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

EVALUATION SCHEME AND SYLLABI

For

B. Tech. 1ST Year

Common to All Branches

EXCEPT Agriculture Engineering and Biotechnology

Effective from the Session: 2022-23

DR. A.P.J ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH.
Sec-11, Jankipuram Vistar, Lucknow - 226031, Uttar Pradesh, India

B. Tech. First Year, Semester- I

(All Branches except Agriculture Engineering and Biotechnology)

3- WEEKS STUDENT INDUCTION PROGRAMME in the beginning of the session													
								Evaluation Scheme					
SN	Subject Code	Subject Name	Type	Category	Period			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total	Credit
					L	T	P	CT	TA	CT+TA	TE/PE	SW+ESE	Cr
1.	BAS101/ BAS102	Engineering Physics/ Engineering Chemistry	**T**	BS	3	1	0	20	10	**30**	**70**	**100**	**4**
2.	BAS103	Engineering Mathematics-I	**T**	BS	3	1	0	20	10	**30**	**70**	**100**	**4**
3.	BEE101/ BEC101	Fundamentals of Electrical Engineering/ Fundamentals of Electronics Engineering	**T**	ES	2	1	0	20	10	**30**	**70**	**100**	**3**
4.	BCS101/ BME101	Programming for Problem Solving/ Fundamentals of Mechanical Engineering	**T**	ES	2	1	0	20	10	**30**	**70**	**100**	**3**
5.	BAS104/ BAS105	Environment and Ecology/ Soft Skills	**T**	BS/ HS	3	0	0	20	10	**30**	**70**	**100**	**3**
6.	BAS151/ BAS152	Engineering Physics Lab/ Engineering Chemistry Lab	**P**	BS	0	0	3	-	50	**50**	**50**	**100**	**1**
7.	BEE151/ BEC151	Basic Electrical Engineering Lab/ Basic Electronics Engineering Lab	**P**	ES	0	0	3	-	50	**50**	**50**	**100**	**1**
8.	BCS151/ BAS155	Programming for Problem Solving Lab**/** English Language Lab	**P**	ES/ HS	0	0	3	-	50	**50**	**50**	**100**	**1**
9.	BCE151 / BWS151	Engineering Graphics & Design Lab/ Workshop Practice Lab	**P**	ES	0	1	3	-	50	**50**	**50**	**100**	**2**
					13	**5**	**12**			**350**	**550**	**900**	**22**

Abbreviation Used:

BS: Basic Science Course
ES: Engineering Science Course
HS: Humanities and Social Science Course
VA: Value Added Course

B. Tech. First Year, Semester- II

(All Branches except Agriculture Engineering and Biotechnology)

								Evaluation Scheme					
SN	**Subject Code**	**Subject Name**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
					L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	BAS202/ BAS201	Engineering Chemistry / Engineering Physics	**T**	BS	3	1	0	20	10	**30**	**70**	**100**	**4**
2.	BAS203	Engineering Mathematics-II	**T**	BS	3	1	0	20	10	**30**	**70**	**100**	**4**
3.	BEC201/ BEE201	Fundamentals of Electronics Engineering / Fundamentals of Electrical Engineering	**T**	ES	2	1	0	20	10	**30**	**70**	**100**	**3**
4.	BME201/ BCS201	Fundamentals of Mechanical Engineering/ Programming for Problem Solving	**T**	ES	2	1	0	20	10	**30**	**70**	**100**	**3**
5.	BAS205/ BAS204	Soft Skills / Environment and Ecology	**T**	HS/ BS	3	0	0	20	10	**30**	**70**	**100**	**3**
6.	BAS252/ BAS251	Engineering Chemistry Lab / Engineering Physics Lab	**P**	BS	0	0	3	-	50	**50**	**50**	**100**	**1**
7.	BEC251/ BEE251	Basic Electronics Engineering Lab/ Basic Electrical Engineering Lab	**P**	ES	0	0	3	-	50	**50**	**50**	**100**	**1**
8.	BAS255/ BCS251	English Language Lab / Programming for Problem Solving Lab	**P**	HS/ ES	0	0	3	-	50	**50**	**50**	**100**	**1**
9.	BWS251/ BCE251	Workshop Practice Lab / Engineering Graphics & Design Lab	**P**	ES	0	1	3	-	50	**50**	**50**	**100**	**2**
10.	BVA251/ BVA252	Sports and Yoga / NSS	**P**	VA	0	0	3		100	***100**		***100**	**0**
					13	**5**	**12+ 3***			**350+ *100**	**550**	**900+ *100**	**22**

*Compulsory Qualifying Audit Course

Abbreviation Used:

BS: Basic Science Course
ES: Engineering Science Course
HS: Humanities and Social Science Course
VA: Value Added Course

Summer Internship (4-week) / NPTEL Course (4-week) during summer break after Semester-II and same will be assessed/evaluated in the Semester-III

DETAILED SYLLABI

B. Tech. First Year

(All Branches except Agriculture Engineering and Biotechnology)

Effective from Session 2022-23

BAS101 / BAS201: ENGINEERING PHYSICS

Content	Contact Hours
Unit-1: Quantum Mechanics	**9**
Inadequacy of classical mechanics, Planck's theory of black body radiation(qualitative), Compton effect, de-Broglie concept of matter waves, Davisson and Germer Experiment, Phase velocity and group velocity, Time-dependent and time-independent Schrodinger wave equations, Physical interpretation of wave function, Particle in a one-Dimensional box.	
Unit-2: Electromagnetic Field Theory	**8**
Basic concept of Stoke's theorem and Divergence theorem, Basic laws of electricity and magnetism, Continuity equation for current density, Displacement current, Maxwell equations in integral and differential form, Maxwell equations in vacuum and in conducting medium, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Plane electromagnetic waves in conducting medium, Skin depth.	
Unit-3: Wave Optics	**10**
Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extended sources, Newton's Rings and its applications, Introduction to diffraction, Fraunhoffer diffraction at single slit and double slit, Absent spectra, Diffraction grating, Spectra with grating, Dispersive power, Resolving power, Rayleigh's criterion of resolution, Resolving power of grating.	
Unit-4: Fiber Optics & Laser	**9**
Fibre Optics: Principle and construction of optical fiber, Acceptance angle, Numerical aperture, Acceptance cone, Step index and graded index fibers, Fiber optic communication principle, Attenuation, Dispersion, Application of fiber. **Laser**: Absorption of radiation, Spontaneous and stimulated emission of radiation, Population inversion, Einstein's Coefficients, Principles of laser action, Solid state Laser (Ruby laser) and Gas Laser (He-Ne laser), Laser applications.	
Unit-5: Superconductors and Nano-Materials:	**8**
Superconductors: Temperature dependence of resistivity in superconducting materials, Meissner effect, Temperature dependence of critical field, Persistent current, Type I and Type II superconductors, High temperature superconductors, Properties and Applications of Super-conductors. **Nano-Materials:** Introduction and properties of nano materials, Basics concept of Quantum Dots, Quantum wires and Quantum well, Fabrication of nano materials -Top-Down approach (CVD) and Bottom-Up approach (Sol Gel), Properties and Application of nano materials.	

Course Outcomes:

On completion of course the students are able :		
CO	**CO Statement**	**Bloom's Level**
CO1	To explain the distribution of energy in black body radiation and to understand the difference in particle and wave nature with explanation of Compton effect and Schrodinger wave equation.	Understanding, Apply
CO2	To understand the concept of displacement current and consistency of Ampere's law and also the properties of electromagnetic waves in different medium with the use of Maxwell's equations.	Understanding, Analyze
CO3	To understand the behavior of waves through various examples/applications of interference and diffraction phenomenon and the concept of grating and resolving power.	Apply
CO4	To know the functioning of optical fiber and its properties and applications. To understand the concept, properties and applications of Laser.	Understanding, **A**pply
CO5	To know the properties and applications of superconducting materials and nano materials.	Understanding

Reference Books:

1. Concepts of Modern Physics - Aurthur Beiser (Mc-Graw Hill)
2. Optics - Brijlal & Subramanian (S. Chand)
3. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
4. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
5. Engineering Physics-Malik HK and Singh AK (Mc Graw Hill)

BAS102 / BAS202: ENGINEERING CHEMISTRY

Course Objectives:

1. To enable the students to understand about the Chemistry of Atomic and Molecular structure, Chemistry of advanced Materials like Liquid crystals, Nanomaterials, Graphite & fullerenes and Green Chemistry.
2. To enable the students to understand and apply the detailed concepts of spectroscopic techniques and stereochemistry to identify the compounds, element etc.
3. To enable the students to understand and apply the concepts related to Electrochemistry, Batteries, Corrosion and Chemistry of Engineering Materials like cement.
4. To enable the students to understand and apply detailed concepts of water source, water impurities, hardness of water and boiler troubles used in industry as well as analysis of coal & determination of calorific values.
5. To enable the students to understand detailed concepts related to polymers, Polymerization, Polymer Blends and Polymer Composites.

Content	Contact Hours
Unit-1:	**8**
Atomic and Molecular Structure: Molecular orbital's of diatomic molecules, Bond Order, Magnetic characters and numerical problems. **Chemistry of Advanced Materials:** ***Liquid Crystals;*** Introduction, Types and Applications of liquid crystals, Industrially important materials used as liquid crystals. ***Graphite and Fullerene;*** Introduction, Structure and applications. ***Nanomaterials;*** Introduction, Preparation, characteristics of nanomaterials and applications of nanomaterials, Carbon Nano Tubes (CNT), **Green Chemistry:** Introduction, 12 principles and importance of green Synthesis, Green Chemicals, Synthesis of typical organic compounds by conventional and Green route (Adipic acid and Paracetamol), Environmental impact of Green chemistry on society.	
Unit-2:	**8**
Spectroscopic Techniques and Applications: Elementary idea and simple applications of UV, IR and NMR, Numerical problems. **Stereochemistry:** Optical isomerism in compounds without chiral carbon, Geometrical isomerism, Chiral Drugs.	
Unit-3:	**8**
Electrochemistry and Batteries: Basic concepts of electrochemistry. ***Batteries;*** Classification and applications of Primary Cells (Dry Cell) and Secondary Cells (Lead Acid battery). ***Corrosion:*** Introduction to corrosion, Types of corrosion, Cause of corrosion, Corrosion prevention and control, Corrosion issues in specific industries (Power generation, Chemical processing industry, Oil & gas industry and Pulp & paper industries). **Chemistry of Engineering Materials:** ***Cement;*** Constituents, manufacturing, hardening and setting, deterioration of cement, Plaster of Paris (POP).	

Unit-4:	**8**
Water Technology: Sources and impurities of water, Hardness of water, Boiler troubles, Techniques for water softening (Lime-Soda, Zeolite, Ion Exchange and Reverse Osmosis process), Determination of Hardness and alkalinity, Numerical problems. **Fuels and Combustion:** Definition, Classification, Characteristics of a good fuel, Calorific Values, Gross & Net calorific value, Determination of calorific value by Bomb Calorimeter, Theoretical calculation of calorific value by Dulong's method, Ranking of Coal, Analysis of coal by Proximate and Ultimate analysis method, Numerical problems, Chemistry of Biogas production from organic waste materials and their environmental impact on society.	
Unit-5:	**8**
Materials Chemistry: ***Polymers;*** Classification, Polymerization processes, Thermosetting and Thermoplastic Polymers, Polymer Blends and Composites, Conducting and Biodegradable polymers, Preparation, properties, industrial applications of Teflon, Lucite, Bakelite, Kelvar, Dacron, Thiokol, Nylon, Buna-N and Buna-S and their environmental impact on society, Speciality polymers. **Organometallic Compounds:** General methods of preparation and applications of Organometallic compounds (RMgX and $LiAlH_4$).	

Course Outcomes:

Upon completion of the course the student should be able to:

Units	Course Outcomes	Bloom's Level
CO-1	Get an understanding of the theoretical principles of chemistry of molecular structure, bonding and properties, Chemistry of advanced materials (liquid crystals, Nanomaterials, Graphite & Fullerene) as well as the Principles of Green Chemistry.	K3
CO-2	Apply the fundamental concepts of determination of structure with various spectral techniques and stereochemistry.	K4
CO-3	Utilize the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and categorize the reasons for corrosion and study methods to control corrosion and develop understanding of Chemistry of Engineering materials (Cement).	K3
CO-4	Develop understanding of the sources, impurities and hardness of water, apply the concepts of determination of calorific values and analyze the coal.	K3
CO-5	Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials. Understanding the applications of specific polymers and Chemistry applicable in industrial process.	K3

Reference Books:

1. Engineering Chemistry by Rath & Singh, 2nd Edition, Cengage Learning India Pvt Ltd Delhi.
2. Engineering Chemistry by SS Dara, S Chand & Co Ltd
3. Engineering Chemistry by Jain & Jain, S.Chand & Comp, New Delhi
4. Engineering Chemistry by K. Sesha Maheswaramma, Pearson
5. Engineering Chemistry by OG Palanna, Mc Graw Hill Education, New Delhi
6. Engineering Chemistry by Shashi Chawala, Dhanpat Rai Publishing Comp, New Delhi
7. University Chemistry by BH Mahan
8. University Chemistry by CNR Rao

BAS103 : ENGINEERING MATHEMATICS-I

Course Objectives:

The objective of this course is to familiarize the graduate engineers with techniques in matrix, calculus, multivariate analysis and vector calculus. It aims to equip the students with standard concepts and tools from intermediate to advanced level that will enable them to tacklemore advanced level of mathematics and applications that they would find useful in their disciplines.
The students will learn:

- The essential tools of matrices, Eigen values and its application in a Comprehensive manner.
- To apply the knowledge of differential calculus in the field of engineering.
- To deal with functions of several variables that is essential in optimizing the results ofreal life problems.
- To apply integral calculus in various field of engineering and have a basicunderstanding of Beta and Gamma functions and application of Dirichlet's integral.
- To deal with vector calculus that is required in different branches of Engineering tograduate engineer.

Content	Contact Hours
Unit-1: Matrices	**8**
Elementary transformations, Inverse of a matrix, Rank of matrix, Solution of system of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Linear Dependence and Independence of vectors, Eigen values and Eigen vectors, Complex Matrices, Hermitian, Skew-Hermitian and Unitary Matrices, Applications to Engineering problems.	
Unit-2: Differential Calculus- I	8
Successive Differentiation (nth order derivatives), Leibnitz theorem, Curve tracing, Partial derivatives, Euler's Theorem for homogeneous functions, Total derivative, Change of variables.	
Unit-3: Differential Calculus-II	8
Expansion of functions by Taylor's and Maclaurin's theorems for functions of one and two variables, Maxima and Minima of functions of several variables, Lagrange's method of multipliers, Jacobians, Approximation of errors.	
Unit-4: Multiple integration	8
Double integral, Triple integral, Change oforder of integration, Change of variables, Beta and Gama function and their properties, Dirichlet's integral and its applications to area and volume, Liouville's extensions of Dirichlet's integral.	
Unit-5: Vector Calculus	8
Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives. **Vector Integration**: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem and Stoke's theorem (without proof) and their applications.	

Course Outcomes:

	Course Outcome (CO)	Bloom's Level
At the end of this course, the students will be able to:		
CO 1	Understand the concept of complex matrices, Eigen values, Eigen vectors and apply the concept of rank to evaluate linear simultaneous equations	K2 & K5
CO 2	Remember the concept of differentiation to find successive differentiation, Leibnitz Theorem, and create curve tracing, and find partial and total derivatives	K1,K6 & K5
CO 3	Applying the concept of partial differentiation to evaluate extrema, series expansion, error approximation offunctions and Jacobians	K3 &K5
CO 4	Remember the concept of Beta and Gamma function; analyze area and volume and Dirichlet's theorem in multiple integral	K1 & K4
CO 5	Apply the concept of Vector Calculus to analyze and evaluate directionalderivative, line, surface and volume integrals.	K3, K4& K5

K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5 – Evaluate, K_6 – Create

Text Books:

1. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publishing Company Ltd.,2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House2002.

Reference Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition,Pearson.
4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Veerarajan T., Engineering Mathematics for first year, McGraw-Hill, New Delhi, 2008.
6. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, McGraw-Hill;Sixth Edition.
7. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition,Pearson Education.
8. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.

BAS203 : ENGINEERING MATHEMATICS-II

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equations, Laplace transform, sequence and series,Fourier series and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The basic knowledge of Laplace transform and its applications in solving differential equations.
- The tool for convergence of series and expansion of function using Fourier series for learning advanced Engineering Mathematics.
- The tools of differentiation of functions of complex variables that are used in various techniques dealing with engineering problems.
- The tools of integration of functions of complex variables that are used in various techniques dealing with engineering problems.

Content	Contact Hours
Unit -1: Ordinary Differential Equation of Higher Order	8
Linear differential equation of nth order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Method of variation of parameters, Cauchy-Euler equation, Application of differential equations in solving engineering problems.	
Unit-2: Laplace Transform	10
Laplace transform, Existence theorem, Properties of Laplace Transform, Laplace transform of derivates and integrals, Unit step function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem. Application of Laplace Transform to solve ordinary differential equations and simultaneous differential equations.	
Unit-3: Sequence and Series	8
Definition of Sequence and series with examples, Convergence of series, Tests for convergence of series, Ratio test, D' Alembert's test, Raabe's test, Comparison test. Fourier series, Half range Fouriersine and cosine series.	
Unit-4: Complex Variable–Differentiation	8
Functions of complex variable, Limit, Continuity and differentiability, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Milne's Thompson Method, Conformal mapping, Mobius transformation and their properties.	
Unit-5: Complex Variable –Integration	8
Complex integration, Cauchy- Integral theorem, Cauchy integral formula, Taylor's and Laurent's series, singularities and itsclassification, zeros of analytic functions, Residues, Cauchy's Residue theorem and its application.	

