

DR. A.P.J. ABDUL KALAM TECHNICAL
UNIVERSITY, UTTAR PRADESH, LUCKNOW



EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. THIRD YEAR

ELECTRONICS AND COMPUTER ENGINEERING

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2021-22]

ELECTRONICS AND COMPUTER ENGINEERING

B.Tech. V Semester Electronics and Computer Engineering

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semester		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KECZ-501	Integrated Circuit Design	3	1	0	30	20	50		100		150	4
2	KECZ-502	Digital Signal Processing	3	1	0	30	20	50		100		150	4
3	KECZ-502	Database Management System	3	1	0	30	20	50		100		150	4
4	KECZ-051-054	Department Elective-I	3	0	0	30	20	50		100		150	3
5	KECZ-055-058	Department Elective-II	3	0	0	30	20	50		100		150	3
6	KECZ-551	Integrated Circuits Lab	0	0	2				25		25	50	1
7	KECZ-552	Database Management System Lab	0	0	2				25		25	50	1
8	KECZ-553	Digital Signal Processing Lab	0	0	2				25		25	50	1
9	KECZ-554	Mini Project/Internship **	0	0	2				50			50	1
10	KNC501	Constitution of India, Law and Engineering	2	0	0	15	10	25		50			NC
11		MOOCs (Essential for Hons. Degree)											
		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

KECZ-051	Computer Architecture and Organization
KECZ-052	Industrial Electronics
KECZ-053	Optical Communication System
KECZ-054	Advance Digital Design using Verilog

Department Elective-II

KECZ-055	Data Analytics
KECZ-056	Web Designing
KECZ-057	Computer Graphics
KECZ-058	Object Oriented System Design

ELECTRONICS AND COMPUTER ENGINEERING

B.Tech. VI Semester ELECTRONICS AND COMPUTER ENGINEERING

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semester		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KECZ-601	Digital Communication	3	1	0	30	20	50		100		150	4
2	KECZ-602	Control System	3	1	0	30	20	50		100		150	4
3	KECZ-603	Design and Analysis of Algorithm	3	1	0	30	20	50		100		150	4
4		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	KECZ-651	Digital Communication Lab	0	0	2				25		25	50	1
7	KECZ-652	Control System Lab	0	0	2				25		25	50	1
8	KECZ-653	Design and Analysis of Algorithm Lab	0	0	2				25		25	50	1
9	KNC601/ KNC602	Constitution of India, Law and Engineering / Indian Tradition, Culture and Society	2	0	0	15	10	25		50			NC
10		MOOCs (Essential for Hons. Degree)											
		Total										900	21

Course Code

Course Title

Department Elective-III

KECZ-061	Microcontroller for Embedded system Design
KECZ-062	Data Communication Networks Web Technology
KECZ-063	Web Technology
KECZ-064	Machine Learning Techniques
KECZ-065	Application of Soft Computing

**B.Tech 3rd Year
V Semester
Syllabus**

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-501	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.

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-502	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.

ELECTRONICS AND COMPUTER ENGINEERING

Database Management System (KECZ-503)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Apply knowledge of database for real life applications.	K ₃
CO 2	Apply query processing techniques to automate the real time problems of databases.	K ₃ , K ₄
CO 3	Identify and solve the redundancy problem in database tables using normalization.	K ₂ , K ₃
CO 4	Understand the concepts of transactions, their processing so they will familiar with broad range of database management issues including data integrity, security and recovery.	K ₂ , K ₄
CO 5	Design, develop and implement a small database project using database tools.	K ₃ , K ₆
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction: Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	08
II	Relational data Model and Language: Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and Their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL	08
III	Data Base Design & Normalization: Functional dependencies, normal forms, first, second, 8 third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design	08
IV	Transaction Processing Concept: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.	08
V	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, Case Study of Oracle.	08
Text books: <ol style="list-style-type: none"> 1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill 2. Date C J, "An Introduction to Database Systems", Addison Wesley 3. Elmasri, Navathe, " Fundamentals of Database Systems", Addison Wesley 4. O'Neil, Databases, Elsevier Pub. 5. RAMAKRISHNAN"Database Management Systems", McGraw Hill 6. Leon & Leon,"Database Management Systems", Vikas Publishing House 7. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications 8. Majumdar & Bhattacharya, "Database Management System", TMH 		

KECZ-051	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, Zvonko Vranesic and Safwat Zaky, "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.

KECZ-052		INDUSTRIAL ELECTRONICS	3L:0T:0P	3 Credits
Unit	Topics			Lectur es
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.

