,“DatabaseSystemConcepts–design&application”,PearsonEducation.
12. Leon& Leon, “Data base Management Systems” ,Vikas Publishing House.
13. O’Neil, “Data bases”, Elsevier Pub.
14. IvanBayross,“SQL,PL/SQL–TheProgrammingLanguageofOracle”,BPBPublications.
15. P.S.Deshpande,“SQLandPL/SQLforOracle10g,BlackBook”,DreamtechPress.
16. George Koch, Kevin Loney, “Oracle: The Complete Reference”, Mc Graw Hill.

CO-PO Matrix

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	-	-	-	1	-	-	3
CO2	3	3	2	1	2	-	-	-	1	-	-	3
CO3	2	2	2	1	2	-	-	-	1	-	-	3
CO4	3	3	1	1	2	-	-	-	1	-	-	3
CO5	3	3	**2**	**1**	**2**	-	-	-	**1**	-	-	3
Avg	**2.8**	**2.8**	**1.8**	**1**	**2**	-	-	-	**1**	-	-	**3**

[BTOE-065] SOFTWARE PROJECT MANAGEMENT

Objectives:

- Plan and schedule tasks, resources, and timelines for effective project execution and coordination.
- Develop strategies for risk identification, assessment, and mitigation to minimize project risks.
- Establish communication channels and protocols for efficient team collaboration and stakeholder engagement.

Subject Code: BTOE-065	SOFTWARE PROJECT MANAGEMENT	L TP:3 0 0	Credits:3

The students will be able to

CO-1	Identify project planning objectives, along with various cost/effort estimation models.
CO-2	Organize &schedule project activities to compute critical path for risk analysis.
CO-3	Monitor and control project activities.

CO-4	Formulate testing objectives and test plan to ensure good software quality under SEI-CMM.
CO-5	Configure changes and manage risks using project management tools.

SYLLABUS

UNIT-I

Project Evaluation and Project Planning:

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control–ProjectportfolioManagement–Cost-benefitevaluationtechnology–Riskevaluation–StrategicprogramManagement–StepwiseProjectPlanning.

UNIT-II

Project Life Cycle and Effort Estimation:

SoftwareprocessandProcessModels–ChoiceofProcessmodels–RapidApplicationdevelopment–Agilemethods–DynamicSystemDevelopmentMethod–ExtremeProgramming– Managing interactive processes – Basics of Software estimation– Effort andCostestimationtechniques–COSMICFullfunctionpoints–COCOMOII–aParametric Productivity Model.

UNIT-III

Activity Planning and Risk Management:

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling –Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation –Creation of critical paths–Cost schedules.

UNIT-IV

Project Management and Control:

Framework for Management and control Collection of data Visualizing progress – CostmonitoringEarnedValueAnalysis–PrioritizingMonitoring–Projecttracking–ChangecontrolSoftwareConfigurationManagement–Managingcontracts–ContractManagement.

UNIT-V

Staffing in Software Projects:

Managing people – Organizational behavior – Best methods of staff selection Motivation – The Oldham Hackman job characteristic model–Stress–Health and Safety–Ethical and Professional concerns–Working in teams Decision making Organizational structures Dispersed and Virtual teams–Communications genres Communication plans Leadership.

TEXTBOOKS

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management–Fifth Edition, McGraw Hill, New Delhi, 2012.
2. RobertK.Wysocki—EffectiveSoftwareProjectManagement–WileyPublication,2011.
3. Walker Royce:—SoftwareProjectManagement-Addison-Wesley,1998.
4. GopalaswamyRamesh,—ManagingGlobalSoftwareProjects–McGrawHillEducation(India),Fourteenth Reprint2013.

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	2	-	-	-	1	-	-	3
CO2	3	3	2	1	2	-	-	-	1	-	-	3
CO3	2	2	2	1	2	-	-	-	1	-	-	3
CO4	3	3	1	1	2	-	-	-	1	-	-	3
CO5	3	3	**2**	**1**	**2**	-	-	-	**1**	-	-	3
Avg	**2.8**	**2.8**	**1.8**	**1**	**2**	-	-	-	**1**	-	-	**3**