Course Outcomes:

	Course Outcome (CO)	Bloom's Level
At the end of this course, the students will be able to:		
CO 1	Remember the concept differentiation to evaluate LDE of nth order with constant coefficient and LDE with variable coefficient of 2nd order.	K1 &K5
CO 2	Understand and apply the concept of Laplace Transform to evaluate differential equations	K2 ,K3 & K5
CO 3	Understand the concept of convergence to analyze the convergence of series and expansion of the function for Fourier series.	K2 & K4
CO 4	Apply the concept of analyticity, Harmonic function and create theimage of function applying conformal transformation	K3, K6& K3
CO 5	Apply the concept of Cauchy Integral theorem, Cauchy Integralformula, singularity and calculus of residue to evaluate integrals	K3& K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Text Books:

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger, Advance Engineering Mathematics , Narosa Publishing - House, 2002

Reference Books:

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R.Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition-McGraw-Hill
6. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. Veerarajan T., Engineering Mathematics for first year, McGraw-Hill, New Delhi, 2008.
8. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6thEdition, McGraw-Hill.
10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, McGraw-Hill.
11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
12. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi.
13. Laplace Transforms by Schaum's series, 2005 Edition, Spiegel Publicaiton.

BEE101 / BEE201: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Content	Contact Hours
Unit -1: DC Circuits	6
Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity, unilateral and bilateral elements. Kirchhoff's laws, Mesh and nodal methods of analysis.	
Unit-2: : Steady State Analysis of Single Phase AC Circuits	6
Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors. Analysis of single phase AC Circuits consisting R-L-C combination (Series and Parallel) Apparent, active & reactive power, Power factor. Concept of Resonance in series & parallel circuits, bandwidth and quality factor. Three phase balanced circuits, voltage and current relations in star and delta connections.	
Unit-3: Transformers	6
Magnetic circuits, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.	
Unit-4: Electrical machines	8
DC machines**:** Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems) Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only) Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications. Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.	
Unit-5: Electrical Installations	4
Introduction of Switch Fuse Unit (SFU), MCB, ELCB, MCCB, ACB. Types of Wires, Cables and Bus-bars. Fundamentals of earthing and lightning protection. Types of Batteries	

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Course Outcomes:

	Course Outcome (CO)
CO 1	Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
CO 2	Analyze the steady state behavior of single phase and three phase AC electrical circuits.
CO 3	Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
CO 4	Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
CO 5	Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

Text Books:

1. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House, 2018.
2. P.V. Prasad, S.Sivanagaraju,"Electrical Engineering:Concepts and Applications" Cengage, 2018
3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. V. D. Toro, "Electrical Engineering Fundamentals", Pearson India, 1989.

Spoken Tutorial (MOOCs):

1. AC DC Circuit Analysis using NgSpice, Open Source Software (http://spoken-tutorial.org)

BEC101 / BEC201 : FUNDAMENTALS OF ELECTRONICS ENGINEERING

Topics	Contact Hours
Unit-1	**8**
Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche) **Diode Application:** Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits **Special Purpose two terminal Devices:** Light-Emitting Diodes, Photo Diodes, Varactor Diodes, Tunnel Diodes.	
Unit-2	8
Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration **Field Effect Transistor:** Construction and Characteristic of JFETs. Transfer Characteristic. MOSFET (MOS) (Depletion and Enhancement) Type, Transfer Characteristic.	
Unit-3	8
Operational Amplifiers: Introduction, Op-Amp basic, Practical Op-Amp Circuits (Inverting Amplifier, Non-inverting Amplifier, Unit Follower, Summing Amplifier, Integrator, Differentiator).Differential and Common-Mode Operation, Comparators.	
Unit-4	8
Digital Electronics: Number system & representation, Binary arithmetic, Introduction of Basic and Universal Gates, using Boolean algebra simplification of Boolean function. K Map Minimization upto 6 Variables.	
Unit-5	8
Fundamentals of Communication Engineering: Basics of signal representation and analysis, Electromagnetic spectrum Elements of a Communication System, Need of modulation and typical applications, Fundamentals of amplitude modulation and demodulation techniques. **Introduction to Wireless Communication:** Overview of wireless communication, cellular communication, different generations and standards in cellular communication systems, Fundamentals of Satellite & Radar Communication.	

Course Outcomes:

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

1. Describe the concept of PN Junction and devices.
2. Explain the concept of BJT, FET and MOFET.
3. Apply the concept of Operational amplifier to design linear and non-linear applications.
4. Perform number systems conversions, binary arithmetic and minimize logic functions.
5. Describe the fundamentals of communication technologies.

Text Books:

1. Robert L. Boylestand / Louis Nashelsky “Electronic Devices and Circuit Theory”, Pearson Education.
2. George Kennedy, “Electronic Communication Systems”, McGrawPublication
3. David A. Bell, “Electronic Devices and Circuits”, Oxford UniversityPress.
4. Jacob Millman, C.C. Halkias, StayabrataJit, “Electronic Devices and Circuits”, McGrawHill.
5. A. Anand Kumar, “Fundamental of Digital Circuits,” PHI 4th edition, 2018.

BCS101 / BCS201: PROGRAMMING FOR PROBLEM SOLVING

Content	Contact Hours
Unit -1:	8
Introduction to Components of a Computer System: Memory, Processor, I/O Devices, Storage, Operating System, Concept of Assembler, Compiler, Interpreter, Loader and Linker. **Idea of Algorithm:** Representation of Algorithm, Flowchart, Pseudo Code with Examples, From Algorithms to Programs, Source Code. **Programming Basics:** Structure of C Program, Writing and Executing the First C Program, Syntax and Logical Errors in Compilation, Object and Executable Code. Components of C Language. Standard I/O in C , Fundamental Data types, Variables and Memory Locations, Storage Classes.	
Unit-2:	8
Arithmetic Expressions and Precedence : Operators and Expression Using Numeric and Relational Operators, Mixed Operands, Type Conversion, Logical Operators, Bit Operations, Assignment Operator, Operator precedence and Associatively. **Conditional Branching:** Applying if and Switch Statements, Nesting if and Else and Switch.	
Unit-3:	8
Iteration and Loops: Use of While, do While and for Loops, Multiple Loop Variables, Use of Break , Goto and Continue Statements. **Arrays:** Array Notation and Representation, Manipulating Array Elements, using Multi Dimensional Arrays. Character Arrays and Strings, Structure, union, Enumerated Data types, Array of Structures, Passing Arrays to Functions.	
Unit-4:	8
Functions: Introduction, Types of Functions, Functions with Array, Passing Parameters to Functions, Call by Value, Call by Reference, Recursive Functions. **Basic of searching and Sorting Algorithms:** Searching & Sorting Algorithms (Linear Search , Binary search , Bubble Sort, Insertion and Selection Sort)	
Unit-5:	8
Pointers: Introduction, Declaration, Applications, Introduction to Dynamic Memory Allocation (Malloc, Calloc, Realloc, Free), String and String functions , Use of Pointers in Self-Referential Structures, Notion of Linked List (No Implementation) **File Handling:** File I/O Functions, Standard C Preprocessors, Defining and Calling Macros and Command-Line Arguments.	

Course Outcome:

Course Outcome (CO)		Bloom's Level
At the End of Course , the Student will be Able to Understand		
CO 1	To Develop Simple Algorithms for Arithmetic and Logical Problems.	K_2, K_3
CO 2	To Translate the Algorithms to Programs & Execution (in C Language).	K_3
CO 3	To Implement Conditional Branching, Iteration and Recursion.	K_3
CO 4	To Decompose a Problem into Functions and Synthesize a Complete Program Using Divide and Conquer Approach.	K_4
CO 5	To Use Arrays, Pointers and Structures to Develop Algorithms and Programs.	K_2, K_3

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze , K_5- Evaluate , K_6- Create

Text Books:

1. Schaum's Outline of Programming with C by Byron Gottfried , McGraw-Hill
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education .
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited, 2015.
4. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
5. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning - 2007.
6. Let Us C By Yashwant P. Kanetkar.
7. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson Addison-Wesley, 2006.
8. Programming in C by Kochan Stephen G. Pearson Education – 2015.
9. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New Age International Publication.
10. Computer Concepts and Programming by Anami, Angadi and Manvi, PHI Publication
11. Computer Concepts and Programming in C by Vikas Gupta, Wiley India Publication
12. Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication

BME101 / BME201: FUNDAMENTALS OF MECHANICAL ENGINEERING

Content	Contact Hours
Unit -1: Introduction to Mechanics	8
Force moment and couple, principle of transmissibility, Varignon's theorem. Resultant of force system- concurrent and non-concurrent coplanar forces, Types of supports (Hinge, Roller) and loads (Point, UDL, UVL), free body diagram, equilibrium equations and Support Reactions. Normal and shear Stress, strain, Hookes' law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety.	
Unit-2: Introduction to IC Engines and Electric Vehicles	8
IC Engine: Basic definition of engine and Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; difference between two-stroke and four stroke IC engines and SI and CI Engines. **Electric vehicles and hybrid vehicles:** Components of an EV, EV batteries, chargers, drives, transmission and power devices. Advantages and disadvantages of EVs. Hybrid electric vehicles, HEV drive train components, advantages of HV.	
Unit-3: Introduction to Refrigeration and Air-Conditioning	8
Refrigeration: Refrigerating effect, Ton of Refrigeration; Coefficient of performance, methods of refrigeration, construction and working of domestic refrigerator, concept of heat pump. **Air-Conditioning:** Its meaning and application, humidity, dry bulb, wet bulb, and dew point temperatures, comfort conditions, construction and working of window air conditioner.	
Unit-4: Introduction to Fluid Mechanics and Applications	8
Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law and Continuity Equation. Working principles of hydraulic turbines (Pelton Wheel and Francis)& pumps (Centrifugal and Reciprocating) and their classifications and hydraulic lift.	
Unit-5: Introduction to Measurement and Mechatronics	12
Introduction to Measurement: Concept of Measurement, Error in measurements, Calibration, measurements of pressure(Bourdon Tube Pressure and U-Tube Manometer), temperature(Thermocouple and Optical Pyrometer), mass flow rate(Venturi Meter and Orifice Meter), strain(Bonded and Unbonded Strain Gauge), force (Proving Ring) and torques(Prony Brake Dynamometer); Concepts of accuracy, precision and resolution. **Introduction to Mechatronic Systems:** Evolution, Scope, Advantages and disadvantages of Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics, and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics.	

Overview of Mechanical Actuation System – Kinematic Chains, Cam, Ratchet Mechanism, Gears and its type, Belt, Bearing. **Hydraulic and Pneumatic Actuation Systems:** Overview: Pressure Control Valves, Direction Control Valves, Rotary Actuators, Accumulators and Pneumatic Sequencing Problems.	

Course Outcomes:

The students will be able to		Blooms Level
CO1	Apply the concept of force resolution and stress and strain to solve basic problems	K3
CO2	Understand the construction details and working of internal combustion engines, electric vehicle and hybrid vehicles.	K2
CO3	Explain the construction detail and working of refrigerator, heat pump and air-conditioner.	K2
CO4	Understand fluid properties, conservation laws and hydraulic machinery used in real life.	K2
CO5	Understand the working principle of different measuring instrument and mechatronics with their advantages, scope and Industrial application.	K2

Reference Books:

1. Basic Mechanical Engineering, G Shanmugam, S Ravindran, McGraw Hill
2. Basic Mechanical Engineering, M P Poonia and S C Sharma, Khanna Publishers
3. Mechatronics : Principles, Concepts and Applications, Nitaigour Mahalik, McGraw Hill
4. Mechatronics, As per AICTE: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S.Balasundaram, Wiley India
5. Mechanical Measurements & Control, Dr. D. S. Kumar. Metropolitan Book Company
6. Fluid Mechanics and Hydraulic Machines, Mahesh Kumar, Pearson India

BAS104 / BAS204: ENVIRONMENT AND ECOLOGY

Course Objectives:

1. Aims and objectives of environmental education emphasize the relationship between man and the environment and educate young people about the importance of nature and the environment.
2. Environmental education aims to **impart ecological knowledge** and promote environmentally conscious behavior towards nature.
3. It encourages young minds to take **responsibility for protecting** the natural environment protection through information and knowledge and to develop environmental awareness.
4. Incidentally, promoting awareness and a sense of respect for nature leads to a comprehensive understanding of the environment and a reasonable attitude towards protecting it.
5. The focus of environmental education is Awareness, Knowledge, Attitude, Skills, Capacity Building and Participation.

Topics	Contact Hours
Unit-1	**8**
Environment: Definition, Types of Environment, Components of environment, Segments of environment, Scope and importance, Need for Public Awareness. ***Ecosystem:*** Definition, Types of ecosystem, Structure of ecosystem, Food Chain, Food Web, Ecological pyramid. Balance Ecosystem. Effects of Human Activities such as Food, Shelter, Housing, Agriculture, Industry, Mining, Transportation, Economic and Social security on Environment, Environmental Impact Assessment, Sustainable Development.	
Unit-2	8
Natural Resources: Introduction, Classification. ***Water Resources;*** Availability, sources and Quality Aspects, Water Borne and Water Induced Diseases, Fluoride and Arsenic Problems in Drinking Water. ***Mineral Resources;*** Material Cycles; Carbon, Nitrogen and Sulfur cycles. ***Energy Resources;*** Conventional and Non conventional Sources of Energy. ***Forest Resources;*** Availability, Depletion of Forests, Environment impact of forest depletion on society.	
Unit-3	8
Pollution and their Effects; Public Health Aspects of Environmental; Water Pollution, Air Pollution, Soil Pollution, Noise Pollution, Solid waste management.	
Unit-4	8
Current Environmental Issues of Importance; Global Warming, Green House Effects, Climate Change, Acid Rain, Ozone Layer Formation and Depletion, Population Growth and Automobile pollution, Burning of paddy straw.	

Unit-5	8
Environmental Protection; Environmental Protection Act 1986, Initiatives by Non Governmental Organizations (NGO's), **Human Population and the Environment:** Population growth, Environmental Education, Women Education.	

Course Outcomes:

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

	Course Outcomes	Bloom's Level
CO-1	Gain in-depth knowledge on natural processes that sustain life, and govern economy.	K2
CO-2	Estimate and Predict the consequences of human actions on the web of life, global economy and quality of human life.	K3
CO-3	Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.	K4
CO-4	Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participate actively in solving current environmental problems and preventing the future ones.	K3
CO-5	Adopt sustainability as a practice in life, society and industry.	K3

Reference Books:

1. Textbook of Environment and Ecology by Dave, Katewa & Singh, 2nd Edition, Cengage Learning India Pvt Ltd Delhi.
2. Environmental Studies by S Deswal, Dhanpat Rai & Co.
3. Environmental Studies by VK Ahluwalia, 2nd Edition,TERI Press, New Delhi.
4. Environmental Studies by R Rajgopalan, Oxford University Press.
5. Environment & Ecology by Singh & Malviya, Acme Learning

BAS105 / BAS205: SOFT SKILLS

Course Objectives:

1. Students will be enabled to **understand** the correct usage of grammar.
2. Students will be able to **converse** well with effective speaking and listening skills in English.
3. Students will be able to **create** substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading and writing
4. Student will be able to **equip** with basics of communication skills and will **apply** it for practical and oral purposes by being honed up in presentation skills and voice-dynamics.
5. Students will be able **build up** personal traits that will make the transition from institution to workplace smoother and help them to excel in their jobs.

Content	Contact Hours
Unit-1 Applied Grammar and Usage:	**8**
Transformation of Sentences: Simple, Compound and Complex, Subject-verb agreement, Prefix and Suffix, Antonyms, Synonyms, Homophones, Homonyms, New word Formation, Select word power	
Unit-2: Listening and Speaking Skills	**8**
Active Listening :Meaning and Art of Listening, Traits of a Good Listener, Listening modes, listening and Note taking, Types of Listening, Listening Techniques using Ted Talk Audio listening with script reading, Pronunciation; Speaking style ; content and sequencing.	
Unit-3: Reading and Writing Skills:	**8**
Reading style: Skimming; Scanning; Churning & Assimilation, Effective writing tools and methods: Inductive Deductive; Exposition; Linear; Interrupted; Spatial & Chronological etc, Official and Business Letter writing, Agenda, Notices, Minutes of meeting,	
Unit-4: Presentation and Interaction Skills	**8**
Introduction to oral communication, Nuances and Modes of Speech Delivery, Public speaking: confidence, clarity, and fluency, Individual Speaking: Elements; Non verbal Communication: Kinesics, Paralinguistic features of Voice-Dynamics, Proxemics, Chronemics, and Presentation Strategies: planning, preparation, organization, delivery	
Unit-5: Work- place skills:	**8**
Leadership qualities; Impact, Communication skills for Leaders: Listening and Responding; Mental health at work place: Managing Stress; Techniques: Application of 4 A's; Avoid; Alter; Access; Adapt	

Course Outcomes:

1. **Write** professionally in simple and correct English.
2. **Demonstrate** active listening with comprehension, and the ability to write clear and well-structured emails and proposals.
3. **Learn** the use of correct body language and tone of voice to enhance communication.
4. **Acquire** the skills necessary to communicate effectively and deliver presentations with clarity and impact
5. **Understand** and apply some important aspects of core skills, like Leadership and stress management.