KECZ 054	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 Zvonko Vranesiv, "Fundamental of Digital Logic with Verilog Design", 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.

KECZ-054	OPTICAL COMMUNICATION SYSTEM	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 Single 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.

Data Analytics (KECZ-055)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to :		
CO 1	Describe the life cycle phases of Data Analytics through discovery, planning and building.	K1,K2
CO 2	Understand and apply Data Analysis Techniques.	K2, K3
CO 3	Implement various Data streams.	K3
CO 4	Understand item sets, Clustering, frame works & Visualizations.	K2
CO 5	Apply R tool for developing and evaluating real time applications.	K3,K5,K6
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction to Data Analytics: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. Data Analytics Lifecycle: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization.	08
II	Data Analysis: Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, neural networks: learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	08
III	Mining Data Streams: Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – real time sentiment analysis, stock market predictions.	08
IV	Frequent Itemsets and Clustering: Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in non-euclidean space, clustering for streams and parallelism.	08
V	Frame Works and Visualization: MapReduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications. Introduction to R - R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.	08

Text books and References:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press.
3. Bill Franks, Taming the Big Data Tidal wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & Sons.
4. John Garrett, Data Analytics for IT Networks : Developing Innovative Use Cases, Pearson Education
5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley
6. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Series, John Wiley
7. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series
8. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis", Elsevier
9. Michael Berthold, David J. Hand," Intelligent Data Analysis", Springer
10. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill
11. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer
12. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication
13. Pete Warden, Big Data Glossary, O'Reilly
14. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons

ELECTRONICS AND COMPUTER ENGINEERING

Web Designing (KECZ-056)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand principle of Web page design and about types of websites	K ₃ , K ₄
CO 2	Visualize and Recognize the basic concept of HTML and application in web designing.	K ₁ , K ₂
CO 3	Recognize and apply the elements of Creating Style Sheet (CSS).	K ₂ , K ₄
CO 4	Understand the basic concept of Java Script and its application.	K ₂ , K ₃
CO 5	Introduce basics concept of Web Hosting and apply the concept of SEO	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction : Basic principles involved in developing a web site, Planning process , Domains and Hosting, Responsive Web Designing , Types of Websites (Static and Dynamic Websites), Web Standards and W3C recommendations, Introduction to HTML: What is HTML , HTML Documents, Basic structure of an HTML document , Creating an HTML document , Mark up Tags , Heading-Paragraphs , Line Breaks	08
II	Elements of HTML: HTML Tags., Working with Text , Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls	08
III	Concept of CSS: Creating Style Sheet, CSS Properties , CSS Styling(Background, Text Format, Controlling Fonts) , Working with block elements and objects , Working with Lists and Tables , CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties) CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector) , CSS Color , Creating page Layout and Site Designs.	08
IV	Introduction to Client Side Scripting , Introduction to Java Script , Javascript Types , Variables in JS, Operators in JS , Conditions Statements , Java Script Loops, JS Popup Boxes , JS Events , JS Arrays, Working with Arrays, JS Objects ,JS Functions , Using Java Script in Real time , Validation of Forms, Related Examples	08
V	Web Hosting: Web Hosting Basics , Types of Hosting Packages, Registering domains , Defining Name Servers , Using Control Panel, Creating Emails in Cpanel , Using FTP Client, Maintaining a Website Concepts of SEO : Basics of SEO, Importance of SEO, Onpage Optimization Basics	08
Text Books:		
1. Steven M. Schafer, "HTML, XHTML, and CSS Bible, 5ed", Wiley India 2. Ian Pouncey, Richard York, "Beginning CSS: Cascading Style Sheets for Web Design", Wiley India		

ELECTRONICS AND COMPUTER ENGINEERING

Computer Graphics (KECZ-057)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand the graphics hardware used in field of computer graphics.	K ₂
CO 2	Understand the concept of graphics primitives such as lines and circle based on different algorithms.	K ₂ , K ₄
CO 3	Apply the 2D graphics transformations, composite transformation and Clipping concepts.	K ₄
CO 4	Apply the concepts of and techniques used in 3D computer graphics, including viewing transformations.	K ₂ , K ₃
CO 5	Perform the concept of projections, curve and hidden surfaces in real life.	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.	08
II	Transformations: Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. Windowing and Clipping: Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Textclipping	08
III	Three Dimensional: 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.	08
IV	Curves and Surfaces: Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.	08
V	Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.	08
Text books: <ol style="list-style-type: none"> 1. Donald Hearn and M Pauline Baker, “Computer Graphics C Version”, Pearson Education 2. Foley, Vandam, Feiner, Hughes – “Computer Graphics principle”, Pearson Education. 3. Rogers, “ Procedural Elements of Computer Graphics”, McGraw Hill 4. W. M. Newman, R. F. Sproull – “Principles of Interactive computer Graphics” – McGraw Hill. 5. Amrendra N Sinha and Arun D Udai,” Computer Graphics”, McGraw Hill. 6. R.K. Maurya, “Computer Graphics ” Wiley Dreamtech Publication. 7. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI Learning Private Limited. 8. Donald Hearn and M Pauline Baker, “Computer Graphics with Open GL”, Pearson education 		

ELECTRONICS AND COMPUTER ENGINEERING

Object Oriented System Design (KECZ-058)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand the application development and analyze the insights of object oriented programming to implement application	K ₂ , K ₄
CO 2	Understand, analyze and apply the role of overall modeling concepts (i.e. System, structural)	K ₂ , K ₃
CO 3	Understand, analyze and apply oops concepts (i.e. abstraction, inheritance)	K ₂ , K ₃ , K ₄
CO 4	Understand the basic concepts of C++ to implement the object oriented concepts	K ₂ , K ₃
CO 5	To understand the object oriented approach to implement real world problem.	K ₂ , K ₃
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling, Introduction to UML, conceptual model of the UML, Architecture.	08
II	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages. Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine , Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram. Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.	08
III	Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations. Structured analysis and structured design (SA/SD), Jackson Structured Development (JSD). Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation. Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.	08
IV	C++ Basics : Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures C++ Functions : Simple functions, Call and Return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions	08
V	Objects and Classes : Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion. Inheritance : Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class Polymorphism : Pointers in C++, Pointes and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism	08

Text Books

1. James Rumbaugh et. al, “Object Oriented Modeling and Design”, Pearson Education
2. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Pearson Education
3. Object Oriented Programming With C++, E Balagurusamy, McGraw Hill.
4. C++ Programming, Black Book, Steven Holzner, dreamtech
5. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia
6. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson
7. The Complete Reference C++, Herbert Schlitz, McGraw Hill.

KECZ-551	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.

KECZ-552	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/](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.

ELECTRONICS AND COMPUTER ENGINEERING

Database Management Systems Lab (KECZ-553)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Understand and apply oracle 11 g products for creating tables, views, indexes, sequences and other database objects.	K2, K4
CO 2	Design and implement a database schema for company data base, banking data base, library information system, payroll processing system, student information system.	K3, K5, K6
CO 3	Write and execute simple and complex queries using DDL, DML, DCL and TCL	K4, K5
CO 4	Write and execute PL/SQL blocks, procedure functions, packages and triggers, cursors.	K4, K5
CO 5	Enforce entity integrity, referential integrity, key constraints, and domain constraints on database.	K3, K4
DETAILED SYLLABUS		
<ol style="list-style-type: none"> 1. Installing oracle/ MYSQL 2. Creating Entity-Relationship Diagram using case tools. 3. Writing SQL statements Using ORACLE /MYSQL: a)Writing basic SQL SELECT statements. b) Restricting and sorting data. c)Displaying data from multiple tables. d)Aggregating data using group function. e)Manipulating data. e)Creating and managing tables. 4. Normalization 5. Creating cursor 6. Creating procedure and functions 7. Creating packages and triggers 8. Design and implementation of payroll processing system 9. Design and implementation of Library Information System 10. Design and implementation of Student Information System 11. Automatic Backup of Files and Recovery of Files 12. Mini project (Design & Development of Data and Application) for following : a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System 		
<p>Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner It is also suggested that open source tools should be preferred to conduct the lab (MySQL , SQL server , Oracle ,MongoDB ,Cubrid ,MariaDBetc)</p>		

**B.Tech 3rd Year
VI Semester
Syllabus**

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-601	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.

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-602	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.