Prescribed Books:

1. Technical Communication, (Second Ed.); O.U.P., Meenakshi Raman & S.Sharma New Delhi, 2011.
2. Business Communication for Managers, Payal Mehra, Pearson, Delhi, 2012.
3. Personality Development, Harold R. Wallace et. al, Cengage Learning India Pvt. Ltd; New Delhi 2006.
4. Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, Delhi 2013.
5. Personality Development & Soft Skills, Barun K.Mitra, Oxford University Press, New Delhi, 2012.
6. Public Speaking, William S. Pfeiffer, Pearson, Delhi, 2012.
7. Human Values, A.N. Tripathi, New Age International Pvt. Ltd. Publishers New Delhi, 2005.
8. English Grammar & Usage, R.P.Sinha, Oxford University Press, New Delhi, 2005.
9. English Grammar & Composition, *Wren* & Martin S.Chand & Co Ltd, New Delhi, 2009.
10. Soft Skills for Everyone. Jeff Butterfield, Cengage Learning India Pvt. Ltd; New Delhi 2017.

BAS151 / BAS251: ENGINEERING PHYSICS LAB

List of Experiments

Any ten experiments (at least four from each group).

Group A

1. To determine the wavelength of sodium light by Newton's ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To determine the specific rotation of cane sugar solution using polarimeter.
4. To determine the focal length of the combination of two lenses separated by a distance and verify the formula for the focal length of combination of lenses.
5. To measure attenuation in an optical fiber.
6. To determine the wavelength of He-Ne laser light using single slit diffraction.
7. To study the polarization of light using He-Ne laser light.
8. To determine the wavelength of sodium light with the help of Fresnel's bi-prism.
9. To determine the coefficient of viscosity of a given liquid.
10. To determine the value of acceleration due to gravity (g) using compound pendulum.

Group B

1. To determine the energy band gap of a given semiconductor material.
2. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To verify Stefan's law by electric method.
5. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
6. To study the resonance condition of a series LCR circuit.
7. To determine the electrochemical equivalent (ECE) of copper.
8. To calibrate the given ammeter and voltmeter by potentiometer.
9. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.
10. To measure high resistance by leakage method.

Course outcomes:

At the end of the course, students will be able to		
CO	**CO Statement**	**Bloom's Level**
CO-1	***Apply*** the principle of interference and diffraction to find the wavelength of monochromatic and polychromatic light.	Apply
CO-2	***Compute*** and **analyze** various electrical and electronic properties of a given material by using various experiments.	Analyze
CO-3	***Verify*** different established laws with the help of optical and electrical experiments.	Apply
CO-4	***Determine*** and ***calculate*** various physical properties of a given material by using various experiments.	Apply
CO-5	**Study** and **estimate** the performance and parameter of given equipment by using graphical and computational analysis.	Apply

Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar & Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta (Krishna Prakashan Meerut)

BAS152 / BAS252 : ENGINEERING CHEMISTRY LAB

Course Objectives:

1. To enable the students to understand about the fundamental concepts of analytical instruments
2. To enable the students to understand about the analysis of chloride content, hardness, alkalinity of water.
3. To enable the students to understand about the measure of pH, surface tension and viscosity of a liquid.
4. To enable the students to understand about the preparation of different resins.
5. To enable the students to understand about the synthesis of organic compounds such as adipic acid and paracetamol by conventional and green route.

LIST OF EXPERIMENTS

1. Calibration of Analytical Equipment and apparatus.
2. Determination of Hardness of water sample by EDTA method.
3. Determination of Alkalinity of water sample.
4. Determination of pH by titrimetric method.
5. Determination of surface tension of given liquid.
6. Determination of Viscosity of a given liquid by viscometer.
7. Determination of the strength of Ferrous ammonium sulfate using external indicator.
8. Determination of the strength of Potassium dichromate using internal indicator.
9. Determination of available chlorine in bleaching powder.
10. Determination of chloride content in water sample.
11. Preparation of Phenol formaldehyde (PF) resin.
12. Preparation of Urea formaldehyde (UF) resin.
13. Preparation of Adipic acid / Paracetamol.
14. Determination of Cell Conductance of a solution.
15. Determination of Rate constant of hydrolysis of esters.
16. Element detection and identification of functional groups in organic compounds.

NOTE: *Instructor may choose any 10 experiments from above and may also change any two of the above..*

Course Outcomes:

Upon completion of the course the student should be able to:

	Course Outcomes	Bloom's Level
CO-1	Get an understanding of the use of different analytical instruments.	K3
CO-2	Measure the molecular / system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in the water.	K3
CO-3	Measure the hardness and alkalinity of the water.	K3
CO-4	Know the fundamental concepts of the preparation of phenol formaldehyde & urea formaldehyde resin, adipic acid and Paracetamol.	K3
CO-5	Estimate the rate constant of reaction.	K3

BEE151 / BEE251 : BASIC ELECTRICAL ENGINEERING LAB

LIST OF EXPERIMENTS

Note: *A minimum of ten experiments from the following should be performed.*

(A) Hardware based experiments

1. Verification of Kirchhoff's laws
2. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
3. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
4. Connection and measurement of power consumption of a fluorescent lamp (tube light).
5. Measurement of power in 3- phase circuit by two-wattmeter method and determination of its power factor for star as well as delta connected load.
6. Determination of parameters of ac single phase series RLC circuit
7. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase
   Transformer
8. Determination of efficiency of a dc shunt motor by load test
9. To study running and speed reversal of a three phase induction motor and record speed in both directions.
10. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

(B) Experiments available on virtual lab

1. Kirchhoff"s laws.
   Virtual lab link: http://vlab.amrita.edu/?sub=3&brch=75&sim=217&cnt=2
2. Thevenin Theorem.
   Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=313&cnt=1
3. RLC series resonance.
   Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=330&cnt=1
4. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
   Virtual lab link: http://vp-dei.vlabs.ac.in/Dreamweaver/measurement.html
5. Determination of parameters of ac single phase series RLC circuit.
   Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=332&cnt=1
6. To observe the B-H loop of a ferromagnetic material in CRO.
   Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=282&sim=1507&cnt=2
7. Determination of the efficiency of a dc motor by loss summation method (Swinburne's test). Virtual lab link: http://em-iitr.vlabs.ac.in/exp5/index.php?section=Theory

Course Outcomes:

	Course Outcome (CO)	Bloom's Level
At the end of this course, the students should be able to:		
CO 1	Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.	K_3
CO 2	Demonstrate the behavior of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits.	K_4
CO 3	Perform experiment illustrating BH curve of magnetic materials.	K_3
CO 4	Calculate efficiency of a single phase transformer and DC machine.	K_4
CO 5	Perform experiments on speed measurement and reversal of direction of three phase induction motor and Identify the type of DC and AC machines based on their construction.	K_4

K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5 – Evaluate, K_6 – Create

BEC151 / BEC251: BASIC ELECTRONICS ENGINEERING LAB

Suggestive List of Experiments

Part A:

1. Study of various types of Active & Passive Components based on the ir ratings.
2. Identification of various types of Printed Circuit Boards (PCB) and soldering Techniques.
3. PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB
4. Winding shop: Step down transformer winding of less than 5VA.
5. Soldering shop: Soldering and disordering of Resistor in PCB. Soldering and disordering of IC in PCB. Soldering and disordering of Capacitor in PCB

Part B:

1. Study of Lab Equipment and Components: CRO, Multimeter, and Function Generator, Power supply-Active, Passive Components and Bread Board.
2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
3. Applications of PN Junction diode: Half & Full wave rectifier- Measurement of V_{rms}, V_{dc}, and ripple factor.
4. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.
5. Characteristic of BJT: BJT in CE configuration.
6. To study Operational Amplifier as Adder and Subtractor
7. Verification of Truth Table of Various Logic Gate.
8. Implementation of the given Boolean function using logic gates in both SOP and POS forms.

Part (C):

Part A	**PCB Lab**: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB	This practical is not possible by virtual lab. It will be conducted only in physical mode
Part B	Study of Lab Equipment's and Components: CRO, Multi meter, Function Generator, Power supply- Active, Passive Components and Bread Board.	NA, These test equipment can be Demonstrated online from any lab of ECE department or physical mode is only option.

(D) Experiments available on virtual lab

PN Junction on diode: Characteristics of PN Junction diode-Static and dynamic resistance measurement from graph.	http://vlabs.iitkgp.ernet.in/be/exp5/index.html
Applications of PN Junction diode: Half & Full wave rectifier- Measurement of V_{rms},V_{dc}, and ripple factor.	http://vlabs.iitkgp.ernet.in/be/exp6/index.html http://vlabs.iitkgp.ernet.in/be/exp7/index.html
Characteristics of Zener diode: V-I characteristics of Zener diode, Graphical measurement of forward and reverse resistance.	http://vlabs.iitkgp.ernet.in/be/exp10/index.html
Characteristic of BJT: BJT in CE configuration.	http://vlabs.iitkgp.ernet.in/be/exp11/index.html
To study Operational Amplifier as Adder and Subtractor	http://vlabs.iitkgp.ernet.in/be/exp17/index.html http://vlabs.iitkgp.ernet.in/be/exp18/index.html
Verification of Truth Table of Various Logic Gate	https://de-iitr.vlabs.ac.in/digital-electronics-iitr/exp/truth-table-gates/
Implementation of the given Boolean function using logic gates in both SOP and POS forms.	https://de-iitr.vlabs.ac.in/digital-electronics-iitr/exp/realization-of-logic-functions/

BCS151 / BCS251: PROGRAMMING FOR PROBLEM SOLVING LAB

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained

   by the student.

2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate

   of Interest and Time are entered through the keyboard.

3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:

    Between 90-100%-----Print 'A'
    80-90%----------Print 'B'
    60-80%----------Print 'C'
    Below 60%----------Print 'D'

11. WAP that takes two operands and one operator from the user, perform the operation, and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.

26. WAP to add and multiply two matrices of order nxn.

27. WAP that finds the sum of diagonal elements of a mxn matrix.

28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.

29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time: aggregate type TIME Start station: string End station: string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:

a. List all the trains (sorted according to train number) that depart from a particular section.

b. List all the trains that depart from a particular station at a particular time.

c. List all he trains that depart from a particular station within the next one hour of a given time.

d. List all the trains between a pair of start station and end station.

30. WAP to swap two elements using the concept of pointers.

31. WAP to compare the contents of two files and determine whether they are same or not.

32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

Note:

a) The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner

b) The subject teachers are suggested to use the concept of project based learning. The subject teacher may giver certain use cases/case studies where student is able to apply multiple concepts in one single program

c) It is also suggested that open source tools should be preferred to conduct the lab. Some open source online compiler to conduct the C lab are as follows:

- **https://www.jdoodle.com/c-online-compiler/**
- **https://www.tutorialspoint.com/compile_c_online.php**
- **https://www.programiz.com/c-programming/online-compiler/**
- **https://www.hackerrank.com/**

Mapping with Virtual Lab

Name of the Lab	Name of the Experiment
Problem Solving Lab	Numerical Representation
	Beauty of Numbers
	More on Numbers
	Factorials
	String Operations
	Recursion
	Advanced Arithmatic
	Searching and Sorting
	Permutation
	Sequences

Course Outcomes:

Course Outcome		Bloom's Level
At the end of course , the student will be able to:		
CO 1	Able to implement the algorithms and draw flowcharts for solving Mathematical and Engineering problems.	K_3, K_4
CO 2	Demonstrate an understanding of computer programming language concepts.	K_3, K_2
CO 3	Ability to design and develop Computer programs, analyzes, and interprets the concept of pointers, declarations, initialization, operations on pointers and their usage.	K_6, K_4
CO 4	Able to define data types and use them in simple data processing applications he/she must be able to use the concept of array of structures.	K_1, K_5
CO 5	Develop confidence for self-education and ability for life-long learning needed for Computer language.	K_3, K_4

BAS155 / BAS255 : ENGLISH LANGUAGE LAB

Course Objectives:

1. To facilitate software based learning to provide the required English Language proficiency to students.
2. To acquaint students with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
3. To train students to use the correct and error-free writing by being well versed in rules of English grammar.
4. To cultivate relevant technical style of communication and presentation at their work place and also for academic uses.
5. To enable students to apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics.

Professional Communication Lab shall have two parts:

1-Interactive Communication Skills:

Students should practice the language with variety of activities and exercises based on employability skills. Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication, based on International Phonetic Alphabets (I.P.A.)

LIST OF PRACTICALS

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic/Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ proposals based on proper Stress and Intonation Mechanics
5. Official/Public Speaking practice sessions based on suitable Rhythmic Patterns.
6. Theme Presentation/ Keynote Presentation based on correct methodologies of argumentation
7. Individual Speech Delivery/Conferencing with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practical's on a model Audio
10. Startup presentations, Video portfolio, Extempore, Role play, Just a Minute (JAM) etc.

2-Computer assisted software based Language Learning:

Software based self-guided learning to provide the required English language proficiency to students from an employability and career readiness standpoint. The software should align to Common European Framework of Reference for Languages (CEFR) and deliver a CEFR level – B2 upon completion.

Course Outcome:

1. Students will be enabled to understand the basic objective of the course by being acquainted with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.

2. Students would be able to create substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading, writing and speaking etc.
3. Students will apply it at their work place for writing purposes such as Presentation/official drafting/administrative communication and use it for document/project/report/research paper writing.
4. Students will be made to evaluate the correct and error-free writing by being well-versed in rules of English grammar and cultivate relevant technical style of communication &presentation at their work place and also for academic uses.
5. Students will apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing interpersonal communication skills and positive attitude leading to their professional competence.

Suggested Softwares:

- *Oxford Achiever* by Oxford University Press.
- *Cambridge English Empower* by Cambridge University Press.
- *MePro.* by Pearson India Education Services Pvt. Ltd.
- *New Interactions* by McGraw-Hill India.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar,2013, Delhi
3. Practical Communication Process & Practice, LU.B. Pandey: A.I.T.B.S. Pub. India Ltd Krishna Nagar, Delhi, 2013.
4. English Grammar and Usage by R.P. Sinha, Oxford University Press, 2005, New Delhi.
5. English Grammar, Composition and Usage by N.K.Agrawal & F.T.Wood, Macmillan India Ltd., New Delhi.
6. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
7. English Grammar & Composition by Wren & Martin, S.Chand & Co. Ltd., New Delhi.
8. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt.Ltd, 2011, New Delhi.
9. Personality Development, Harold R. Wallace &L.Ann Masters, Cengage Learning, New Delhi
10. Personality Development & Soft Skills, Barun K.Mitra, Oxford University Press, 2012 New Delhi.
11. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
12. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.
13. Spoken English- A manual of Speech and Phonetics by R.K.Bansal & J.B.Harrison, Orient Blackswan, 2013, New Delhi.
14. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi

BCE151/ BCE251: ENGINEERING GRAPHICS & DESIGN LAB

Course Objectives:

- To prepare the students for the effective technical communication.
- To provide them exposure of techniques, skills, and modern engineering tools necessary for engineering practice.
- To prepare the students to design a system, component, or process to meet desired needs within realistic constraints around them in professional life.

Content	Contact Hours
Unit-1: Introduction to Engineering Drawing and Orthographic Projections	**8**
Principles of Engineering Graphics and their significance. Dimensioning, Lettering. Scales: Plain, Diagonal and Engineering Scales. Orthographic Projection, Projection of Point, Projection of Lines: Projection of straight lines; Projection of lines inclined to one plane and both planes.	
Unit-2: Projection of Planes and Solids	**8**
Projection of polygonal surface and circular lamina located in first quadrant inclined to one or both reference planes. Classification of solids, Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.	
Unit-3: Sections of Regular Solids and development of Surfaces	**8**
Sections of Solids: Right regular solids and Auxiliary views for the true shape of the sections such as Prism, Cylinder, Pyramid, and Cone. Development of surfaces for various regular solids such as Prism, Cylinder, Pyramid and Cone.	
Unit-4: Isometric Projection	**8**
Isometric Projection: Isometric scales, Isometric projections of simple and combination of solids. Perspective Projection: Orthographic representation of perspective views — Plane figures and simple solids — Visual Ray Method. Conversion of pictorial view into orthographic Projection.	
Unit-5: Introduction to Computer Aided Design	**8**
Introduction to AutoCAD: Basic commands for 2D drawing: Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style, etc. Transformation of Projections: Conversion of Isometric Views to Orthographic Views and Vice-Versa in AutoCAD. Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form.	

Course Outcome:

After completion, of course students will be able to:

CO 1: Use scales and draw projections of objects.

CO 2: Explain views of solids and their sectional surfaces.

CO 3: Analyze and draw isometric projections of objects.

CO 4: Demonstrate orthographic representation of perspective views using modern tools.

CO 5: Apply AutoCAD software for creation of engineering drawing and models

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Suggested Text/ Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
4. Engineering Graphics & Design, A.P. Gautam & Pradeep Jain, Khanna Publishing House
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
6. (Corresponding set of) CAD Software Theory and User Manuals.

BWS151/ BWS251: WORKSHOP PRACTICE LAB

S. No.	Mechanical Workshop	Duration
1	**Introduction to Mechanical workshop material, tools and machines**	3 Hrs
	To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.	
	To study and use of different types of tools, equipment, devices & machines used in fitting, sheet metal and welding section.	
	To determine the least count of Vernier calliper, vernier height gauge, micrometer (Screw gauge) and take different reading over given metallic pieces using these instruments.	
2	**Machine shop**	3 Hrs
	Demonstration of working, construction and accessories for Lathe machine	
	Perform operations on Lathe - Facing, Plane Turning, step turning, taper turning, threading, knurling and parting.	
3	**Fitting shop**	3 Hrs
	1. Practice marking operations. 2. Preparation of U or V -Shape Male Female Work piece which contains: Filing, Sawing, Drilling, Grinding.	
4	**Carpentry Shop**	3 Hrs
	Study of Carpentry Tools, Equipment and different joints.	
	Making of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint	
5	**Welding Shop**	6 Hrs
	Introduction to BI standards and reading of welding drawings.	
	Practice of Making following operations Butt Joint Lap Joint TIG Welding MIG Welding	
6	**Moulding and Casting Shop**	6 Hrs

	Introduction to Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes Demo of mould preparation and Aluminum casting Practice – Study and Preparation of mould for Plastic	
7	**CNC Shop**	6 Hrs
	Study of main features and working parts of CNC machine and accessories that can be used. Perform different operations on metal components using any CNC machines	
8	**To prepare a product using 3D printing**	3 Hrs
	Total	**33 Hrs**

Course Outcome:

The students will be able to		**Blooms Level**
CO1	Use various engineering materials, tools, machines and measuring equipments.	**K3**
CO2	Perform machine operations in lathe and CNC machine.	**K3**
CO3	Perform manufacturing operations on components in fitting and carpentry shop.	**K3**
CO4	Perform operations in welding, moulding, casting and gas cutting.	**K3**
CO5	Fabricate a job by 3D printing manufacturing technique	**K3**

Reference Books:

1. Workshop Practice, H S Bawa, McGraw Hill
2. Mechanical Workshop Practice, K C John, PHI
3. Workshop Practice Vol 1, and Vol 2, by HazraChoudhary , Media promoters and Publications
4. CNC Fundamentals and Programming, By P. M. Agrawal, V. J. Patel, Charotar Publication.

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

Evaluation Scheme & Syllabus

For

B.Tech. 2nd Year

Artificial Intelligence and Data Science

Artificial Intelligence and Machine Learning

Computer Science & Design

On

AICTE Model Curriculum

(Effective from the Session: 2022-23)

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

B.TECH (COMPUTER SCIENCE AND ENGINEERING

Artificial Intelligence and Data Science
Artificial Intelligence and Machine Learning
Computer Science & Design

SEMESTER- III

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KOE031-038 / KAS302	Engineering Science Course/ Maths IV	3	1	0	30	20	50		100		150	4
2	KAS301/ KVE 301	Technical Communication/Universal Human values	2 3	1 0	0 0	30	20	50		100		150	3
3	KCS301	Data Structure	3	1	0	30	20	50		100		150	4
4	KCS302	Computer Organization and Architecture	3	1	0	30	20	50		100		150	4
5	KCS303	Discrete Structures & Theory of Logic	3	0	0	30	20	50		100		150	3
6	KCS351	Data Structures Using C Lab	0	0	2				25		25	50	1
7	KCS352	Computer Organization Lab	0	0	2				25		25	50	1
8	KCS353	Discrete Structure & Logic Lab	0	0	2				25		25	50	1
9	KCS354	Mini Project or Internship Assessment*	0	0	2			50				50	1
10	KNC301/ KNC302	Computer System Security/Python Programming	2	0	0	15	10	25		50			0
11		MOOCs (Essential for Hons. Degree)											
		Total										**950**	**22**

*The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.

SEMESTER- IV

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KAS402/ KOE041-048	Maths IV/Engg. Science Course	3	1	0	30	20	50		100		150	4
2	KVE401/ KAS401	Universal Human Values/ Technical Communication	3 2	0 1	0 0	30	20	50		100		150	3
3	KCS401	Operating Systems	3	0	0	30	20	50		100		150	3
4	KCS402	Theory of Automata and Formal Languages	3	1	0	30	20	50		100		150	4
5	KCS403	Microprocessor	3	1	0	30	20	50		100		150	4
6	KCS451	Operating Systems Lab	0	0	2				25		25	50	1
7	KCS452	Microprocessor Lab	0	0	2				25		25	50	1
8	KCS453	Python Language Programming Lab	0	0	2				25		25	50	1
9	KNC402/ KNC401	Python Programming/Computer System Security	2	0	0	15	10	25		50			0
10		MOOCs (Essential for Hons. Degree)											
		Total										**900**	**21**

B.TECH. (COMPUTER SCIENCE AND ENGINEERING
Artificial Intelligence and Data Science
Artificial Intelligence and Machine Learning
Computer Science & Design

THIRD SEMESTER (DETAILED SYLLABUS)

KCS 301	**DATA STRUCTURE**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory, used by the algorithms and their common applications.	**K_1, K_2**
CO 2	Discuss the computational efficiency of the sorting and searching algorithms.	**K_2**
CO 3	Implementation of Trees and Graphs and perform various operations on these data structure.	**K_3**
CO 4	Understanding the concept of recursion, application of recursion and its implementation and removal of recursion.	**K_4**
CO 5	Identify the alternative implementations of data structures with respect to its performance to solve a real world problem.	**K_5, K_6**
DETAILED SYLLABUS		**3-1-0**

Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Basic Terminology, Elementary Data Organization, Built in Data Types in C. Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off. Abstract Data Types (ADT) **Arrays**: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable & Two variables Polynomial.	08
II	**Stacks:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.	08
III	**Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing. **Sorting:** Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort and Radix Sort.	08
IV	**Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and	08

	Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.	
V	**Trees:** Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer(Linked List) Representation, Binary Search Tree, Strictly Binary Tree ,Complete Binary Tree . A Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertation , Deletion, Searching & Modification of data in Binary Search . Threaded Binary trees, Traversing Threaded Binary trees. Huffman coding using Binary Tree. Concept & Basic Operations for AVL Tree , B Tree & Binary Heaps	08

Text books:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India
2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.
3. Lipschutz, "Data Structures" Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.
4. Thareja, "Data Structure Using C" Oxford Higher Education.
5. AK Sharma, "Data Structure Using C", Pearson Education India.
6. Rajesh K. Shukla, "Data Structure Using C and C++" Wiley Dreamtech Publication.
7. Michael T. Goodrich, Roberto Tamassia, David M. Mount "Data Structures and Algorithms in C++", Wiley India.
8. P. S. Deshpandey, "C and Data structure", Wiley Dreamtech Publication.
9. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education.
10. Berztiss, AT: Data structures, Theory and Practice, Academic Press.
11. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill.
12. Adam Drozdek "Data Structures and Algorithm in Java", Cengage Learning

KCS 302	COMPUTER ORGANIZATION AND ARCHITECTURE	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course , the student will be able to understand	
CO 1	Study of the basic structure and operation of a digital computer system.	K_1, K_2
CO 2	Analysis of the design of arithmetic & logic unit and understanding of the fixed point and floating-point arithmetic operations.	K_2, K_4
CO 3	Implementation of control unit techniques and the concept of Pipelining	K_3
CO 4	Understanding the hierarchical memory system, cache memories and virtual memory	K_2
CO 5	Understanding the different ways of communicating with I/O devices and standard I/O interfaces	K_2, K_4

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general registers organization, stack organization and addressing modes.	**08**
II	**Arithmetic and logic unit:** Look ahead carries adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers	**08**
III	**Control Unit:** Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: micro programme sequencing, concept of horizontal and vertical microprogramming.	**08**
IV	**Memory:** Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.	**08**
V	**Input / Output**: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	**08**

Text books:

1. Computer System Architecture - M. Mano
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky Computer Organization, McGraw-Hill, Fifth Edition, Reprint 2012
3. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, Third Edition, 1998. Reference books
4. William Stallings, Computer Organization and Architecture-Designing for Performance, Pearson Education, Seventh edition, 2006.
5. Behrooz Parahami, "Computer Architecture", Oxford University Press, Eighth Impression, 2011.
6. David A. Patterson and John L. Hennessy, "Computer Architecture-A Quantitative Approach", Elsevier, a division of reed India Private Limited, Fifth edition, 2012
7. Structured Computer Organization, Tannenbaum(PHI)

KCS 303	DISCRETE STRUCTURES & THEORY OF LOGIC	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Write an argument using logical notation and determine if the argument is or is not valid.	K_3, K_4
CO 2	Understand the basic principles of sets and operations in sets.	K_1, K_2
CO 3	Demonstrate an understanding of relations and functions and be able to determine their properties.	K_3
CO 4	Demonstrate different traversal methods for trees and graphs.	K_1, K_4
CO 5	Model problems in Computer Science using graphs and trees.	K_2, K_6

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Set Theory**: Introduction, Combination of sets, Multisets, Ordered pairs. Proofs of some general identities on sets. Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Recursive definition of relation, Order of relations. **Functions:** Definition, Classification of functions, Operations on functions, Recursively defined functions. Growth of Functions. **Natural Numbers:** Introduction, Mathematical Induction, Variants of Induction, Induction with Nonzero Base cases. Proof Methods, Proof by counter – example, Proof by contradiction.	**08**
II	**Algebraic Structures:** Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphisms, Definition and elementary properties of Rings and Fields.	**08**
III	**Lattices**: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra.	**08**
IV	**Propositional Logic:** Proposition, well formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference. (8) **Predicate Logic:** First order predicate, well formed formula of predicate, quantifiers, Inference theory of predicate logic.	**08**
V	**Trees:** Definition, Binary tree, Binary tree traversal, Binary search tree. **Graphs:** Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring, Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences. **Combinatorics**: Introduction, Counting Techniques, Pigeonhole Principle	**08**

Text books:

1.Koshy, Discrete Structures, Elsevier Pub. 2008 Kenneth H. Rosen, Discrete Mathematics and Its Applications, 6/e, McGraw-Hill, 2006.

2. B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, 5/e, Prentice Hall, 2004.

3.E.R. Scheinerman, Mathematics: A Discrete Introduction, Brooks/Cole, 2000.

4.R.P. Grimaldi, Discrete and Combinatorial Mathematics, 5/e, Addison Wesley, 2004

5.Liptschutz, Seymour, " Discrete Mathematics", McGraw Hill.

6.Trembley, J.P & R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", McGraw Hill.

4. Deo, 7.Narsingh, "Graph Theory With application to Engineering and Computer.Science.", PHI.

8. Krishnamurthy, V., "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi

KCS 351 DATA STRUCTURE USING C LAB

Write C Programs to illustrate the concept of the following:

1. Sorting Algorithms-Non-Recursive.
2. Sorting Algorithms-Recursive.
3. Searching Algorithm.
4. Implementation of Stack using Array.
5. Implementation of Queue using Array.
6. Implementation of Circular Queue using Array.
7. Implementation of Stack using Linked List.
8. Implementation of Queue using Linked List.
9. Implementation of Circular Queue using Linked List.
10. Implementation of Tree Structures, Binary Tree, Tree Traversal, Binary Search Tree, Insertion and Deletion in BST.
11. Graph Implementation, BFS, DFS, Minimum cost spanning tree, shortest path algorithm.

KCS 352 COMPUTER ORGANIZATION LAB

1. Implementing HALF ADDER, FULL ADDER using basic logic gates
2. Implementing Binary -to -Gray, Gray -to -Binary code conversions.
3. Implementing 3-8 line DECODER.
4. Implementing 4x1 and 8x1 MULTIPLEXERS.
5. Verify the excitation tables of various FLIP-FLOPS.
6. Design of an 8-bit Input/ Output system with four 8-bit Internal Registers.
7. Design of an 8-bit ARITHMETIC LOGIC UNIT.
8. Design the data path of a computer from its register transfer language description.
9. Design the control unit of a computer using either hardwiring or microprogramming based on its register transfer language description.
10. Implement a simple instruction set computer with a control unit and a data path.

KCS 353 DISCRETE STRUCTURE & LOGIC LAB

Programming Language/Tool Used: C and Mapple

1. Write a program in C to create two sets and perform the Union operation on sets.
2. Write a program in C to create two sets and perform the Intersectison operation on sets.
3. Write a program in C to create two sets and perform the Difference operation on sets.
4. Write a program in C to create two sets and perform the Symmetric Difference operation.
5. Write a program in C to perform the Power Set operation on a set.
6. Write a program in C to Display the Boolean Truth Table for AND, OR , NOT .
7. Write a C Program to find Cartesian Product of two sets
8. Write a program in C for minimum cost spanning tree.
9. Write a program in C for finding shortest path in a Graph

Note: Understanding of mathematical computation software Mapple to experiment the followings (exp. 10 to 25):

10. Working of Computation software
11. Discover a closed formula for a given recursive sequence vice-versa
12. Recursion and Induction
13. Practice of various set operations
14. Counting
15. Combinatorial equivalence
16. Permutations and combinations
17. Difference between structures, permutations and sets
18. Implementation of a recursive counting technique
19. The Birthday problem
20. Poker Hands problem
21. Baseball best-of-5 series: Experimental probabilities
22. Baseball: Binomial Probability
23. Expected Value Problems
24. Basketball: One and One
25. Binary Relations: Influence

B.TECH.

Artificial Intelligence and Data Science
Artificial Intelligence and Machine Learning
Computer Science & Design

FOURTH SEMESTER (DETAILED SYLLABUS)

KCS 401	**OPERATING SYSTEM**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Understand the structure and functions of OS	K_1, K_2
CO 2	Learn about Processes, Threads and Scheduling algorithms.	K_1, K_2
CO 3	Understand the principles of concurrency and Deadlocks	K_2
CO 4	Learn various memory management scheme	K_2
CO 5	Study I/O management and File systems.	K_2,K_4

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction** : Operating system and functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multiprocess Systems, Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.	**08**
II	**Concurrent Processes**: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation; Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem; Inter Process Communication models and Schemes, Process generation.	**08**
III	**CPU Scheduling:** Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.	**08**
IV	**Memory Management:** Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.	**08**
V	**I/O Management and Disk Scheduling**: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.	**08**

Text books:

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley
2. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education
3. Harvey M Dietel, " An Introduction to Operating System", Pearson Education
4. D M Dhamdhere, "Operating Systems : A Concept based Approach", 2nd Edition,
5. TMH 5. William Stallings, "Operating Systems: Internals and Design Principles ", 6th Edition, Pearson Education

KCS 402	THEORY OF AUTOMATA AND FORMAL LANGUAGES	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars	K_4, K_6
CO 2	Analyze and design, Turing machines, formal languages, and grammars	K_4, K_6
CO 3	Demonstrate the understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving	K_1, K_5
CO 4	Prove the basic results of the Theory of Computation.	K_2,K_3
CO 5	State and explain the relevance of the Church-Turing thesis.	K_1, K_5

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Basic Concepts and Automata Theory:** Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output- Moore Machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata, Myhill-Nerode Theorem, Simulation of DFA and NFA	**08**
II	**Regular Expressions and Languages:** Regular Expressions, Transition Graph, Kleen's Theorem, Finite Automata and Regular Expression- Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages- Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability- Decision properties, Finite Automata and Regular Languages, Regular Languages and Computers, Simulation of Transition Graph and Regular language.	**08**
III	**Regular and Non-Regular Grammars**: Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF), Chomsky Hierarchy, Programming problems based on the properties of CFGs.	**08**
IV	**Push Down Automata and Properties of Context Free Languages**: Nondeterministic Pushdown Automata (NPDA)- Definition, Moves, A Language Accepted by NPDA, Deterministic Pushdown Automata(DPDA) and Deterministic Context free Languages(DCFL), Pushdown Automata for Context Free Languages, Context Free grammars for Pushdown Automata, Two stack Pushdown Automata, Pumping Lemma for CFL, Closure properties of CFL, Decision Problems of CFL, Programming problems based on the properties of CFLs.	**08**
V	**Turing Machines and Recursive Function Theory** : Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem, Post's Correspondance Problem, Introduction to Recursive Function Theory.	**08**

Text books:

1. Introduction to Automata theory, Languages and Computation, J.E.Hopcraft, R.Motwani, and Ullman. 2nd edition, Pearson Education Asia
2. Introduction to languages and the theory of computation, J Martin, 3rd Edition, Tata McGraw Hill
3. Elements and Theory of Computation, C Papadimitrou and C. L. Lewis, PHI
4. Mathematical Foundation of Computer Science, Y.N.Singh, New Age International

KCS 403	MICROPROCESSOR	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Apply a basic concept of digital fundamentals to Microprocessor based personal computer system.	K_3, K_4
CO 2	Analyze a detailed s/w & h/w structure of the Microprocessor.	K_2,K_4
CO 3	Illustrate how the different peripherals (8085/8086) are interfaced with Microprocessor.	K_3
CO 4	Analyze the properties of Microprocessors(8085/8086)	K_4
CO 5	Evaluate the data transfer information through serial & parallel ports.	K_5

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Microprocessor evolution and types, microprocessor architecture and operation of its components, addressing modes, interrupts, data transfer schemes, instruction and data flow, timer and timing diagram, Interfacing devices.	**08**
II	Pin diagram and internal architecture of 8085 microprocessor, registers, ALU, Control & status, interrupt and machine cycle. Instruction sets. Addressing modes. Instruction formats Instruction Classification: data transfer, arithmetic operations, logical operations, branching operations, machine control and assembler directives.	**08**
III	Architecture of 8086 microprocessor: register organization, bus interface unit, execution unit, memory addressing, and memory segmentation. Operating modes. Instruction sets, instruction format, Types of instructions. Interrupts: hardware and software interrupts.	**08**
IV	Assembly language programming based on intel 8085/8086. Instructions, data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions	**08**
V	Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.	**08**