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-603	DESIGN AND ANALYSIS OF ALGORITHM	3L:1T:0P	4 Credits
----------	----------------------------------	----------	-----------

Unit	Topics	Lectures
I	Introduction: Algorithms, Analyzing Algorithms, Complexity of Algorithms, Growth of Functions, Performance Measurements, Sorting and Order Statistics - Shell Sort, Quick Sort, Merge Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time.	8
II	Advanced Data Structures: Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List	8
III	Divide and Conquer with Examples Such as Sorting, Matrix Multiplication, Convex Hull and Searching. Greedy Methods with Examples Such as Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim’s and Kruskal’s Algorithms, Single Source Shortest Paths - Dijkstra’s and Bellman Ford Algorithms.	8
IV	Dynamic Programming with Examples Such as Knapsack. All Pair Shortest Paths – Warshal’s and Floyd’s Algorithms, Resource Allocation Problem. Backtracking, Branch and Bound with Examples Such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets.	8
V	Selected Topics: Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP- Completeness, Approximation Algorithms and Randomized Algorithms.	8

Text Books:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, Printice Hall of India.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008.
4. LEE "Design & Analysis of Algorithms (POD)", McGraw Hill
5. Richard E. Neapolitan "Foundations of Algorithms" Jones & Bartlett Learning
6. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.

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

1. Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.
2. Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).
3. Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.
4. Apply classical sorting, searching, optimization and graph algorithms.
5. Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-061	MICROCONTROLLER FOR EMBEDDED SYSTEMS	3L:0T:0P	3 Credits
-----------------	---	-----------------	------------------

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	Peripheral Devices: Watch dog timer, system clocks, Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition ADC and Comparator in MSP430, data transfer using DMA.	8
IV	Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.	8
V	Internet of Things (IoT): overview and architecture, Overview of wireless sensor networks and design examples. Various wireless connectivity: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications, Building IoT applications using CC3100 user API for connecting sensors.	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, 2006
2. John H Davies, "MSP430 Microcontroller Basics" Newnes Publication, 2008

Reference Books:

1. TI MSP430x5xx and MSP430x6xx Family User's Guide , Revised 2018.

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 Microcontroller SoC (system on chip).
4. Evaluate the data transfer information through serial & parallel ports and implement its interfacing with MSP430.
5. Demonstrate the basics of IoT, WSN and its application sectors and design IoT based projects using MSP430 microcontroller.

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-062	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.
2. S. Tanenbaum, “Computer Networks”, 4th Edition, Pearson, 2013.
3. 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.

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-063	WEB TECHNOLOGY	3L:0T:0P	3 Credits
-----------------	-----------------------	-----------------	------------------

Unit	Topics	Lectures
I	Introduction: Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, Writing Web Projects, Connecting to Internet, Introduction to Internet services and tools, Introduction to client-server computing. Core Java: Introduction, Operator, Data type, Variable, Arrays, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Event handling, Introduction to AWT, AWT controls, Layout managers	8
II	Web Page Designing: HTML: List, Table, Images, Frames, forms, CSS, Document type definition, XML: DTD, XML schemes, Object Models, presenting and using XML, Using XML Processors: DOM and SAX, Dynamic HTML	8
III	Scripting: Java script: Introduction, documents, forms, statements, functions, objects; introduction to AJAX, Networking : Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagram.	8
IV	Enterprise Java Bean: Preparing a Class to be a JavaBeans, Creating a JavaBeans, JavaBeans Properties, Types of beans, Stateful Session bean, Stateless Session bean, Entity bean. Java Database Connectivity (JDBC): Merging Data from Multiple Tables: Joining, Manipulating, Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures.	8
V	Servlets: Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session. Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries.	8

Text Books:

1. Burdman, Jessica, “Collaborative Web Development” Addison Wesley
2. Xavier, C, “ Web Technology and Design” , New Age International
3. Ivan Bayross,” HTML, DHTML, Java Script, Perl & CGI”, BPB Publication
4. Bhawe, “Programming with Java”, Pearson Education
5. Herbert Schildt, “The Complete Reference:Java”, McGraw Hill

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

1. Explain web development Strategies and Protocols governing Web.
2. Develop Java programs for window/web-based applications.
3. Design web pages using HTML, XML, CSS and JavaScript.
4. Creation of client-server environment using socket programming.
5. Building enterprise level applications and manipulate web databases using JDBC. Design interactive web applications using Servlets and JSP.