Text books:

1. Gaonkar, Ramesh S , "Microprocessor Architecture, Programming and Applications with
2. 8085", Penram International Publishing.
3. Ray A K , Bhurchandi K M , "Advanced Microprocessors and Peripherals", TMH
4. Hall D V ,"Microprocessor Interfacing', TMH
5. Liu and, " Introduction to Microprocessor", TMH
6. Brey, Barry B, "INTEL Microprocessors", PHI
7. Renu Sigh & B.P. Gibson G A , " Microcomputer System: The 8086/8088 family'' ,PHI
8. Aditya P Mathur Sigh, "Microprocessor, Interfacing and Applications M Rafiqzzaman, "Microprocessors, Theory and Applications
9. J.L. Antonakos, An Introduction to the Intel Family of Microprocessors, Pearson, 1999

KCS 451 OPERATING SYSTEM LAB

1. Study of hardware and software requirements of different operating systems (UNIX,LINUX,WINDOWS XP, WINDOWS7/8
2. Execute various UNIX system calls for
    i. Process management
    ii. File management
    iii. Input/output Systems calls
3. Implement CPU Scheduling Policies:
    i. SJF
    ii. Priority
    iii. FCFS
    iv. Multi-level Queue
4. Implement file storage allocation technique:
    i. Contiguous(using array)
    ii. Linked –list(using linked-list)
    iii. Indirect allocation (indexing)
5. Implementation of contiguous allocation techniques:
    i. Worst-Fit
    ii. Best- Fit
    iii. First- Fit
6. Calculation of external and internal fragmentation
    i. Free space list of blocks from system
    ii. List process file from the system
7. Implementation of compaction for the continually changing memory layout and calculate total movement of data
8. Implementation of resource allocation graph RAG)
9. Implementation of Banker‟s algorithm
10. Conversion of resource allocation graph (RAG) to wait for graph (WFG) for each type of method used for storing graph.
11. Implement the solution for Bounded Buffer (producer-consumer)problem using inter process communication techniques-Semaphores
12. Implement the solutions for Readers-Writers problem using inter process communication technique -Semaphore

KCS 452 MICROPROCESSOR LAB

1. Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085.
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a program to arrange an array of data in ascending and descending order.
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8085 instruction set.
7. To write a program to initiate 8251 and to check the transmission and reception of character.
8. To interface 8253 programmable interval timer to 8085 and verify the operation of 8253 in six different modes.
9. To interface DAC with 8085 to demonstrate the generation of square, saw tooth and triangular wave.
10. Serial communication between two 8085 through RS-232 C port**.**

KCS 453 PYTHON LANGUAGE PROGRAMMING LAB

1. To write a python program that takes in command line arguments as input and print the number of arguments.
2. To write a python program to perform Matrix Multiplication.
3. To write a python program to compute the GCD of two numbers.
4. To write a python program to find the most frequent words in a text file.
5. To write a python program find the square root of a number (Newton's method).
6. To write a python program exponentiation (power of a number).
7. To write a python program find the maximum of a list of numbers.
8. To write a python program linear search.
9. To write a python program Binary search.
10. To write a python program selection sort.
11. To write a python program Insertion sort.
12. To write a python program merge sort.
13. To write a python program first n prime numbers.
14. To write a python program simulate bouncing ball in Pygame.

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

Evaluation Scheme & Syllabus

For

B.Tech. 3rd Year

COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

on

AICTE Model Curriculum

(Effective from the Session: 2022-23)

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

B.TECH.

COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

CURRICULUM STRUCTURE

SEMESTER- V													
Sl. No.	**Subject Codes**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
			L	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1	KCS501	Database Management System	3	1	0	30	20	50		100		150	4
2	KAI501	Artificial Intelligence	3	1	0	30	20	50		100		150	4
3	KCS503	Design and Analysis of Algorithm	3	1	0	30	20	50		100		150	4
4	Dept. Elective-I	Departmental Elective-I	3	0	0	30	20	50		100		150	3
5	Dept. Elective-II	Departmental Elective-II	3	0	0	30	20	50		100		150	3
6	KCS551	Database Management System Lab	0	0	2				25		25	50	1
7	KAI551	Artificial Intelligence Lab	0	0	2				25		25	50	1
8	KCS553	Design and Analysis of Algorithm Lab	0	0	2				25		25	50	1
9	KCS554	Mini Project or Internship Assessment*	0	0	2				50			50	1
10	KNC501/ KNC502	Constitution of India. Law and Engineering / Indian Tradition, Culture and Society	2	0	0	15	10	25		50			
11		MOOCs (Essential for Hons. Degree)											
		Total										**950**	**22**

*The Mini Project or internship (4 weeks) conducted during summer break after IV semester and will be assessed during V semester.

SEMESTER- VI												
Sl. No.	**Subject Codes**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
			L	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1	KAI601	Machine Learning Techniques	3	1	0	30	20	50		100		150	4
2	KCS602	Web Technology	3	1	0	30	20	50		100		150	4
3	KCS603	Computer Networks	3	1	0	30	20	50		100		150	4
4	Dept. Elective-III	Departmental Elective-III	3	0	0	30	20	50		100		150	3
5		Open Elective-I [Annexure - B(iv)]	3	0	0	30	20	50		100		150	3
6	KAI651	Machine learning Lab	0	0	2				25		25	50	1
7	KCS652	Web Technology Lab	0	0	2				25		25	50	1
8	KCS653	Computer Networks 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			
10		MOOCs (Essential for Hons. Degree)											
		Total										**900**	**21**

Departmental Elective-I

1. KAI051 Mathematical Foundation AI , ML and Data Science
2. KCS052 Web Designing
3. KDS051 Business Intelligence and Analytics
4. KCS054 Object Oriented System Design
5. KDS052 Distributed System

Departmental Elective-II

1. KML051 Cloud Computing
2. KAI052 Natural Language Processing
3. KCS056 Application of Soft Computing
4. KAI053 Intelligent Database System
5. KCS502 Compiler Design

Departmental Elective-III

1. KAI061 Cyber Forensic analytics
2. KDS061 Image Analytics
3. KML061 Advanced Machine Learning
4. KML062 Stream Processing and Analytics
6. KDS063 Software Engineering

B.TECH.

Computer Science and Engineering (Artificial Intelligence & Machine Learning)

FIFTH SEMESTER (DETAILED SYLLABUS)

KCS 501	**DATABASE MANAGEMENT SYSTEM**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
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:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
2. Date C J, "An Introduction to Database Systems", Addision Wesley
3. Elmasri, Navathe, " Fundamentals of Database Systems", Addision 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

KAI501	ARTIFICIAL INTELLIGENCE	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.	K_2
CO 2	Understand search techniques and gaming theory.	K_2, K_3
CO 3	The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.	K_3 , K_4
CO 4	Student should be aware of techniques used for classification and clustering.	K_2 , K_3
CO 5	Student should aware of basics of pattern recognition and steps required for it.	K_2 , K_4

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION :** Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.	**08**
II	**PROBLEM SOLVING METHODS** Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games	**08**
III	**KNOWLEDGE REPRESENTATION** First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information	**08**
IV	**SOFTWARE AGENTS** Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.	**08**
V	**APPLICATIONS** AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving	**08**

Text books:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. I. Bratko, ―Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008
4. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
5. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.
6. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

KCS 503	DESIGN AND ANALYSIS OF ALGORITHM	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course , the student will be able to understand	
CO 1	Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.	K_4, K_6
CO 2	Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).	K_5, K_6
CO 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.	K_2, K_5
CO 4	Apply classical sorting, searching, optimization and graph algorithms.	K_2, K_4
CO 5	Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.	K_2, K_3

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
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.	**08**
II	**Advanced Data Structures:** Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List	**08**
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.	**08**
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.	**08**
V	**Selected Topics:** Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP-Completeness, Approximation Algorithms and Randomized Algorithms	**08**

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 ÉvaTardos, Algorithm Design, Pearson, 2005.
7. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006.
8. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins, 1997
9. Robert Sedgewick and Kevin Wayne, Algorithms, fourth edition, Addison Wesley, 2011.
10. Harsh Bhasin,"Algorithm Design and Analysis",FirstEdition,Oxford University Press.
11. Gilles Brassard and Paul Bratley,Algorithmics:Theory and Practice,Prentice Hall,1995.

KAI 051	MATHEMATICAL FOUNDATION AI , ML AND DATA SCIENCE	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Understand and apply the probability distributions, random number generation and density estimations to perform analysis of various kinds of data	K2, K_4, K_6
CO 2	Understand and manipulate data, design and perform simple Monte Carlo experiments, and be able to use resampling methods	K_5, K_6
CO 3	Perform statistical analysis on variety of data	K_2, K_5
CO 4	Perform appropriate statistical tests using R and visualize the outcome	K_2, K_4
CO 5	Discuss the results obtained from their analyses after creating customized graphical and numerical summaries	K_2, K_3

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Descriptive Statistics:** Diagrammatic representation of data, measures of central tendency, measures of dispersion, measures of skewness and kurtosis, correlation, inference procedure for correlation coefficient, bivariate correlation, multiple correlations, linear regression and its inference procedure, multiple regression. **Probability:** Measures of probability, conditional probability, independent event, Bayes' theorem, random variable, discrete and continuous probability distributions, expectation and variance, markov inequality, chebyshev's inequality, central limit theorem.	**08**
II	**Inferential Statistics:** Sampling & Confidence Interval, Inference & Significance. Estimation and Hypothesis Testing, Goodness of fit, Test of Independence, Permutations and Randomization Test, t-test/z-test (one sample, independent, paired), ANOVA, chi-square. **Linear Methods for Regression Analysis:** multiple regression analysis, orthogonalization by Householder transformations (QR); singular value decomposition (SVD); linear dimension reduction using principal component analysis (PCA).	**08**
III	**Pseudo-Random Numbers:** Random number generation, Inverse-transform, acceptance-rejection, transformations, multivariate probability calculations. **Monte Carlo Integration:** Simulation and Monte Carlo integration, variance reduction, Monte Carlo hypothesis testing, antithetic variables/control variates, importance sampling, stratified sampling Markov chain Monte Carlo (McMC): Markov chains; Metropolis-Hastings algorithm; Gibbs sampling; convergence	**08**
IV	**Vector Spaces-** Vector Space, Subspace , Linear Combination, Linear Independence, Basis, Dimension, Finding a Basis of a Vector Space , Coordinates, Change of Basis **Inner Product Spaces-** Inner Product, Length, Orthogonal Vectors, Triangle Inequality, Cauchy-Schwarz Inequality, Orthonormal (Orthogonal) Basis, Gram-Schmidt Process	**08**
V	**Linear Transformations**- Linear Transformations and Matrices for Linear Transformation, Kernel and Range of a Linear Transformations, Change of Basis **Eigenvalues and Eigenvectors**- Definition of Eigenvalue and Eigenvector, Diagonalization , Symmetric Matrices and Orthogonal Diagonalization	**08**

References:

1. S.C. Gupta & V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons
2. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Press.
3. Dudewicz, E.J., Mishra, S.N., "Modern Mathematical Statistics", Willy
4. Purohit S. G., Gore S. D., Deshmukh S. K., "Statistics using R, Narosa
5. Rizzo, M. L., "Statistical Computing with R", Boca Raton, FL: Chapman & Hall/CRC Press
6. Normal Maltoff, The Art of R programming, William
7. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media
8. M. D. Ugarte, A. F. Militino, A. T. Arnholt, "Probability and Statistics with R", CRC Press
9. Kundu, D. and Basu, A., "Statistical computing – existing methods and recent developments", Narosa
10. Gentle, James E., Härdle, Wolfgang Karl, Mori, Yuich, "Handbook of Computational Statistics", Springer
11. Givens and Hoeting, "Computational Statistics", Wiley Series in Prob. and Statistics
12. Elementary Linear Algebra by Ron Larson, 8th edition, Cengage Learning, 2017

KCS 052	WEB DESIGNING	
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

KDS 051	BUSINESS INTELLIGENCE AND ANALYTICS	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Understand the essentials of BI & data analytics and the corresponding terminologies	K_2
CO 2	Analyze the steps involved in the BI - Analytics process	K_3, K_4
CO 3	Illustrate competently on the topic of analytics	K_2, K_3
CO 4	Understand & Implement the K-Means Clustering with Iris Dataset	K_2, K_3
CO 5	Demonstrate the real time scenario (Case study) by using BI & Analytics techniques	K_5, K_6

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**BUSINESS INTELLIGENCE – INTRODUCTION:** Introduction - History and Evolution: Effective and Timely decisions, Data Information and Knowledge, Architectural Representation, Role of mathematical Models, Real Time Business Intelligent System.	**8**
II	**BI – DATA MINING & WAREHOUSING:**Data Mining - Introduction to Data Mining, Architecture of Data Mining and How Data mining works(Process) , Functionalities & Classifications of Data Mining, Representation of Input Data, Analysis Methodologies. Data Warehousing - Introduction to Data Warehousing, Data Mart, Online Analytical Processing (OLAP) – Tools, Data Modelling, Difference between OLAP and OLTP, Schema – Star and Snowflake Schemas, ETL Process – Role of ETL	**8**
III	**BI – DATA PREPARTTION:** Data Validation - Introduction to Data Validation, Data Transformation – Standardization and Feature Extraction, Data Reduction – Sampling, Selection, PCA, Data Discretization	**8**
IV	**BI – DATA ANALYTICS PROCESS -** Introduction to analytics process, Types of Analytical Techniques in BI –Descriptive, Predictive, Perspective, Social Media Analytics, Behavioral, Iris Datasets	**8**
V	**IMPLEMENTATION OF BI –** Business Activity Monitoring, Complex Event Processing, Business Process Management, Metadata, Root Cause Analysis.	**8**

Text Books:

1. Carlo-Vercellis, "Business Intelligence Data Mining and Optimization for Decision-Making", First Edition
2. Drew Bentely, "Business Intelligence and Analytics" ,@2017 Library Pres., ISBN: 978-1-9789-2136-8
3. Larissa T. Moss & Shaku Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle
4. For Decision-Support Applications", First Edition, Addison-Wesley Professional,2003
5. Kimball, R., Ross, M., Thornthwaite, W., Mundy, J., and Becker, B. John, "The Data Warehouse
6. Lifecycle Toolkit: Practical Techniques for Building Data Warehouse and Business Intelligence Systems", Second Edition, Wiley & Sons, 2008.
7. Cindi Howson, "Successful Business Intelligence", Second Edition, McGraw-Hill Education, 2013.

KCS 054	OBJECT ORIENTED SYSTEM DESIGN	
	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 Rumbaughet. al, "Object Oriented Modeling and Design", PHI
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education
3. Object Oriented Programming With C++, E Balagurusamy, TMH
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 Compete Reference C++, Herbert Schlitz, TMH

KDS 052	DISTRIBUTED SYSTEM	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	To provide hardware and software issues in modern distributed systems.	K1 , K2
CO 2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.	K2
CO 3	To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.	K4
CO 4	To know about Shared Memory Techniques and have Sufficient knowledge about file access	K1
CO 5	Have knowledge of Synchronization and Deadlock.	K1
DETAILED SYLLABUS		**3-0-0**

Unit	Topic	Proposed Lecture
I	**Characterization of Distributed Systems**: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models. Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks ,Lamport's& vectors logical clocks. Concepts in Message Passing Systems: causal order, total order, total causal order, Techniques for Message Ordering, Causal ordering of messages, global state, termination detection.	**08**
II	**Distributed Mutual Exclusion:** Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms. Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.	**08**
III	**Agreement Protocols:** Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system. Distributed Resource Management: Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory.	**08**
IV	Failure Recovery in Distributed Systems: Concepts in Backward and Forward recovery, Recovery in Concurrent systems, Obtaining consistent Checkpoints, Recovery in Distributed Database Systems. Fault Tolerance: Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols	**08**
V	**Transactions and Concurrency Control**: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.	**08**

Text books:

1. Singhal&Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Ramakrishna,Gehrke," Database Management Systems", McGraw Hill
3. Vijay K.Garg Elements of Distributed Compuitng , Wiley
4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education
5. Tenanuanbaum, Steen," Distributed Systems", PHI

KML051	CLOUD COMPUTING	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Describe architecture and underlying principles of cloud computing.	K_3
CO 2	Explain need, types and tools of Virtualization for cloud.	K_3, K_4
CO 3	Describe Services Oriented Architecture and various types of cloud services.	K_2, K_3
CO 4	Explain Inter cloud resources management cloud storage services and their providers Assess security services and standards for cloud computing.	K_2, K_4
CO 5	Analyze advanced cloud technologies.	K_3, K_6

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction To Cloud Computing:** Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.	**08**
II	**Cloud Enabling Technologies Service Oriented Architecture:** REST and Systems of Systems – Web Services – Publish, Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.	**08**
III	**Cloud Architecture, Services And Storage:** Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.	**08**
IV	**Resource Management And Security In Cloud:** Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.	**08**
V	**Cloud Technologies And Advancements Hadoop:** MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine —- Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.	**08**

Text books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

KAI 052	NATURAL LANGUAGE PROCESSING	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able :		
CO 1	To learn the fundamentals of natural language processing	K_1 , K_2
CO 2	To understand the use of CFG and PCFG in NLP	K_1 , K_2
CO 3	To understand the role of semantics of sentences and pragmatic	K_2
CO 4	To Introduce Speech Production And Related Parameters Of Speech.	K_1 , K_2
CO 5	To Show The Computation And Use Of Techniques Such As Short Time Fourier Transform, Linear Predictive Coefficients And Other Coefficients In The Analysis Of Speech.	K_3, K_4

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION:** Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance **WORD LEVEL ANALYSIS :** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Word Tokenization,Math with words TF-IDF Vectors, Finding meaning in word count (Semantic Analysis), Linguistic Background: Outline of English Syntax, Introduction to Semantics and Knowledge Representation,Zipf's Law	**08**
II	**SYNTACTIC ANALYSIS:** Context Free Grammars, Grammar rules for English, Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks. Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing Feature structures, Unification of feature structures.	**08**
III	**SEMANTICS AND PRAGMATICS:** Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.	**08**
IV	**BASIC CONCEPTS of Speech Processing :**Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.	**08**
V	**SPEECH-ANALYSIS**: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual Real World NLP Challenges-Information Extraction and Question Answering,DialogEngines,Optimization,Parallelization and batch processing	**08**

Text books:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Lawrence RabinerAndBiing-Hwang Juang, "Fundamentals Of Speech Recognition", Pearson Education, 2003.
4. Daniel JurafskyAnd James H Martin, "Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition", Pearson Education, 2002.

5. Frederick Jelinek, "Statistical Methods Of Speech Recognition", MIT Press, 1997.
6. 1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
7. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
8. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
9. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

KCS 056 APPLICATION OF SOFT COMPUTING

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to :		
CO 1	Recognize the feasibility of applying a soft computing methodology for a particular problem	K_2, K_4
CO 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.	K2,K_4, K_6
CO 3	Apply neural networks to pattern classification and regression problems and compare solutions by various soft computing approaches for a given problem.	K_3, K_5
CO 4	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems	K_3, K_4
CO 5	Apply genetic algorithms to combinatorial optimization problems	K3, K5

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
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 hetro-associative memory.	**08**
II	**Neural Networks-II (Back propagation networks):** Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.	**08**
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.	**08**
IV	**Fuzzy Logic –II (Fuzzy Membership, Rules)** : Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications&Defuzzificataions, Fuzzy Controller, Industrial applications	**08**
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.	**08**

Text books:

1. S. Rajsekaran& G.A. VijayalakshmiPai, "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. SimanHaykin,"Neural Networks"Prentice Hall of India
4. Saroj Kaushik, Sunita Tiwari, "Soft Computing: Fundamentals, Techniques and Applications", McGraw Hill Education
5. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

6. Kumar Satish, “Neural Networks” Tata Mc Graw Hill

KAI 053	INTELLIGENT DATABASE SYSTEM	
	Course Outcome (CO)	**Bloom’s Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Understand the concepts of Intelligent database.	K_2
CO 2	Make study of the Database installation then create the database with user and apply SQL.	K_2, K_3
CO 3	Understand the concepts of knowledge-based systems and apply with AI	K_2, K_3
CO 4	Design and create the small applications	K_5, K_6
CO 5	Analyze and Implement for various real-time applications in Intelligent Database System	K_4, K_5

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to IDBS-** Informal definition of the domain - General characteristics of IDBSs - Data models and the relational data model - A taxonomy of intelligent database systems - Guidelines for using intelligent database systems. **Practical Component:** (a) Install the LAMP (b) Configure and setup the Connection between back end & Front End.	**08**
II	**Semantic Data Models** Nested and semantic data models – Introduction - The nested relational model - Semantic models - Hyper-semantic data models - Object-oriented approaches to semantic data modeling – Objectoriented database systems - Basic concepts of a core object-oriented data model - Comparison with other data models - Query languages and query processing - Operational aspects – Systems – The ODMG standard - The object-relational data model - Java and databases – Conclusions – Active database systems - Basic concepts – Issues – Architectures - Research relational prototypes—the Starburst Rule System - Commercial relational approaches. **Practical Component:** (a) Design & create the DB user in database. (b) Using SQL - create sample DB for Language –DDL, DML and DCL. (c) Create sample java/PHP pages with database access.	**08**
III	**Knowledge-Based Systems- AI Ccontext** Characteristics and classification of the knowledge-based systems – Introduction - The resolution principle - Inference by inheritance – Conclusion - Deductive database systems - Basic concepts - DATALOG language - Deductive database systems and logic programming systems—differences - Architectural approaches - Research prototypes - Updates in deductive databases - Integration of deductive database and object database technologies - Constraint databases - Conclusions. **Practical Component:** 1. Working on basic commands on datalog 2. Practice on projection and Selection in datalog **3.** Write a program that uses + and - from racket/base as external queries using DATALOG language	**08**

IV	**Advanced Knowledge-Based Systems** Introduction - Architectural solutions - The 'general bridge' solution - Extending a KBS with components proper to a DBMS - The 'tight coupling' approach – Conclusion - Advanced solutions: Introduction - A 'knowledge level' approach to the interaction with an IAS- TELOS - a language for implementing very large 'integral approach' systems- The CYC project - Other projects based on a 'conceptual representation' approach - Lexical approaches to the construction of large KBs. **Practical Component:** Implement the techniques to manage knowledge-based systems.	**08**
V	**Applications in IDBS** Introduction - Temporal databases - Basic concepts - Temporal data models - Temporal query languages – Ontologies -Ontology theoretical foundations - Environments for building ontologies - Structured, semi-structured and unstructured data - Multimedia database - Semi-structured data - Mediators – Motivation – Architecture - Application of mediators to heterogeneous systems –Proposals - Multi-Agents systems - Main issues in designing a multi-agent system - Open problems. Internet indexing and retrieval - Basic indexing methods - Search engines or meta-searchers – Internet spiders - Data mining - Data mining tasks - Data mining tools - Medical and legal information systems - Medical information systems - Legal information systems – Conclusions. **Practical Component:** 1. Implement the temporal databases. 2. Design and develop a project using medical information system.	**08**

Text Books:

1. Elisa Bertino, Barbara Catania, GianPieroZarri, “Intelligent Database Systems”,Collection ACM Press.
2. Ngoc ThanhNguyen, RadoslawKatarzyniak,andShyi-MingChen (Eds.), "Advances in Intelligent Information andDatabase Systems ", Springer, 2010.

KCS 502	COMPILER DESIGN	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Acquire knowledge of different phases and passes of the compiler and able to use the compiler tools like LEX, YACC, etc. Students will also be able to design different types of compiler tools to meet the requirements of the realistic constraints of compilers.	K_3, K_6
CO 2	Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.	K_2, K_6
CO 3	Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.	K_4, K_5
CO 4	Acquire knowledge about run time data structure like symbol table organization and different techniques used in that.	K_2, K_3
CO 5	Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.	K_2, K_4

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Compiler**: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.	**08**
II	**Basic Parsing Techniques:** Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.	**08**
III	**Syntax-directed Translation:** Syntax-directed Translation schemes, Implementation of Syntax-directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.	**08**
IV	**Symbol Tables**: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.	**08**
V	**Code Generation:** Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.	**08**

Text books:

1. K. Muneeswaran,CompilerDesign,FirstEdition,Oxford University Press.
2. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill,2003.
3. HenkAlblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
4. Aho, Sethi& Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education
5. V Raghvan, " Principles of Compiler Design", TMH
6. Kenneth Louden," Compiler Construction", Cengage Learning.
7. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

KCS 551	DATABASE MANAGEMENT SYSTEMS LAB	
	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.	K_2, K_4
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	K_4, K_5
CO 4	Write and execute PL/SQL blocks, procedure functions, packages and triggers, cursors.	K_4, K_5
CO 5	Enforce entity integrity, referential integrity, key constraints, and domain constraints on database.	K_3, K_4

DETAILED SYLLABUS

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) h) Hotel Management System

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)

Database Management Systems Lab (KCS 551): Mapping with Virtual Lab

Name of the Lab	Name of the Experiment
Database Management Lab (KCS-551)	Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)
	Data Manipulation Language(DML) Statements
	Data Query Language(DQL) Statements: (Select statement with operations like Where clause, Order by, Logical operators, Scalar functions and Aggregate functions)
	Transaction Control Language(TCL) statements: (Commit(make changes permanent), Rollback (undo)
	Describe statement: To view the structure of the table created

KAI 551	**ARTIFICIAL INTELLIGENCE LAB**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Use of python to understand the concept of AI	K_3
CO 2	Implementation of Different AI Techniques	K_4, K_5
CO 3	Application of AI techniques in practical Life	K_4
CO 4	Understanding of Natural Language Tool Kit.	K_2
CO 5	Practical Application of Natural Language Tool Kit	K_4, K_5

DETAILED SYLLABUS

1. Write a python program to implement Breadth First Search Traversal
2. Write a python program to implement Water Jug Problem
3. Write a python program to remove punctuations from the given string
4. Write a python program to sort the sentence in alphabetical order
5. Write a program to implement Hangman game using python.
6. Write a program to implement Tic-Tac-Toe game using python.
7. Write a python program to remove stop words for a given passage from a text file using NLTK
8. Write a python program to implement stemming for a given sentence using NLTK
9. Write a python program to POS (Parts of Speech) tagging for the give sentence using NLTK
10. Write a python program to implement Lemmatization using NLTK
11. Write a python program to for Text Classification for the give sentence using NLTK

Note: The Instructor may add/delete/modify/tune experiments

KCS 553	DESIGN AND ANALYSIS OF ALGORITHM LAB	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Implement algorithm to solve problems by iterative approach.	K_2, K_4
CO 2	Implement algorithm to solve problems by divide and conquer approach	K_3, K_5
CO 3	Implement algorithm to solve problems by Greedy algorithm approach.	K_4, K_5
CO 4	Implement algorithm to solve problems by Dynamic programming, backtracking, branch and bound approach.	K_4, K_5
CO 5	Implement algorithm to solve problems by branch and bound approach.	K_3, K_4

DETAILED SYLLABUS

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 non-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 non-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.
13.6. 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 = {Sl, S2,.....,Sn} 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 solution.
19. Design and implement to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

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 (C, C++ etc)

KAI 601 MACHINE LEARNING TECHNIQUES

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able:		
CO 1	To understand the need for machine learning for various problem solving	K_1 , K_2
CO 2	To understand a wide variety of learning algorithms and how to evaluate models generated from data	K_1 , K_3
CO 3	To understand the latest trends in machine learning	K_2 , K_3
CO 4	To design appropriate machine learning algorithms and apply the algorithms to a real-world problems	K_4 , K_6
CO 5	To optimize the models learned and report on the expected accuracy that can be achieved by applying the models	K_4, K_5

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
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;	**08**
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,andGaussiankernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.	**08**
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.	**08**
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-deriving car etc.	**08**
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.	**08**

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
5. M. Gopal, "Applied Machine Learning", McGraw Hill Education

KCS 602	WEB TECHNOLOGY	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Explain web development Strategies and Protocols governing Web.	K_1, K_2
CO 2	Develop Java programs for window/web-based applications.	K_2, K_3
CO 3	Design web pages using HTML, XML, CSS and JavaScript.	K_2, K_3
CO 4	Creation of client-server environment using socket programming	K_1, K_2,
CO 5	Building enterprise level applications and manipulate web databases using JDBC	K_3, K_4
CO6	Design interactive web applications using Servlets and JSP	K_2, K_3

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
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	**08**
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	**08**
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.	**08**
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.	**08**
V	**Servlets:** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, HandlingHTTP 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..	**08**

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. Bhave, "Programming with Java", Pearson Education
5. Herbert Schieldt, "The Complete Reference:Java", TMH.
6. Hans Bergsten, "Java Server Pages", SPD O'Reilly
7. Margaret Levine Young, "The Complete Reference Internet", TMH

8. Naughton, Schildt, "The Complete Reference JAVA2", TMH
9. Balagurusamy E, "Programming in JAVA", TMH

KCS 603	COMPUTER NETWORKS	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course , the student will be able to	
CO1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission	K_1,K_2
CO2	Apply channel allocation, framing, error and flow control techniques.	K_3
CO3	Describe the functions of Network Layer i.e. Logical addressing, subnetting& Routing Mechanism.	K_2,K_3
CO4	Explain the different Transport Layer function i.e. Port addressing, Connection Management, Error control and Flow control mechanism.	K_2,K_3
CO5	Explain the functions offered by session and presentation layer and their Implementation.	K_2,K_3
CO6	Explain the different protocols used at application layer i.e. HTTP, SNMP, SMTP, FTP, TELNET and VPN.	K_2
	DETAILED SYLLABUS	**3-0-0**

Unit	Topic	Proposed Lecture
I	**Introductory Concepts**: Goals and applications of networks, Categories of networks, Organization of the Internet, ISP, Network structure and architecture (layering principles, services, protocols and standards), The OSI reference model, TCP/IP protocol suite, Network devices and components. **Physical Layer:** Network topology design, Types of connections, Transmission media, Signal transmission and encoding, Network performance and transmission impairments, Switching techniques and multiplexing.	**08**
II	**Link layer:** Framing, Error Detection and Correction, Flow control (Elementary Data Link Protocols, Sliding Window protocols). Medium Access Control and Local Area Networks: Channel allocation, Multiple access protocols, LAN standards, Link layer switches & bridges (learning bridge and spanning tree algorithms).	**08**
III	**Network Layer:** Point-to-point networks, Logical addressing, Basic internetworking (IP, CIDR, ARP, RARP, DHCP, ICMP), Routing, forwarding and delivery, Static and dynamic routing, Routing algorithms and protocols, Congestion control algorithms, IPv6.	**08**
IV	**Transport Layer:** Process-to-process delivery, Transport layer protocols (UDP and TCP), Multiplexing, Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.	**08**
V	**Application Layer:** Domain Name System, World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login, Network management, Data compression, Cryptography – basic concepts.	**08**

Text books:

Text books and References:

1. Behrouz Forouzan, "Data Communication and Networking", McGraw Hill
2. Andrew Tanenbaum "Computer Networks", Prentice Hall.
3. William Stallings, "Data and Computer Communication", Pearson.
4. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.
5. Peterson and Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann
6. W. A. Shay, "Understanding Communications and Networks", Cengage Learning.
7. D. Comer, "Computer Networks and Internets", Pearson.
8. Behrouz Forouzan, "TCP/IP Protocol Suite", McGraw Hill.

KAI 061	CYBER FORENSIC ANALYTICS	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Outline the Cyber crime and its types.	K_1, K_2
CO 2	Explore the Cyber Forensics Techniques	K_1, K_2
CO 3	Use the Cyber Investigation Techniques	K_3, K_4
CO 4	Explore the Cyber Evidence Management Techniques	K_3, K_4
CO 5	Outline the Cyber Laws in India	K_1, K_2

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Cyber Crime:** Cyber Space – Cyber Crime – Criminal Behaviour – Jurisdictional Concerns - Jurisprudential Inconsistency – eCash Security – Prepaid Cards – Stored Values Cards – Mobile Payments – Internet Payment Services -Cyber stalking - Cyber extortion – Cyber terrorism - Cyber warfare –Cyber weapons -ATM frauds – Phreaking – Internet Gambling **Practical Component:** 1. Key logger 2. Email Fraud	**08**
II	**Cyber Forensics:** Digital device – Hard disk –Disk characteristics - Disk imaging - Data Carving – Techniques – commercial piracy - soft lifting – Steganography – Network components - Port scans - Wireshark - pcap analysis - Trojans and Backdoors – Botnets - DoS – DDoS Attacks - Honey Pots – Malware – Virus and Worms **Practical Component:** 1. Pcab file Analysis – Case Study 2. Network Port Scan – Forensics	**08**
III	**Cyber Investigation** Concepts of Investigation - cyber investigation, Network Investigation - Investigating audit logs -Investigating Web attacks - Investigating Computer Intrusions - Profiling – Cyber Criminal profiling – Stylometric Techniques – Warranted searches – Warrantless searches – Undercover Techniques **Practical Component:** 1. Investigating Audit Logs 2. Investigating Web attacks	**08**
IV	**Evidence Management:** Evidence – Digital Evidence - Types – physical evidence – Real evidence – Circumstantial evidence –network evidence - Evidence collection – Evidence Analysis - Contextual Information –Evidence Management – pre search activities – On Scene activities – Report Preparations **Practical Component:** 1. Digital Evidence Analysis 2. Network Analysis	**08**
V	**Cyber Laws and Authorities**	

	Information Technology Act 2000 – Digital signature - Electronic Governance - Secure electronic records - Regulation of certifying authorities – CERNTin - Electronic signature certificates - Penalties compensation - Future Trends and Emerging Concerns **Practical Component:** 1. Digital Signature	**08**

Text Books:

1. Marjie T. Britz, "Computer Forensics and Cyber Crime", Pearson, 2013.
2. Garima Tiwari, "Understanding Laws– Cyber Laws And Cyber Crimes", Lexis Nexis, 2014.
3. Chuck Easttom, Jeff Taylor, "Computer Crime, Investigation, and the Law", Course Technology, 2018.
4. Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", Eoghan Casey, 2018.