ELECTRONICS AND COMPUTER ENGINEERING

KECZ-064	MACHINE LEARNING TECHNIQUES	3L:0T:0P	3 Credits
-----------------	------------------------------------	-----------------	------------------

Unit	Topics	Lectures
I	INTRODUCTION – Learning, Types of Learning, Well defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning, Decision Tree Learning, Bayesian networks, Support Vector Machine, Genetic Algorithm), Issues in Machine Learning and Data Science Vs Machine Learning;	8
II	REGRESSION: Linear Regression and Logistic Regression BAYESIAN LEARNING - Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. SUPPORT VECTOR MACHINE: Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel, and Gaussian kernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.	8
III	DECISION TREE LEARNING - Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.	8
IV	ARTIFICIAL NEURAL NETWORKS – Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks, Derivation of Backpropagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; DEEP LEARNING - Introduction, concept of convolutional neural network, Types of layers – (Convolutional Layers, Activation function, pooling, fully connected), Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for eg on Diabetic Retinopathy, Building a smart speaker, Self-driving car etc.	8
V	REINFORCEMENT LEARNING –Introduction to Reinforcement Learning, Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process, Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Q Learning. GENETIC ALGORITHMS: Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications.	8

Text Books:

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag..

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

1. To understand the need for machine learning for various problem solving
2. To understand a wide variety of learning algorithms and how to evaluate models generated from data.
3. To understand the latest trends in machine learning.
4. To design appropriate machine learning algorithms and apply the algorithms to a real-world problems.
5. To optimize the models learned and report on the expected accuracy that can be achieved by applying the models

KECZ-065	APPLICATION OF SOFT COMPUTING	3L:0T:0P	3 Credits
-----------------	--------------------------------------	-----------------	------------------

Unit	Topics	Lectures
I	Neural Networks-I (Introduction & Architecture) : Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetero-associative memory.	8
II	Neural Networks-II (Back propagation networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perceptron model; back propagation learning methods, effect of learning rule coefficient; back propagation algorithm, factors affecting backpropagation training, applications.	8
III	Fuzzy Logic-I (Introduction): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.	8
IV	Fuzzy Logic –II (Fuzzy Membership, Rules) : Membership functions, inference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications & Defuzzifications, Fuzzy Controller, Industrial applications	8
V	Genetic Algorithm(GA): Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.	8

Text Books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.
2. N. P. Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press. Reference Books:
3. Simon Haykin, "Neural Networks", Pearson Education
4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
5. Kumar Satish, “Neural Networks” McGraw Hill

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

1. Recognize the feasibility of applying a soft computing methodology for a particular problem.
2. Understand the concepts and techniques of soft computing and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.
3. Apply neural networks to pattern classification and regression problems and compare solutions by various soft computing approaches for a given problem
4. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
5. Apply genetic algorithms to combinatorial optimization problems.

KECZ-651	DIGITAL COMMUNICATION LAB	0L:0T:2P	1 Credit
----------	---------------------------	----------	----------

SUGGESTIVE LIST OF EXPERIMENTS:

Part A

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 $\lambda/2$ antenna and to calculate beam-width, front / back ratio, and gain of the antenna.
2. To study folded dipole antenna and to calculate beam-width, front / back ratio, and gain of the antenna.
3. To study $\lambda/2$ phase array end-fire antenna and to calculate beam-width, front / back ratio, and gain of the antenna.
4. To study broadside array antenna and to calculate beam-width, front / back ratio, and gain 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 the key parameters.
5. To conceptualize error detection & correction using different coding schemes in digital communication.

KECZ-652	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, peak time, 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 of k.
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 as root locus, Bode plot and Nyquist plot.

KECZ-653	DESIGN AND ANALYSIS OF ALGORITHM LAB	0L:0T:2P	1 Credit
-----------------	---	-----------------	-----------------

SUGGESTIVE LIST OF EXPERIMENTS:

1. Program for Recursive Binary & Linear Search.
2. Program for Heap Sort.
3. Program for Merge Sort.
4. Program for Selection Sort.
5. Program for Insertion Sort.
6. Program for Quick Sort.
7. Knapsack Problem using Greedy Solution
8. Perform Travelling Salesman Problem
9. Find Minimum Spanning Tree using Kruskal's Algorithm
10. Implement N Queen Problem using Backtracking
11. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n > 5000 and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.
12. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n > 5000, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.
13. Implement , the 0/1 Knapsack problem using
 - (a) Dynamic Programming method
 - (b) Greedy method.
14. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
15. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.
16. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
17. Write programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm.
- (b) Implement Travelling Sales Person problem using Dynamic programming.
18. Design and implement to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d. For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner It is also suggested that open source tools should be preferred to

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

1. Implement algorithm to solve problems by iterative approach.
2. Implement algorithm to solve problems by divide and conquer approach.
3. Implement algorithm to solve problems by Greedy algorithm approach.
4. Implement algorithm to solve problems by Dynamic programming, backtracking, branch and bound approach.
5. Implement algorithm to solve problems by branch and bound approach.