KDS 061	**IMAGE ANALYTICS**	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Infer the basics and fundamentals of digital image processing and Apply the various techniques for intensity transformations functions. Implement Color image Smoothing and Sharpening.	K_1, K_2
CO 2	Illustrate Morphological operation and Apply Some Basic Morphological Algorithms.	K_2, K_3
CO 3	Apply image segmentation techniques such as Optimum Global Thresholding using Otsu's Method, Active Contours: Snakes and Level Sets for various real-time applications.	K_3, K_4
CO 4	Analysis various Feature Extraction methods and Implement for various real-time applications.	K_3, K_4
CO 5	Apply and Analysis various Image Pattern Classification methods such as Minimum-Distance Classification, Optimum (Bayes) Statistical Classification, and Deep Convolutional Neural Network.	K_3, K_4
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Fundamentals:** Introduction – Fundamental steps in Image Processing Systems – Image Acquisition – Sampling and Quantization – Pixel Relationships – Mathematical Tools Used in Digital Image Processing. Some Basic Intensity Transformation Functions: Image Negatives, Log Transformations, Power-Law Transformations - Histogram Processing. Color Fundamentals - Fundamentals of Spatial Filtering - Smoothing Spatial Filters - Sharpening Spatial Filters. **Practical Component:** Use Python/ MATLAB 1. Apply various intensity transformations functions. 2. Computing and plotting image histograms and use standard image processing toolbox Spatial filters. 3. Implement color image Smoothing and Sharpening.	**08**
II	**Morphological Image Processing:** Morphological Image Processing: Fundamentals - Erosion and Dilation - Opening and Closing – Hit or Miss Transform - Some Basic Morphological Algorithms – Morphological Reconstruction – Grayscale Morphology **Practical Component:** Use Python/ MATLAB 1. Implement Morphological operations. 2. Implement Morphological Reconstruction. 3. Implement Grayscale Morphology.	**08**

III	**Image Segmentation** Introduction - Point, Line, and Edge Detection – Thresholding: Foundation, Basic Global thresholding, Optimum Global Thresholding using Otsu's Method, Multiple Thresholds, Variable Thresholding –Segmentation by Region Growing and by Region Splitting and Merging – Image Segmentation: Active Contours: Snakes and Level Sets. **Practical Component:** Use Python/ MATLAB 1. Implement Optimum Global Thresholding using Otsu's Method. 2. Implement Image segmentation by Region Growing, Splitting and Merging 3. Implement Image Segmentation by Active Contours using anyone method Snakes and Level Sets.	**08**
IV	**Feature Extraction** Background - Representation – Boundary Preprocessing – Boundary Feature Descriptors: Some Basic Boundary Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments - Regional Feature Descriptors: Some Basic Descriptors, Topological and Texture Descriptors, Moment Invariants – Principal Components as Feature Descriptors – Whole-image Features Object – Scale-Invariant Feature Transform (SIFT). **Practical Component:** Use Python/ MATLAB 1. Implement Boundary Feature Descriptors 2. Implement Topological and Texture Descriptors 3. Implement Scale-Invariant Feature Transform (SIFT)	**08**
V	**Image Pattern Classification** Background -Patterns and Pattern Classes – Pattern Classification by Prototype Matching: Minimum-Distance Classifier, Using Correlation for 2-D prototype matching, Matching SIFT Features, Matching Structural Prototypes - Optimum (Bayes) Statistical Classifiers - Neural Networks and Deep Learning: Background - The Perceptron - Multilayer Feedforward Neural Networks - Deep Convolutional Neural Networks **Practical Component:** Use Python/ MATLAB 1. Implement Minimum-Distance Classification Algorithm. 2. Implement Optimum (Bayes) Statistical Classification Algorithm. 3. Implement Deep Convolutional Neural Network.	**08**

Text Books:

1. Rafael C Gonzalez, Richard E Woods, "Digital Image Processing", 4th Edition, Pearson, 2018.
2. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
3. Anil K.Jain, "Fundamentals of Digital Image Processing", Person Education, 2003.

KML 061	ADVANCED MACHINE LEARNING	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Understand advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation.	K_1, K_2
CO 2	Apply various machine learning algorithms in a range of real-world applications.	K_3, K_3
CO 3	Integrate and apply their expertise to produce solutions for real-world problems.	K_4, K_5
CO 4	Comparative Analysis of different Machine Learning Algorithms	K_4
CO 5	Interpret and Analyze results with reasoning using different ML techniques.	K_4, K_5

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Artificial Neural Network** Introduction to ANN, Perceptron, Cost Function, Gradient Checking, multi-layer perceptron and backpropagation algorithm that is used to help learn parameters for a neural network, Random Initialization	**08**
II	**Bayesian Learning** Probability theory and Bayes rule, Naive Bayes learning algorithm, Bayes nets.	**08**
III	**Decision Trees** Representing concepts as decision trees, Recursive induction of decision trees, best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting, noisy data, and pruning.	**08**
IV	**Reinforcement Learning** Reinforcement earning through feedback network, function approximation.	**08**
V	**Ensemble Methods** Bagging, boosting, stacking and learning with ensembles. Random Forest	**08**

Text Books:

1. Tom Mitchell, Machine Learning, McGraw Hill, 1997.
2. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.
3. Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021
4. EthemApaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010.
5. Kevin P. Murphy, Machine Learning: a Probabilistic Perspective, The MIT Press, 2012.

KML 062 / KDS 053	STREAM PROCESSING AND ANALYTICS	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Explain the need for stream processing	K_1, K_2
CO 2	Comprehend the architectures of stream processing.	K_2, K_3
CO 3	Explain and run Distributed Processing and Resilience Model	K_1, K_2
CO 4	Design effective streaming solutions using Structured Streaming	K_5, K_6
CO 5	Design effective streaming solutions using Spark Streaming	K_5, K_6

DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Fundamentals of Stream Processing:** What Is Stream Processing? Examples of Stream Processing- Scaling Up Data Processing- Distributed Stream Processing- Introducing Apache Spark. Stream-Processing Model: Sources and Sinks- Immutable Streams Defined from One Another- Transformations and Aggregations- Window Aggregations - Stateless and Stateful Processing- The Effect of Time. **Practical Component:** a. Installing and configuring Apache Spark b. Installing and configuring the Scala IDE c. Installing and configuring JDK	**08**
II	**Components of a Data Platform-** Architectural Models- The Use of a Batch-Processing Component in a Streaming Application- Referential Streaming Architectures- Streaming Versus Batch Algorithms. Apache Spark as a Stream-Processing Engine: Spark's Memory Usage- Understanding Latency-Throughput- Oriented Processing- Fast Implementation of Data Analysis. **Practical Component:** a. Write your own Spark Streaming program, to count the number of words in text data received from a data server listening on a TCP socket b. Write a simple Spark Streaming program that prints a sample of the tweets it receives from Twitter every second.	**08**
III	**Spark's Distributed Processing Model:** Running Apache Spark with a Cluster Manager- Spark's Own Cluster Manager - Resilience and Fault Tolerance in a Distributed System- Data Delivery Semantics- Microbatching and One-Element-at-a-Time - Bringing Microbatch and One-Record-at a- Time Closer Together- Dynamic Batch Interval- Structured Streaming Processing Model. Spark's Resilience Model: Resilient Distributed Datasets in Spark - Spark Components - Spark's Fault-Tolerance Guarantees. **Practical Component:** a. Create Spark RDD using parallelize with spark Context Parallelize() method and using Spark shell b. Write a scripts in Spark to Read all text files from a directory into a single RDD c. Write a spark program to load a CSV file into Spark RDD using a Scala d. Write a Spark Streaming program for adding 1 to the stream of integers in a reliable, fault tolerant manner, and then visualize them.	**08**

IV	**Introducing Structured Streaming-** The Structured Streaming Programming Model – Structured Streaming in Action – Structured Streaming Sources – Structured Streaming Sinks - Event Time–Based Stream Processing. **Practical Component:** a. Develop a streaming application by- Connecting to a Stream, Preparing the Data in the Stream, Performing Operations on Streaming Dataset, creating a Query, Starting the Stream Processing and Exploring the data. b. Create a Structured streaming job by Initializing Spark, acquiring streaming data from sources, declaring the operations we want to apply to the streaming data and outputting the resulting data using Sinks. c. Create a small but complete Internet of Things (IoT)-inspired streaming program. d. Define the schema in Structured Streaming to handle the data at different levels. e. Create custom sinks to write data to systems not supported by the default implementations	**08**
V	**Introducing Spark Streaming** - The Spark Streaming Programming Model - The Spark Streaming Execution Model - Spark Streaming Sources - Spark Streaming Sinks - Time-Based Stream Processing- Working with Spark SQL – Checkpointing - Monitoring Spark Streaming- Performance Tuning. **Practical Component:** (i) Develop any Spark Streaming application and do the following : a) Create a Spark Streaming Context, b) Define one or several DStreams from data sources or other DStreams c) Define one or more output operations to materialize the results of these	**08**

Text Books:

1. Gerard Maas and Francois Garillot , "Stream Processing with Apache Spark: Mastering Structured Streaming and Spark Streaming", O'Reilly, 2019.
2. Henrique C. M. Andrade, BuğraGedik and Deepak S. Turaga, "Fundamentals of Stream Processing: Application Design, Systems, and Analytics", Cambridge University Press, 2014.
3. Bryon Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, 1st edition, 2014.
4. AninditaBasak, Krishna Venkataraman, Ryan Murphy, Manpreet Singh, "Stream Analytics with Microsoft Azure", Packt Publishing, December 2017.

KDS 063	SOFTWARE ENGINEERING	
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course, the student will be able to	
CO 1	Explain various software characteristics and analyze different software Development Models.	K_1, K_2
CO 2	Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards.	K_1, K_2
CO 3	Compare and contrast various methods for software design	K_2, K_3
CO 4	Formulate testing strategy for software systems, employ techniques such as unit testing, Test driven development and functional testing.	K_3
CO 5	Manage software development process independently as well as in teams and make use of Various software management tools for development, maintenance and analysis.	K_5

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.	**08**
II	**Software Requirement Specifications (SRS):** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.	**08**
III	**Software Design:** Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	**08**
IV	**Software Testing:** Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, TopDown and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.	**08**
V	**Software Maintenance and Software Project Management:** Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re- Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.	**08**

Text books:

1.RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Pankaj Jalote, Software Engineering, Wiley
3. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
4. KK Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
5. Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.

6. Ian Sommerville, Software Engineering, Addison Wesley.
7. Kassem Saleh, "Software Engineering", Cengage Learning.
8. P fleeger, Software Engineering, Macmillan Publication

KAI 651	MACHINE LEARNING LAB	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Understand complexity of Machine Learning algorithms and their limitations;	K_5, K_6
CO 2	Understand modern notions in data analysis-oriented computing;	K_5, K_6
CO 3	Be capable of performing experiments in Machine Learning using real-world data.	K_5, K_6
CO 4	Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;	K_5, K_6

DETAILED SYLLABUS

Implementation of following machine learning algorithms in various projects using Python:

Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and

wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Note: The Instructor may add/delete/modify/tune experiments

KCS 652	**WEB TECHNOLOGY LAB**	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Develop static web pages using HTML	K_2, K_3
CO 2	Develop Java programs for window/web-based applications.	K_2, K_3
CO 3	Design dynamic web pages using Javascript and XML.	K_3, K_4
CO 4	Design dynamic web page using server site programming Ex. ASP/JSP/PHP	K_3, K_4
CO 5	Design server site applications using JDDC,ODBC and section tracking API	K_3, K_4

DETAILED SYLLABUS

This lab is based on the Web Technologies. Some examples are as follows:

1. Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject
2. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access.
3. Write programs using Java script for Web Page to display browsers information.
5. Write a Java applet to display the Application Program screen i.e. calculator and other.
6. Writing program in XML for creation of DTD, which specifies set of rules. Create a style sheet in CSS/ XSL & display the document in internet explorer.
7. Program to illustrate JDBC connectivity. Program for maintaining database by sending queries. Design and implement a simple servlet book query with the help of JDBC & SQL. Create MS Access Database, Create on ODBC link, Compile & execute JAVA JDVC Socket.
8. Install TOMCAT web server and APACHE. Access the above developed static web pages for books web site, using these servers by putting the web pages developed.
9. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.
10. Install a database (Mysql or Oracle). Create a table which should contain at least the following fields: name, password, email-id, phone number Write a java program/servlet/JSP to connect to that database and extract data from the tables and display them. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
11. Write a JSP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database
12. Design and implement a simple shopping cart example with session tracking API.

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 (Java , JSP , Bootstrap Firebug , WampServer , MongoDB, etc)

KCS 653	COMPUTER NETWORKS LAB	
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to		
CO 1	Simulate different network topologies.	K_3, K_4
CO 2	Implement various framing methods of Data Link Layer.	K_3, K_4
CO 3	Implement various Error and flow control techniques.	K_3, K_4
CO 4	Implement network routing and addressing techniques.	K_3, K_4
CO 5	Implement transport and security mechanisms	K_3, K_4

DETAILED SYLLABUS

1. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
2. Study of Socket Programming and Client – Server model
3. Write a code simulating ARP /RARP protocols.
4. Write a code simulating PING and TRACEROUTE commands
5. Create a socket for HTTP for web page upload and download.
6. Write a program to implement RPC (Remote Procedure Call)
7. Implementation of Subnetting .
8. Applications using TCP Sockets like
   a. Echo client and echo server b. Chat c. File Transfer
9. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer
10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS
11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. i. Link State routing ii. Flooding iii. Distance vector
12. To learn handling and configuration of networking hardware like RJ-45 connector, CAT-6 cable, crimping tool, etc.
13. Configuration of router, hub, switch etc. (using real devices or simulators)
14. Running and using services/commands like ping, traceroute, nslookup, arp, telnet, ftp, etc.
15. Network packet analysis using tools like Wireshark, tcpdump, etc.
16. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
17. Socket programming using UDP and TCP (e.g., simple DNS, data & time client/server, echo client/server, iterative & concurrent servers)

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 (C , C++ , Java , NS3, Mininet, Opnet, TCP Dump, Wireshark etc.

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DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY
LUCKNOW

Evaluation Scheme & Syllabus

For

B.Tech. 4th Year

Electronics and Computer Engineering

On

AICTE Model Curriculum

(Effective from the Session: 2022-23)

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY
LUCKNOW

B.Tech. 4th Year VII 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	KHU 701/ KHU 702	HSMC-1#/ HSMC-2#	3	0	0	30	20	50		100		150	3
2	KECZ 071-074	Department Elective –IV (From EC Domian)	3	0	0	30	20	50		100		150	3
3	KECZ 075-079	Department Elective –V (From CS Doamin)	3	0	0	30	20	50		100		150	3
4		Open Elective-II	3	0	0	30	20	50		100		150	3
5	KECZ 751 A/ KECZ 751 B/ KECZ 751 C	Lab as per department electives*	0	0	2				25		25	50	1
6	KECZ 752	Mini Project or Internship Assessment**	0	0	2				50			50	1
7	KECZ 753	Project 1	0	0	8				150			150	4
8		MOOCs (Essential for Hons. Degree)											
		Total										**850**	**18**
**The Mini Project or internship (4 weeks) conducted during summer break after VI semester and will be assessed during VII semester.													

Department Elective-IV

KECZ-071- Information Theory & Coding
KECZ-072- VLSI Design
KECZ-073- Wireless & Mobile Communication
KECZ-074- Microwave & Radar Engineering

Department Elective-V

KECZ-075- Artificial Intelligence
KECZ-076- Internet of Things
KECZ-077- High Performance Computing
KECZ-078- Mobile Computing
KECZ-079- Distributed System

***Lab as per Department Elective**

KECZ-751A VLSI Design Lab
KECZ-751B Microwave & Radar Engineering Lab
KECZ-751C Department may conduct one lab based on the CS domain elective chosen for the curriculum. The department shall on its own prepare complete list of practical for the lab and arrange for proper setup and conduct accordingly.

*Students will opt one subject from the list of Department Elective with its corresponding lab.

#Humanities & Social Science including Management Courses

B.Tech. 4th Year VIII 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	KHU-702/ KHU-701	HSMC-2#/ HSMC-1#	3	0	0	30	20	50		100		150	3
2	KOE08X	Open Elective –III	3	0	0	30	20	50		100		150	3
3	KOE08X	Open Elective –IV	3	0	0	30	20	50		100		150	3
4	KECZ 851	Project II	0	0	18				100		300	400	9
5		MOOCs (Essential for Hons. Degree)											
		Total										**850**	**18**

B.Tech. 4th Year
Electronics and Computer Engineering
Detailed Syllabus

KECZ-071	Information Theory & Coding	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Entropy**: Entropy, Joint Entropy and Conditional Entropy, Relative Entropy and Mutual Information, Relationship Between Entropy and Mutual Information, Chain Rules for Entropy, Relative Entropy and Mutual Information, Jensen's Inequality and Its Consequences, Log Sum Inequality and Its Applications, Data-Processing Inequality, Fano's Inequality.	8
II	**Asymptotic Equipartition Property**: Asymptotic Equipartition Property Theorem. **Consequences of the AEP:** Data Compression, High-Probability Sets and the Typical Set Data Compression: Examples of Codes, Kraft Inequality, Optimal Codes, Bounds on the Optimal Code Length, Kraft Inequality for Uniquely Decodable Codes, Huffman Codes, Optimality of Huffman Codes, Shannon–Fano–Elias Coding.	8
III	**Channel Capacity:** Channel Capacity for Various Binary Channels, Symmetric Channels, Properties of Channel Capacity, Preview of Channel Coding Theorem, Jointly Typical Sequences, Channel Coding Theorem, Channel capacity Theorem.	8
IV	**Block Codes:** Introduction to block codes, Single-parity check codes, Product codes, Repetition codes, Hamming codes, Minimum distance of block codes, Soft-decision decoding, Automatic-repeat-request schemes. **Linear Block codes:** Definition of linear Block Codes, Generator matrices, Standard array, Parity-check matrices, Error detection and correction.	8
V	**Convolution codes:** Encoding convolutional codes, Generator matrices for convolutional codes, Generator polynomials for convolutional codes, Graphical representation of convolutional codes, Viterbi Algorithm, Binary Cycle Codes, BCH codes. RS codes, Golay codes.	8

Text Books:

1. Bose, Information Theory, Coding and Cryptography, McGraw-Hill Education, 3rd Edition, (2 July 2016).
2. Joy A. Thomas, Thomas M. Cover, "Elements of information theory", Wiley-Interscience; 2nd edition (July 18, 2006).
3. S. Gravano, "Introduction to Error Control Codes" OUP Oxford (24 May 2001).
4. Robert B. Ash, "Information Theory", Dover Publications (November 1, 1990).
5. Todd k Moon, "Error Correction Coding: Mathematical Methods and Algorithms " Wiley, 2005.

Reference Books:

1. Simon Haykin, "Digital communication", John Wiley.
2. Ranjan Bose, "ITC and Cryptography", Tata McGraw-Hill.
3. Roberto Togneri, Christopher J.S deSilva, "Fundamentals of Information Theory and Coding Design", CRC Press.

Course Outcomes:

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

1. Explain each block involved in digital communication thoroughly with applications.
2. Apply the knowledge of basic concepts of probability and entropies to analyze the behavior of a communication system.
3. Analyze the use of source coding and evaluating all the techniques of source coding.
4. Examine the significance of channel coding and evaluating all available techniques of channel coding and decoding with challenges.
5. Examine various error control coding techniques.

KECZ-072	VLSI Design	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction:** VLSI Design flow, general design methodologies; critical path and worst case timing analysis, overview of design hierarchy, layers of abstraction, integration density and Moore's law, VLSI design styles, packaging, CMOS Logic, Propagation Delay definitions, sheet resistance.	8
II	**Interconnect Parameters:** Resistance, Inductance, and Capacitance, skin effect and its influence , lumped RC Model, the distributed RC Model, transient Response, RC delay model, Linear Delay Model, Logical Effort of Paths, Scaling.	8
III	**Dynamic CMOS design:** steady-state behavior of dynamic gate circuits, noise considerations in dynamic design, charge sharing, cascading dynamic gates, domino logic, np-CMOS logic, problems in single-phase clocking, two-phase non-overlapping clocking scheme, Sequential CMOS Logic Circuits, Layout design.	8
IV	**Semiconductor Memories:** Dynamic Random Access Memories (DRAM), Static RAM, non-volatile memories, flash memories, Pipeline Architecture. Low – Power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low – Power Design through voltage scaling,	8
V	**Introduction to Testing:** Faults in digital circuits. Modeling of faults, Functional Modeling at the Logic Level, Functional Modeling at the Register, Structural Model and Level of Modeling. Design for Testability, Ad Hoc Design for Testability Techniques, Controllability and Observability, Introduction to Built-in-self-test (BIST) Concept.	8

Text Book:

1. Sung-Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis & Design",Mcgraw Hill, 4th Edition.

2. Neil H.E.Weste, David Money Harris, “CMOS VLSI Design – A circuits and Systems Perspective” Pearson, 4th Edition.

Reference Books:

1. D. A. Pucknell and K. Eshraghian, “Basic VLSI Design: Systems and Circuits”, PHI, 3rd Ed.,1994.
2. R. J. Baker, H. W. Li, and D. E. Boyce , " CMOS circuit design, layout, and simulation", Wiley-IEEE Press,2007.
3. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design" , Jaico Publishing House.

Course Outcomes:

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

1. Express the concept of VLSI design and CMOS circuits and delay study.
2. Analyze mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits.
3. Design and analyze various combinational & sequential circuits based on CMOS technology.
4. Examine power logic circuits and different semiconductor memories used in present day technology.
5. Interpret faults in digital circuits, Fault Models and various Testing Methodologies.

KECZ-073	Wireless and Mobile Communication	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Wireless Communication Fundamentals:** Evolution of mobile radio communication fundamentals. General Model of Wireless Communication Link, Types of Signals, Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, Channel Assignment, Frequency reuse, Channel Assignment strategies, Handoff Strategies Cellular Interferences, Sectorization; Wireless Channel and Radio Communication, Free Space Propagation Model, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing; Wireless Channel Modeling: AWGN Channel, Rayleigh Channel, Rician Fading Channel, Nakagami Fading Channel, Ocumura and Hata Path Loss Model; Channel Modeling: Stochastic, Flat Fading, Wideband Time-Dispersive Channel Modeling.	8
II	**Spread Spectrum and Diversity:** Theory of Vocoders, Types of Vocoders; Spread Spectrum Modulation, Pseudo-Noise Codes with Properties and Code Generation Mechanisms, DSSS and FHSS Systems, Time Hopping and Hybrid Spread Systems; Multicarrier Modulation Techniques, Zero Inter Symbol Interference Communication Techniques, Detection Strategies, Diversity Combining Techniques: Selection Combining, Threshold Combining, Equal Gain Combining, Maximum Ratio Combining; Spatial Diversity and	8

	Multiplexing in MIMO Systems, Channel Estimation.	
III	**Equalization and Multiple Access:** Equalization Techniques: Transversal Filters, Adaptive Equalizers, Zero Forcing Equalizers, Decision Feedback Equalizers, and related algorithms; Multiplexing and Multiple Access: FDMA, TDMA, CDMA, OFDMA, SC- FDMA, IDMA Schemes and Hybrid Method of Multiple Access Schemes, RAKE Receiver; Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes.	**8**
IV	**Cellular Networks:** GSM system for mobile Telecommunication, General Packet Radio Service, Edge Technology; CDMA Based Standards: IS 95 to CDMA 2000, Wireless Local Loop, IMT 2000 and UMTS, Long Term Evolution (LTE), Mobile Satellite Communication.	**8**
V	**Other Wireless Networks:** Introduction to Mobile Adhoc Networks, Bluetooth, Wi-Fi Standards, WiMax Standards, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Wireless Standards IMT 2000, Introduction to 4G & 5G and concept of NGN.	**8**

Text Books:

1. T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson Publications, Second Edition.
2. Upena Dalal, "Wireless Communication and Networks", Oxford Press Publications, first edition.
3. T L Singal, "Wireless Communications", McGraw Hill Publications, 2010.

Reference Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
2. S. Haykin & M. Moher, "Modern wireless communication", Pearson, 2005.

Course Outcomes:

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

1. Express the basic knowledge of mobile radio & cellular communication fundamentals and their application to propagation mechanisms, path loss models and multi-path phenomenon.
2. Analyze the performance of various voice coding and diversity techniques.
3. Apply the knowledge of wireless transmission basics to understand the concepts of equalization and multiple access techniques.
4. Examine the performance of cellular systems being employed such as GSM, CDMA and LTE using various theoretical and mathematical aspects.
5. Express basic knowledge of Mobile Adhoc networks and the existing & upcoming data communication networks in wireless and mobile communication domain.

KECZ-074	**Microwave & Radar Engineering**	**3L:0T:0P**	**3 Credits**

Unit	**Topics**	**Lectures**

I	**Transmission Line:** Transmission line equations & solutions, reflection and transmission coefficient, standing wave, standing wave ratio, line impedance and admittance, Introduction to strip lines, Microstrip Transmission line (TL). **Wave Guide:** Rectangular Wave guide -Field Components and Parameters, TE, TM Modes, Dominant Mode, Circular Waveguides: TE, TM modes. Wave Velocities, Wave guide Cavities.	**10**
II	**Passive microwave devices:** Microwave Junctions and Couplers, Scattering Matrix, Passive microwave devices: Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators. S parameter analysis of all components.	**8**
III	**Microwave tubes :** Microwave Tubes: Limitation of Conventional Active Devices at Microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling Wave Tube, Backward Wave Oscillators: Their Schematic, Principle of Operation, Performance Characteristic and their applications.	**7**
IV	**Microwave Measurements:** Measurement of Insertion Loss, Frequency, Cavity Q, Dielectric Constant, Scattering Parameters, Noise Factors, Return Loss, Impendence; VSWR Metering and Measurement, High Power Measurement; Power Meters, Microwave Amplifiers.	**7**
V	**Introduction to RADAR systems:** RADAR Block diagram, RADAR Range equation, Probability of detection of false alarm, Integration of RADAR pulses, RADAR cross section of targets, MTI RADAR, CW RADAR.	**8**

Text Books:

1. Liao, S.Y., " Microwave Devices & Circuits", 3rd Edition, Prentice Hall of India Publication, 1995.
2. Sushrut Das, "Microwave Engineering", 1st Edition, Oxford University Publication, 2015.
3. M.I. Skolnik, "Introduction to Radar Engineering ", 3rd Edition, Tata McGraw Hill Publication, 2001.

Reference Books:

1. A Das and S.K. Das, "Microwave Engineering", 1st Edition, Tata McGraw Hill Publication, 2000.

Course Outcomes:

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

1. Analyze various parameters and characteristics of the transmission line and waveguide and also use of wave guide component as per applications.
2. Describe, analyze and design simple microwave circuits and devices e g couplers, Attenuators, Phase Shifter and Isolators. Student will also understand the microwave propagation in ferrites.
3. Analyze the difference between the conventional tubes and the microwave tubes for

the transmission of the EM waves.

4. Acquire knowledge about the handling and measurement of microwave equipment.
5. Differentiate different Radars, find applications and use of its supporting systems.

KECZ-075	ARTIFICIAL INTELLIGENCE	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**INTRODUCTION :** Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.	8
II	**PROBLEM SOLVING METHODS:** Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games	8
III	**KNOWLEDGE REPRESENTATION:** First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information	8
IV	**SOFTWARE AGENTS:** Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.	8
V	**APPLICATIONS:** AI applications – Language Models – Information Retrieval-Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving	8

Text Books:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.First Edition, 2008
4. Nils J. Nilsson, —The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.

5. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.
6. Gerhard Weiss, —Multi Agent Systems‖, Second Edition, MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

Course Outcomes:

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

1. Describe the basics of the theory and practice of Artificial Intelligence as a discipline and Intelligent agents.
2. Explain search techniques and gaming theory.
3. Implement knowledge representation techniques and problem solving strategies to common AI applications.
4. Compare techniques used for classification and clustering.
5. Evaluate basics of pattern recognition and steps required for it.

KECZ-076	INTERNET OF THINGS	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability.	8
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	8
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	8

IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	**8**
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	**8**

Text Book:

1. Olivier Hersent,David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", wiley
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014
6. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India

Course Outcome:

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

1. Demonstrate basic concepts, principles and challenges in IoT.
2. Illustrate functioning of hardware devices and sensors used for IoT.
3. Analyze network communication aspects and protocols used in IoT.
4. Execute IoT for developing real life applications using Ardunio programming.
5. Develop IoT infrastructure for popular applications.

KECZ-077	**HIGH PERFORMANCE COMPUTING**	**3L:0T:0P**	**3 Credits**

Unit	Topics	Lectures
I	**Overview of Grid Computing Technology**, History of Grid Computing, High Performance Computing, Cluster Computing. Peer-to-Peer Computing, Internet Computing, Grid Computing Model and Protocols, Types of Grids:	**8**

	Desktop Grids, Cluster Grids, Data Grids, High- Performance Grids, Applications and Architectures of High Performance Grids, High Performance Application Development Environment.	
II	**Open Grid Services Architecture**: Introduction, Requirements, Capabilities, Security Considerations, GLOBUS Toolkit	**8**
III	**Overview of Cluster Computing:** Cluster Computer and its Architecture, Clusters Classifications, Components for Clusters, Cluster Middleware and SSI, Resource Management and Scheduling, Programming, Environments and Tools, Cluster Applications, Cluster Systems,	**8**
IV	**Beowulf Cluster**: The Beowulf Model, Application Domains, Beowulf System Architecture, Software Practices, Parallel Programming with MPL, Parallel Virtual Machine (PVM).	**8**
V	**Overview of Cloud Computing**: Types of Cloud, Cyber infrastructure, Service Oriented Architecture Cloud Computing Components: Infrastructure, Storage, Platform, Application, Services, Clients, Cloud Computing Architecture.	**8**

Text Book:

1. Laurence T.Yang, Minyi Guo – High Performance Computing Paradigm and Infrastructure John Wiley
2. Ahmar Abbas, "Grid Computing: Practical Guide to Technology & Applications", Firewall Media, 2004.
3. Joshy Joseph and Craig Fellenstein , "Grid Computing" Pearson Education, 2004.
4. lan Foster, et al.,"The Open Grid Services Architecture", Version 1.5 (GFD.80). Open Grid Forum, 2006.
5. RajkumarBuyya. High Performance Cluster Computing: Architectures and Systems. PrenticeHall India, 1999.

Course Outcome:

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

1. Explain the basic concept of Computer architecture and Modern Processor.
2. Classify the basic concepts of access optimization and parallel computers.
3. Describe different parallel processing platforms involved in achieving high performance computing.
4. Develop efficient and high performance parallel programming.
5. Identify parallel programming using message passing paradigm.

KECZ-078	MOBILE COMPUTING	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.	8
II	Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.	8
III	Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	8
IV	Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.	8
V	Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.	8

Text Book:

1. J. Schiller, Mobile Communications, Addison Wesley.
2. A. Mehrotra, GSM System Engineering.
3. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.
4. Charles Perkins, Mobile IP, Addison Wesley.
5. Charles Perkins, Ad hoc Networks, Addison Wesley.

Course Outcome:

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

1. Explain and discuss issues in mobile computing and illustrate overview of wireless telephony and channel allocation in cellular systems.
2. Explore the concept of Wireless Networking and Wireless LAN.
3. Analyse and comprehend Data management issues like data replication for mobile computers, adaptive clustering for mobile wireless networks and Disconnected operations.
4. Identify Mobile computing Agents and state the issues pertaining to security and fault tolerance in mobile computing environment.
5. Compare and contrast various routing protocols and will identify and interpret the performance of network systems using Adhoc networks

KECZ-079	DISTRIBUTED SYSTEM	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Characterization of Distributed Systems**: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models. Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks ,Lamport's & vectors logical clocks. Concepts in Message Passing Systems: causal order, total order, total causal order, Techniques for Message Ordering, Causal ordering of messages, global state, termination detection.	8
II	**Distributed Mutual Exclusion:** Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms. Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.	8
III	**Agreement Protocols:** Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed	8

	Database system. Distributed Resource Management: Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory.	
IV	**Failure Recovery in Distributed Systems**: Concepts in Backward and Forward recovery, Recovery in Concurrent systems, Obtaining consistent Checkpoints, Recovery in Distributed Database Systems. Fault Tolerance: Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols	**8**
V	**Transactions and Concurrency Control**: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.	**8**

Text Book:

1. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill
2. Ramakrishna,Gehrke," Database Management Systems", McGraw Hill
3. Vijay K.Garg Elements of Distributed Computing , Wiley
4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education
5. Tenanuanbaum, Steen," Distributed Systems", PHI

Course Outcome:

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

1. Explain hardware and software issues in modern distributed systems.
2. Classify knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
3. Analyze the current popular distributed systems such as peer-to-peer (P2P) systems.
4. Classify shared Memory Techniques and have sufficient knowledge about file access.
5. Describe knowledge of Synchronization and Deadlock.

KECZ-751A	VLSI DESIGN LAB	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. Design and analysis of basic of logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR.
2. Design and implementation of Half adder and Full adder using CMOS logic.
3. To simulate the schematic of the common drain amplifier.
4. To simulate the schematic of the differential amplifier.
5. To simulate the schematic of the operational amplifier.
6. Design of 3-8 decoder using MOS technology.
7. Design a 4:1 Multiplexer.
8. Design and implementation of Flip flop circuit.
9. Layout design of PMOS, NMOS transistors.
10. Layout design of CMOS inverter and its analysis.

Course Outcomes:

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

1. Design the logic gates.
2. Implementation of combinational and sequential circuits using CMOS logic.
3. Analyze amplifier circuits.
4. Design sequential circuits such as flip flop.
5. Perform the layout designing for physical analysis of the MOS transistor and MOS based circuits.

KECZ-751B	MICROWAVE & RADAR ENGINEERING LAB	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. To study microwave test bench.
2. To study the characteristics of reflex klystron tube and to determine its electronic tuning range.
3. To determine the frequency and wavelength in a rectangular waveguide working on TE01 mode.
4. To study measurement of reflection coefficient and standing wave ratio using double minima method.
5. a) To study isolation and coupling coefficient of a magic Tee.
   b) To measure coupling coefficient, Insertion loss & Directivity of a Directional coupler.
6. To study V-I characteristic of Gunn diode.
7. To measure an unknown impedance with Smith chart.
8. a) To measure attenuation and insertion loss of a fixed and variable attenuator.

b) To measure isolation and insertion loss of a three port Circulators/Isolator.

9. Study of Attenuator (Fixed and Variable type).
10. To Study working of Doppler radar, and measure the velocity of the object moving in the Radar range.

Course Outcomes:

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

1. Describe working on microwave testing bench.
2. Practically demonstrate the Characteristics of Reflex klystron using Microwave bench setup.
3. Demonstrate the performance of the Gunn diode using Microwave bench setup.
4. Perform measurement of Frequency, attenuation, VSWR, Impedance of microwave passive device using Klystron Bench Setup.
5. Interpret the basics of Smith chart for solution of transmission line problems and impedance matching.

KECZ-751C	Lab As per Department Elective from CS Domain	0L:0T:2P	1 Credit

Department may conduct one lab based on the CS domain elective chosen for the curriculum. The department shall prepare complete list of practical for the lab and arrange for proper setup and conduct accordingly on its own.